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THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary monthly meeting of the Club was held in the Royal Society's Hall on Monday, April 13, 1931. The President, Mr. C. Barrett, C.M.Z.S., occupied the chair, and there were about 120 members and visitors present.

CORRESPONDENCE.

From the Forests Commission of Victoria, notifying that a conference of representatives of organisations interested in the protection of native flora would be held on Tuesday, April 14, to discuss the operation of the Wild Flowers and Native Plants Protection Act, 1930, and asking for the attendance of delegates from the Club.

From the Combined Progress Association of the Shire of Fern Tree Gully, asking for the co-operation of the Club in an effort to have 1000 acres of the Monbulk State Forest proclaimed as a sanctuary for native flora and fauna. It was resolved that the Club would support this project.

ELECTION OF MEMBERS.

On a show of hands the following were duly elected:—As Ordinary Members: Miss D. Howell, Sandringham; Miss P. Mackay, Elsternwick; Mr. G. T. Stewart, Caulfield. And as Associate Members: Masters D. Bond, Hawthorn; P. Crevelli, Melbourne; and S. D. Meyer, St. Kilda.

GENERAL BUSINESS.

The Chairman welcomed to the meeting Mr. A. H. S. Lucas, M.A., B.Sc., an Honorary Life Member, who is re-visiting Melbourne. Mr. Lucas, in replying, expressed his gratification at being able to attend a Club meeting again after a long absence in other States. He referred to his work in making an extensive collection of Australian seaweeds, and exhibited at the meeting specimens gathered from Victorian waters.

The Chairman drew attention to three books of pressed New Zealand Ferns, presented to the Club by Mr. H. Whitmore, and thanked the donor on behalf of the Club.

Mr. Geo. Coghill congratulated Mr. A. J. Swaby on his selection by the committee to fill the office of Hon. Assistant Secretary and Librarian, and moved that Mr. Swaby's appointment be confirmed. Mr. E. E. Pescott seconded the motion, which was carried unanimously.

The Chairman referred to the retirement of Mr. J. A. Kershaw from the position of Director of the National Museum, and mentioned the very valuable assistance Mr. Kershaw had always given in furthering the interests of the Club. Appreciative references were also made by Messrs. F. G. A. Barnard, F. E. Wilson, and F. Pitcher. Mr. Kershaw responded.

LECTURE.

Mr. C. Daley, B.A., F.L.S., taking for his subject "The Food of the Aborigines," gave a very interesting paper which dealt comprehensively with the varieties of food consumed by the blacks in an uncivilized state, and also the methods of preparing it. A fine display of exhibits was tabled in illustration of the paper and explained by the lecturer.

EXHIBITS.

By Mr. S. R. Mitchell.—Munyerno seed and Nardoo, from Lake Eyre, S.A. (The seeds and sporocarps are ground and eaten by aborigines.) Mill and muller (Nardoo stone), from Wilcannia, N.S.W. Leaves of Pituri, *Duboisia Hopwoodii*, from Queensland. (These leaves are chewed and have a narcotic effect.)

By Mr. C. French, jun.—Native bread, *Polyporus mylittae*, in all stages, including the mushroom-like fructification, which is rarely seen.

By Mr. C. Daley.—Hammer and anvil stones, and mill stones for crushing food. Shells, bones, and contents of coastal middens: emu and crocodile eggs, quandong nuts, paper bark used for wrapping food, flaked pebbles used for detaching shell-fish from rocks, native bread (*Polyporus*), eaten fresh and uncooked.

By Mr. F. Pitcher.—*Polyporus mylittae* or stone fungus, also smaller specimens showing slices easily cut with a knife when fresh. Collected at Drouin and Warburton.

By Mr. A. J. Swaby.—Pot-grown plant of *Marsilia* (Nardoo), probably *M. hirsuta*. Collected at Altona.

By Mr. F. Faulkhead, of Heyfield.—Cone of Bunya Bunya Pine, *Araucaria Bidwilli*, Queensland. (Seeds are eaten by aborigines.)

By Mr. E. J. Aisbett.—Stone axe of diorite, with well-ground edge, from Dartmoor, Victoria.

By Mr. E. E. Pescott.—(a) Aboriginal foods. Root of *Brachychiton populneum*; fruit of *Adansonia Gregorii*; painting of Parakeelya. (b) Timber specimen from termites' nest, showing the disappearance of soft sections of wood, leaving only the medullary rays. (c) Stone axe (grooved), also used as a mill stone.

By Mr. A. J. Tadgell.—(1) The Hill Banksia, *Banksia collina*, now coming into flower between Powelltown and Launching Place.

(2) The Silver Banksia, *Banksia marginata*, met with on the moors between Sandringham and Beaumaris.

By Mr. C. Barrett.—New Zealand Land Shells, *Paryphanta hochstetteri* Pfr.

By Mr. W. H. Nicholls.—Eight water colour studies of Australian orchids.

EXCURSION TO THE BOTANY SCHOOL, UNIVERSITY.

About 20 members and friends attended at the Botany School on April 11, and, in the absence of Professor Ewart, were shown over the new and well-appointed building by Dr. Ethel McLennan. Many of the very interesting exhibits in the museum were explained by Dr. McLennan, and in one of the laboratories some plant experiments in progress were demonstrated by Mr. L. A. Thomas, B.Sc., a fellow Club member. In glass jars, seeds of *Epacris* were sprouting on a layer of sterilised jelly, thus proving that an association of a fungus with their roots, as found in the case of naturally growing plants of this genus, was not essential to their growth.

In the herbarium, which contains large, handsome cabinets presented by Trinity College, per the Rev. H. M. R. Rupp, B.A., is an extensive collection of dried specimens, and also one of micro fungi in a living condition, since these organisms cannot be preserved indefinitely. It is expected that a collection of Australian flora, as complete as possible, will be preserved in this herbarium, of which the late Mr. H. B. Williamson had charge. A vote of thanks to Dr. McLennan and Mr. Thomas was accorded.

A. E. R.

EXCURSION TO ZOOLOGICAL GARDENS.

At the kind invitation of the Director, Mr. A. Wilkie, some 50 members were welcomed by him at the Zoological Gardens on Saturday afternoon, March 28. In a personally conducted tour of the Gardens, Mr. Wilkie excelled as a guide, and his anecdotes about his charges, mostly humourous, but sometimes with a tragic side, were much appreciated as first-hand information. All the animals appeared to be in good condition and many of them responded to the Director's greetings. Among the novelties were black tiger-snakes, from Flinders Island, in Bass Straits, secured by a collector who has since paid the penalty of his hazardous occupation. In the shade, these snakes appear quite black, but in sunlight the distinguishing "tiger" bands are faintly discernable.

The Platypus, which had been in captivity for six weeks to the date of our visit, and appeared to be doing very well, was obligingly on view, and swam about its little pond in the large flight aviary, dabbling among the weeds in the approved duck fashion. It has taken readily to a diet of minced meat and fresh-water shrimps, placed in a dish below the surface of the water. A hearty vote of thanks was accorded to Mr. Wilkie, who stated, in reply, that it was always a pleasure to him to meet members of the Club at the Gardens.

A. E. R.

THE STUDY OF FRESH-WATER SPONGES AS A HOBBY.*

By N. Gist Gee, Rockefeller Foundation, Peking, China.

For one who sits at a desk a good portion of the day absorbed in the duties which hold his attention most of the time, it is a wise plan to have an interest in some pleasant pursuit which is not related to the office duties. A complete change of occupation often proves to be very restful. Relaxation from a sustained effort of one kind comes with a complete change of interest or activity. To such an individual we would like to present the appeal of the fresh-water sponge as a hobby.

To the study of fresh-water sponges, which are different in several respects from marine sponges, there are several most interesting phases. Only four of these will be mentioned here.

Study of Science For Its Own Sake.

First of all, it is a study of sponges for the sake of science. So far as we know there is no important economic value to this group of animals. Early reports tell us of how the Russians formerly rubbed the powdered sponge on the skin to bring about a reddish colour, and other records tell us of extracts being made from the sponges by treatment with alcohol, and then of this extract being used medicinally.

We have also read of how people, in certain places, digging in earth filled with the silicious spicules (minute needle-like structures) of these sponges, have been troubled with the irritation caused by their pricking the skin. On rare occasions the water-pipes in city water systems have become clogged with the growth of these sponges, and some claim that they even impart a disagreeable odour to the water supply in a few places. These cases are rare, however, and even if the sponges may cause inconvenience now and then, they are not generally troublesome.

Secondly, the collection of fresh-water sponges is a most fascinating outdoor undertaking. Many of them are very small or form very thin crusts over their supports, and do not look like the sponges with which we are familiar; but some of the larger *Ephydatias* grow larger and thicker than some of the smaller *Spongillas* and have at least a slight resemblance to the bath sponges, which are marine forms.

Fresh-water sponges may be found growing on submerged plant stems or leaves, on rocks, logs, or other such supports, and in some cases they may be found on the shells of molluscs, even while

*For detailed information of what is at present known concerning the fresh-water sponges of Australia and New Zealand, the reader is referred to a recent article by Mr. Gee on this subject in the *Records of the Australian Museum*, vol. XVIII, No. 2, pp. 25-62, 1931.

the animals are alive and moving about in the sand, as well as after the animals have died.

The sponges may be found in either running or still water. It has been observed that the outlet of a lake is usually a favourable location for sponges if they occur at all in the lake. Most of the known fresh-water sponges have been collected in comparatively shallow waters, though a few forms have been secured by dredging in the deeper waters. Streams, ponds, and lakes, all are possible sources of sponges, but it often requires a careful search to find some of the specimens even when they are present, and it is not every body of water that proves to be a suitable place for the growth of sponges.

The "tanks" of India and some of the canals of China have proved to be good places for the growth of some sponges; both places are rich in organic matter. Again, lake water in other parts of the world with very little of this kind of matter in it, may prove equally suitable for other types of sponges.

Methods of Preservation.

Collecting takes one into the great out-of-doors and brings one into close communion with nature in many of her moods during the changes of seasons. Sponge specimens for taxonomic study should bear gemmules (small asexual reproductive bodies), and the best time to secure these is in the fall or winter time when the provision is made to tide the animals over the cold of the winter months or a period of drought. Be sure always to collect gemmules. When collected, sponges should preferably be preserved in 95 per cent. alcohol, but this method of preservation is often inconvenient or even impossible.

Sponges may be preserved by drying them slowly in the shade and then after the odour has disappeared, by wrapping them in soft paper—not in cotton—and packing them in light wooden or tin boxes. Careful records should be kept as to locality and date of collection, collector, habitat, colour, general appearance of the sponge colony as it grows, method of growth, etc. If specimens are sent to the writer by sample post, he will gladly undertake to identify the materials sent.

In the third place, correspondence with the specialists—Spongologists—who are working in this field, furnishes delightful contacts with a splendid group of scientists in all parts of the world. Exchange of ideas, opinions, specimens and reprints is most helpful, and one can get literature on the subject in almost any language he may wish—in English, German, French, Dutch, Russian, Japanese, etc. The ability of even the best of linguists will be thoroughly taxed by the veritable babel of languages in which much of the desired information is locked up. The number of active workers in this field is small, and we have found most of

them very patient and helpful to an amateur just beginning the pursuit of his hobby.

The Laboratory Work.

The fourth phase of the subject we wish to discuss is the laboratory work. While the laboratory work keeps one indoors, yet it is quite different from ordinary office work; careful manipulation of minute portions of sponges require the development of an accurate technique in order to avoid the loss of rare bits of *co-types* furnished by those museums, or those individuals who have in their collections the *types* of the various known species of sponges.

The development and the physiology of sponges are subjects full of interest and scientific value, but they are rather exacting subjects and one must have plenty of free time to follow through the processes of growth continuously.

On the other hand, the taxonomic study of this group can be made an intermittent affair. The dried sponges can be easily stored in pasteboard boxes in shallow drawers where they can readily be referred to if they are properly numbered and catalogued. When thoroughly dry the sponges are odourless; the moths do not bother them, and so far, we have not been troubled by any of the ordinary museum pests. The sponges are also easily handled and are clean.

Microscopic Preparations.

In order to make a satisfactory microscopic examination of a sponge one should have at least three good slides showing (1) the skeleton spicules, gemmule spicules, and flesh spicules if any are present; (2) whole cleared gemmules; (3) a thin cross-section of the sponge, showing the structure of the skeleton and the location and arrangement of the gemmules.

To prepare the first type of slide, a small clean bit of the sponge should be taken, representing the basal, the parenchyma and the surface areas, and it must, by all means, include several gemmules. Boil this in a small test tube with three to five cubic centimetres of concentrated nitric acid until all of the organic matter has disappeared and only the silicious spicules are left behind. These can then—after having been washed free of acid—be transferred with a glass tube to the microscope slide and allowed to dry. We find that it is an advantage in a moist climate to dry off the spicules over an alcohol flame. When thoroughly dry the balsam and cover-glass may be added and the slide properly labelled. In order to avoid mixing the spicules of several sponges on the slide and causing much confusion, the greatest care must be taken to wash the test tubes and the glass tube absolutely clean before using them a second time.

It is our experience that to attach a short rubber tube to a faucet and wash the glass tube by attaching it to the rubber tube and

forcing the water through it under strong pressure, is a very satisfactory method of dislodging any spicules that may adhere to the sides of the glass tube. This process works well, especially if used before the spicules stick to the dry walls of the glass tube; so it is best to wash it each time immediately after using it.

Preparation of Gemmule Slide.

The gemmules are usually opaque and need to be cleared before being mounted. Often xylol or cedar oil will clear them, but as a matter of routine it has been found wise to first put the gemmules into a 10 per cent. solution of sodium or potassium hydroxide for a week or ten days and then to wash them thoroughly and run them through a series of alcohols into xylol and mount them in balsam. It is advisable, in the case of delicate gemmules, to support the cover-glass with bits of glass to keep from crushing or distorting them. It is important also to keep the gemmules wet with xylol during the operation of mounting them or they may get air bubbles in them and thus make them opaque.

An old safety razor blade makes a good section cutter and with a little practice very thin free-hand sections can be made from the dry sponge. Put these into xylol and thus free them from air. Select a thin section showing clearly the typical sponge structure and also some sections of gemmules *in situ* and mount in balsam.

So often a drawing—even a good one—cannot show all the details one may wish to record. Frequently good photographs can be made to supplement the drawing and present an accurate likeness of the object.

Suggested Outline for Describing Sponges.

Many other items of information concerning the sponge as a whole should also be available. We would suggest the following order of topics for the description of a fresh-water sponge.

Historical Statement.—This should include such historical data concerning the sponge as would serve a useful purpose to future workers. Such a statement would reduce the amount of searching necessary to study the literature of the sponge being studied.

Habitat.—This should give all available information about the conditions under which the sponge was found growing.

Colour.—While the colour of the same species varies a great deal under different conditions of growth, and while this is not in itself a distinctive characteristic, yet it is well to record the colour where possible.

General Characteristics.—A full description of the gross characteristics of the sponge, its support, its method of growth, its dimensions, its surface appearance, the location and characteristics of its oscules, etc., should be recorded.

Structure.—In certain species the skeleton spicules are bound together in definite ways which assist in the determination of the sponge. Usually distinct fibres are formed by the union of spicules by the spongin. Record the nature of the skeleton—whether the sponge is brittle or firm—and the location and arrangement of the gemmules in the skeleton.

Skeleton Spicules.—Accurate measurements in microns of the length and thickness of the spicules should be made. Careful detail drawings to show the distinguishing peculiarities of the species in hand should be made. The following points should also be recorded:—Shape; whether the ends are rounded or pointed, if sharp pointed whether gradually or suddenly pointed; straight or curved; smooth or spined, if spined location and size of spines. Comparisons with the spicules of related forms are often helpful.

Flesh Spicules.—A record should be made if they are not present, and if they are present they should be described as in the case of the skeleton spicules.

Gemmules.—Do they occur singly, in groups of several, or in layers bound together? Measure the diameter carefully, and study the pore tube or foraminal opening. The noted characteristics should be drawn or better still, photographed when this can be done. Both the drawing and the photograph are desirable—one checks the other. How do these differ from others in the same group?

Gemmule Spicules.—There is such variation in these that all care should be used in giving descriptions, drawings, photographs and measurements of the various spicules found. Often there are different kinds of spicules found in the same gemmule. There are such great differences between these spicules in the several genera of sponges that it is not possible to give one outline to cover them all. Compare with related species.

Type.—If a new species, state where the *type* is being deposited and where *co-types* may be referred to by workers.

Distribution.—It is important to record not only the place where the specimen described was found but also the known distribution of the species.

Remarks—Very often it is desired to make certain additional comparisons with other related species or to record other points of interest in connection with the study of the sponge. Such observations as are not provided for above can be stated under this heading.

The advantage of such an arrangement of the sponge descriptions as is given above is evident as it indicates the information desired concerning each species and makes comparisons of the details satisfactory and simple.

BLUE-TONGUED LIZARDS.

By DAVID FLEAY.

A Southern Blue-tongue Lizard, *Tiliqua nigrolutea*, in my collection—it came from the Snowy River—has given birth to three fine young ones.

This species—the lizard of the forest—which feeds upon berries, leaves and insects, in much the same manner as its cousins, is practically restricted to Victoria, South Australia, and Tasmania, and is not so definitely banded as the northern and western species.

Of the typically Australian genus, *Tiliqua*, I am fortunate in having in captivity representations of three of five recorded species, and this affords excellent opportunities for comparison. The lizard least known to us is the Western Blue-tongue, which species offers perhaps the most interesting features of all. *Tiliqua occipitalis* is an inhabitant of far western Victoria, south, central and Western Australia, and its most outstanding characteristic is the extreme lightness of weight. Unlike the other Blue-tongues, it does not drag its body over the ground, but walks clear, with the tail held in a line with the body!

The distinctive colour of this lizard, with the four or five broad bands across a yellow body, is such that one would readily recognise it on sight.

Tiliqua scincoides, the Northern Blue-tongue, so named on account of its extended geographical range, from Tasmania to Torres Strait Islands, is often nearly black in colour, and is the giant of the genus. Certainly it must reach maximum size towards the northern part of its range, for in Victoria it is generally smaller than the southern species. In the Zoology School (University) one specimen, from Gayndah (Queensland) is the best part of two feet in length, even though regeneration of the broken tail had just commenced at the time of death.

On a recent trip to the Monaro plateau, I discovered and brought home a Southern Blue-tongue, measuring 19 in. in length, as compared with the usual 15 inches. From accounts given by local residents, even this fine lizard was not considered of record size.

One of the most favoured haunts of the Northern species is the basalt country and sea coast. It is essentially a reptile of the drier localities. In the stone walls of Laverton and Werribee, I have often collected more Blue-tongues than snakes. The colouration on the ventral surface occasionally is a rich yellow.

T. scincoides is said to be oviparous, and this is supported by Lucas and Frost. Some years ago I examined a female, and found that it contained a dozen eggs; but the observations of Dr. Haacke (1885) and the late Edgar Waite tend to prove a viviparous mode of reproduction. *T. nigrolutea* brings forth from three

to nearly a dozen young towards the end of March. One of my "Blueies" produced eleven or twelve offspring. The period of gestation extends over a period of three months, and the females remain almost continually in all available sunlight during February and March. Even though the weather be cold, a little sunlight causes them to emerge, though other occupants of the cage remain under cover.

The young lizards, being thrown on their own resources at birth, are extremely pugnacious, and, though measuring only 3 inches in length, snap and hiss vigorously at all comers. This is the beginning of the most active stages in their development. Young blue-tongues are seldom observed in the bush. They take three or four years to reach adult size, as I have observed over a number of years, but how carefully they conceal themselves in their own natural haunts!

Skins are shed rapidly as growth proceeds, and the young lizards shown in the photograph had each lost at least one coat though only 24 hours old!

Several hours after birth one little reptile practically tore a fore-limb from its brother's body, so fiercely did they struggle. These recent arrivals were quick to take advantage of defaults in the big cage, and one was discovered comfortably curled up beneath the floor of a neighbouring box. He had squeezed through the wire.

Encountered in the wild state, with no hope of avoiding detection, the adult Southern Blue-tongue relies on bluff, gaping jaws and explosive hisses to scare the intruder; but if he thinks that you have not seen him, he humps his back into a rigid, one-sided shape and remains perfectly motionless. Combined with protective colouration, this attitude assists in no small measure to render the lizard inconspicuous.

Finally, a plea for "Bluey." Even in these enlightened days, the battered wreck of a once handsome lizard is too often seen; the victim has either been deliberately run down by a car, or received crushing blows from a heavy stick.

During a ramble in April at Ballarat, the cries of a leveret, a very young "kitten," attracted our attention, and on investigation the little animal was found in the jaws of a dog which accompanied the party. The leveret was rescued, fortunately, unhurt. To liberate it while the dog was about was to endanger its life again, so I carried it for a considerable distance. It settled down in the crook of my arm, and, seemingly, went to sleep. Such a soft, silky little bundle! When we reached a patch of tussocky grass, the dog being well out of sight, I released the leveret, and away it went, apparently none the worse for its strange adventure.

Z.McT.

Plate I.

Western Blue-tongue, *Tiliqua occipitalis*

Southern Blue-tongue, *Tiliqua nigrolutea*, and young
(24 hours after birth)

Photos. by D. Fleay

NATIONAL MUSEUM INSECT COLLECTIONS

The extensive collection of butterflies in the National Museum has been increased by a large series of North American species, received by way of exchange from the United States National Museum, at Washington. This fine addition comprises some 800 specimens, representing more than 300 different kinds, which, together with those previously in the collection, makes it the most extensive of North American butterflies in Australia.

Of insects generally the Museum has, at a rough estimate, between 600,000 and 700,000 specimens, collected from all parts of the world. These are arranged in specially constructed, air-tight cabinet drawers. The Australian collection, upon which special attention has been concentrated, is probably one of the most complete of its kind, and has a special value from the fact that so much of the material has been more or less closely associated with our earliest Australian entomologists, as well as many British and European specialists of world-wide repute.

One of the most important of the exotic collections is the celebrated "Curtis" collection of British insects, acquired in 1863. This is contained in seven beautifully constructed cabinets of 158 drawers, and numbers upwards of 41,000 specimens. The cabinets are of the celebrated Standish make and are themselves of historical importance.

This is probably one of the most valuable collections of British insects existing, and is the result of more than forty years' work. It is in an excellent state of preservation, particular care having been taken to preserve it in precisely the same state as when Curtis left it when he became blind. Embracing a large number of types, of Curtis, Haliday, Walker, and others, it also includes the specimens figured in Curtis's great work on "British Entomology," published in 1824–39, in 16 volumes and illustrated with 769 beautifully executed plates, the colouring of which alone cost upwards of £3000. Accompanying the collection is Curtis's MS. catalogue of the whole of his British collection, occupying four quarto volumes, in which copious notes, very closely written in a clear, minute hand, are given on nearly every species, together with exact localities and dates of collecting.

Many of the species are now extremely rare and some have become extinct in England. Among the latter is a small moth, *Schiffermuelleria woodiella*, measuring little more than half an inch across its expanded wings. This is the original type specimen described and figured by Curtis, and has a unique history. Collected, with a number of others, at Manchester by a local collector, Robert Cribb, more than a century ago, this example was given to Curtis to be named, and two other specimens parted with. Nothing, however, would induce Cribb to part with any of his remaining

examples. He had given way to intemperance, and when he failed to pay his debts at the beer-house, the landlady consigned his box of specimens into the kitchen fire. Of the only three examples of *S. woodiella* known to exist, the type specimen is in the Melbourne Museum, one in the British Museum, and the third in the Museum at Manchester.

Another great rarity of historic importance is the brilliant butterfly known as the "Large Copper," of which there are eleven excellent examples in this collection. First discovered between 1790 and 1800, when it occurred abundantly over a fairly wide tract of fen country in Huntingdon and Cambridgeshire in England, it is now extinct. From 1820 to 1845 large numbers were captured by London collectors, but three or four years later it had disappeared altogether.

Among other collections of note in the National Museum may be mentioned the "Castelnau" collection, obtained from the late Compte F. de Castelnau, in 1867. Castelnau was at that time Consul for France in Melbourne, and had previously collected extensively in South America. Apart from entomology, he was a well-known authority on fishes. In 1872-3 he published, in the *Proceedings of the Zoological and Acclimatization Society of Victoria*, his "Contributions to the Ichthyology of Australia," adding very largely to our knowledge of Victorian fishes.

Castelnau's collection, which consisted entirely of beetles, from all parts of the world, occupies five large cabinets and numbers approximately 21,000 specimens. His method of mounting was unusual, each specimen being mounted on a small cork tablet, and in many instances, when the beetle itself could not be obtained a carefully coloured drawing was substituted.

The "Howitt" collection, formed by the late Dr. Godfrey Howitt, uncle of the late Dr. A. W. Howitt, is also confined to Coleoptera, practically all Australian, and includes the type specimens of the Pselaphidae described by the late Rev. R. L. King, in 1864. Dr. Howitt, who in the sixties lived in Hawthorn Road, Caulfield, was a keen entomologist, a frequent visitor at the Museum, and a correspondent of many of the earlier workers. His collection is still of necessity used for purposes of reference by present day workers.

Many other smaller, though by no means less important, collections, the results of more than 70 years' careful selection, occupy their place in the Entomological room at the Museum, where they are constantly referred to and are indispensable to systematists, both in Australia and abroad.

J.A.K.

WATER BEETLES AND FLIGHT.

By C. DEANE.

To the lover of nature, the large water-beetle, *Dytiscus*, of Europe, figured in many books on natural history and in magazines, is well known, at any rate in print and picture, and especially to students of entomology, who will be acquainted with its Australian relative, *Cybister*.

Hydrophilid sp. (much enlarged).

Swimming in the stagnant ponds or lagoons by day in search of prey, *Cybister* rises only occasionally to the surface for a bubble of air. At times, however, its range is no longer limited by the boundaries of its little inland sea, and it takes wing and eventually may find another water-hole. It flies at night, because it is attracted to the light of the lamp. Does it also fly in the daytime? If the flight is confined to the hours of darkness, does the insect every evening rejoice in the use of its pinions, or only when the air is warm and favourable? Most of the sages are silent on this point.

Balfour-Browne has recorded in his book "Concerning the Habits of Insects," some interesting observations on the water-beetles and their habits, but this particular point is not dealt with.

A second kind of water-beetle is the seemingly four-eyed *Gyrinus* of the Old World, with the corresponding *Enhydrus* (formerly also *Gyrinus*) abundant in the mountain streams of this continent. Different somewhat in habit from *Cybister*, it skims about on the surface with a motion which becomes very erratic when the insect is disturbed, and has earned for the creature the popular nickname of "whirligig." Day long nearly it floats and moves on the surface, going below only when danger is impending, and when its whirling tactics can no longer be relied upon as a means of escape from its pursuer, or the net.

But there is yet a third group of water-beetles. These have not the two-ended boat-shape of body; they have not the powerful swimming legs, anterior in the case of *Enhydrus* and posterior in *Cybister*, with the other two pairs shorter in each case. In fact, they swim neither at the surface nor below; as far as we know,

they are not able to swim. According to the dictates of nature and their physical structure, like any land beetle, they walk along the ground or climb over the surface of stones or logs and up the stems of reeds and plants, all the while submerged. Some of them, it is said, obtain air from the respiratory systems of the plants upon which they feed. In this group there are many species belonging to several families, and these not even nearly related. The author has described a few new species of *Hydrophilidae*, one of which, taken by himself in Southern Queensland, is shown in the accompanying illustration (reproduced from *Pro. Royal Soc. of Vic.*, lxiii, Part II, p. 168). Its claws are strong and it can withstand the force of the current. A pair of gauzy, delicately fringed, iridescent wings, folded beneath the compact elytra, are eloquent of its powers of flight.

Is it diurnal or nocturnal aviation that it enjoys? What of those iridescent colours? Do insects which fly only at night have wings which exhibit this quality?

Are there any insects at all which fly only at night? For example, many *Carabidae*, which are normally of night-flying habit, will fly during the day under special circumstances. I have seen the air on a bright sunny day at Launching Place, during flood time, almost thick with several species of *Carabidae*, species which, under ordinary conditions, I have not seen flying in the sunshine, although they are very common and of wide range; perhaps they were escaping from the affected area to redistribute towards more favorable ground. But all the Coleoptera which I know definitely to be normally of night flying and not day flying habit, have wings which are not iridescent. It may be, then, that the members of my new species fly quite commonly during the day.

Among the beetles with gauzy iridescent wings are the giant Buprestid *Catoxantha gigantea*, of Java; the mirror-headed jewel beetle, *Hypocisseis latipennis*, Macleay, of Queensland; *Buprestis rufipes*, Oliv., of U.S.A.; the fire beetle, *Merimna atrata*, L. and G., of Australia; the blue metallic longicorn, *Phaolus metallicus*, Newm., of N.S.W.; the small, slender longicorn, *Stenoderus suturalis*, Oliv., of N.S.W.; the oil beetle, *Zonitis cyanipennis*, Pascoe, of N.S.W.; and several species of hunting beetles, Cleridae, belonging to the genus *Aulicus* in Australia. It appears to be an uncommon character with beetles, not more than one or two in a thousand species possessing it to any marked degree, when averaged over all the species in the order, although it may be common to many or most of the individuals of a particular tribe or genus.

These creatures have not been widely collected in Australia, but, judging from the results which have come to hand, there is ample opportunity for collectors in this country to find species new to science. I commend this field of endeavour.

A NEW AUSTRALIAN TERRESTRIAL ORCHID

By W. H. NICHOLLS.

Caleana Nublingii, Nov. sp.

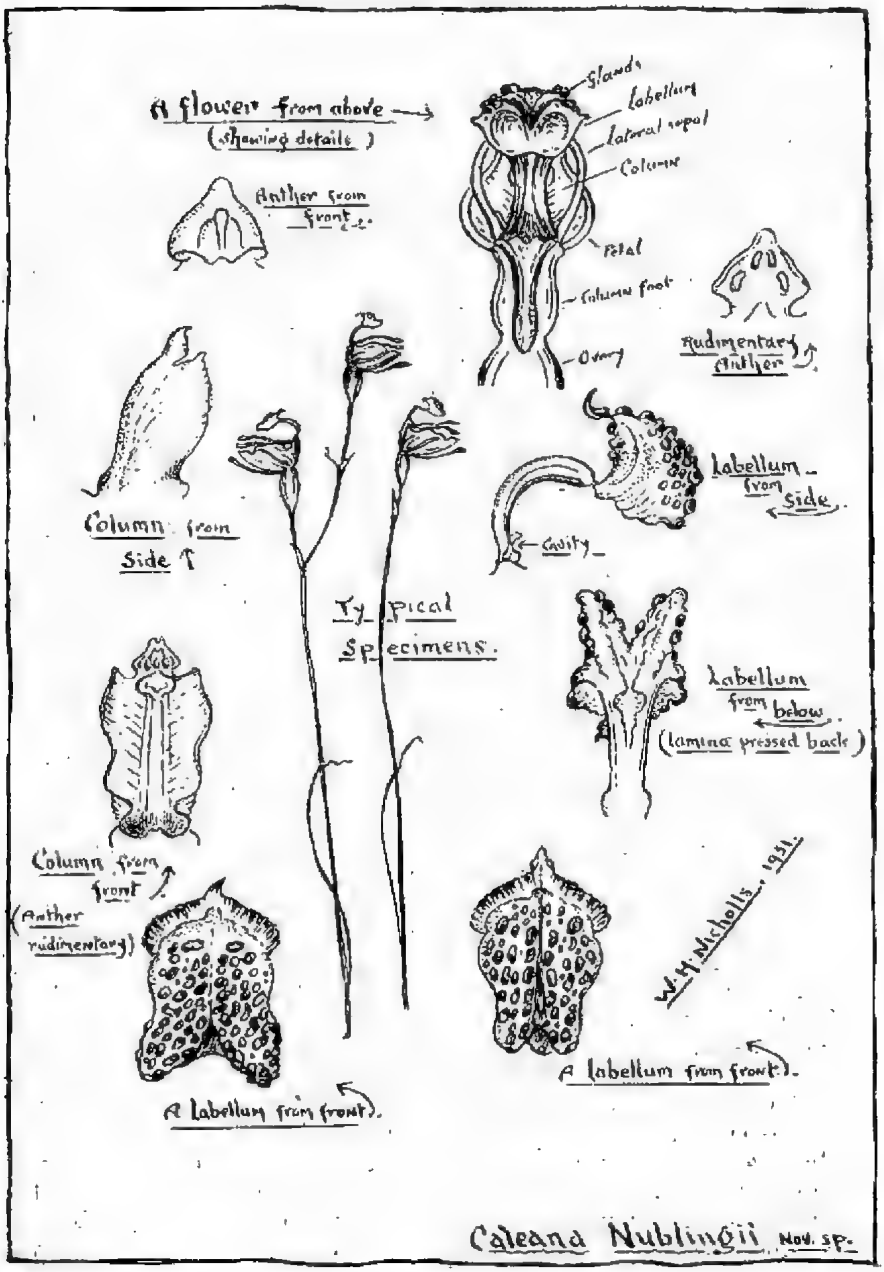
Planta glabra, gracillima, circa 10 cm. alta; folium angustum, lineare, circiter 2½ cm. longum; caulis gracillimus; flores 1 vel 2, viridi-purpurei; pedicellis gracilibus; sepala lateralia et sepalum dorsale sub-æqualia, linearea; spathulata, incurva, canaliculata, circiter 7 mm. longa; petala anguste-linearea, circiter 5½ mm. longa; labellum pyriforme, marginibus gibbosum, irritabile inflexum; lamina tuberculata, apice lato, bilobato vel emarginato; columna incumbens.

A very slender, glabarous species, about 10 cm. high; stem reddish-brown, wiry; leaf very narrow-linear, almost filiform, glabrous, about 2½ cm. in length; flowers 1-2 (two specimens only so far found), green with red and purplish markings; peticels slender, a small very acute bract subtending; ovary ovate; dorsal sepal narrow-linear, spathulate, channelled on the inner side, apex acute, incurved, exceeding the column slightly; lateral petals narrow linear, not channelled, embracing the column wings, a little shorter than sepals; dorsal sepal and lateral petals arising from posterior base of column; lateral sepals from anterior base; lateral sepal about same length and shape as dorsal one; labellum somewhat pyriform, gibbous, peltate as in other species of the genus; connecting strap wide, semi-circular, concave on the underside, very irritable, attached to frontal foot of column, lamina about 3½ 4 mm. long by about 2½ mm. wide, the entire surface, outer and lower margins covered with numerous, small, greenish-purple tubercules of irregular shapes; lamina centrally divided by a narrow longitudinal groove, which gradually widens below to a definite bi-lobed, emarginate, or retuse-truncate ending; apices broad and rounded; upper margins crenate, thin; apice cuneate-acute; underside deeply-concave, two-celled; column about 6½ mm. high, encumbent (of similar shape to column in *C. nigrita* Lindl.), light-green, very widely winged throughout; column foot extending along labellum-strap (to which it is adnate) and forming a cup-like cavity; stigma somewhat circular, concave; Anther* erect with an obtuse or emarginate apex; Pollinia not observed.

New South Wales, Bell, Blue Mountains, E. Nubling, 27/12/30.

This curious and very interesting orchid is named after Mr. E. Nubling, of Sydney, who discovered it at Bell, in the Blue Mountains. He writes:—"Found on the 27/12/30, on a rocky and sandy spur (Hawkesbury sandstone formation) at about 3500 ft. altitude; the spur extends for some considerable distance towards

*Anther rudimentary in two flowers examined, the inner surface marked by raised callosities (see fig. 5). In the third flower it was fairly well formed, but lacked the Pollinia.


A flower from above
(showing details)
Glands
Labellum
Lateral sepal
Column
Anther from front
Petal
Column foot
Ovary
Rudimentary Anther
Column from side
Typical Specimens.
Labellum from side
Cavity
Labellum from below
(lamina pressed back)
Column from front
(Anther rudimentary)
W.H. Nicholls, 1931.
A labellum from front.
A labellum from front.
Caleana Nublingii Nov. sp.

the Grose River (though probably some 1500 ft. above it). *C. major* R.Br., and *C. minor*, R.Br., found not far from them."

The new species is hardly likely to be confused with others; though to *C. minor*, R.Br., and *C. Sullivanii*, F.V.M., it bears a superficial resemblance, it differs from both in important details, chiefly in the shape of the labellum. This addition brings the number of recorded members of a small genus to five, the other representatives are *C. major*, R.Br., *C. minor* R.Br., *C. nigrita* Ldl. and *C. Sullivanii*, F.V.M. All except *C. minor* are endemic to Australia. *C. major* and *C. minor* are widely-diffused, both species occurring in New South Wales, Queensland, South Australia, Victoria, and Tasmania; the smaller species extending its range to New Zealand. *C. Sullivanii* has bee found only in Victoria (Grampians), while *C. nigrita* is recorded only from Western Australia.

MOORABOOL SANCTUARY.

This area comprises the Moorabool Reservoir reserve, and is a very delightful spot, visited by many for picnics and outings generally. It is easy of access, being situated only about a mile and a half off the main Ballarat-Melbourne highway, the turn-off being on the Melbourne side of the hamlet of Wallace. As one drives through the main gate, the word "Sanctuary" catches the eye, and to the nature lover that word means a good deal. He thinks to himself, "Here I shall find something interesting," and generally he does. This large sheet of water resembles a natural lake, and is backed by low rises clothed in eucalypts interspersed with plantations of pines. By a narrow track, winding through pines and eucalypts, and open spaces, grass clothed, one is able to encircle the sheet of water, and very pleasant walking it makes on a fine autumn day. Close to the picnic ground, a long, gentle, grassy slope has been trimmed to form a "beach." This is finished off with a wall of New Zealand flax. With the tall pines behind it, it is a very pleasant, shady resting place, and gives the most charming outlook in the reserve. Water birds abound in this sanctuary. Black Swans are particularly numerous. Ducks, Coots and White-fronted Herons also are seen in goodly numbers. Recently, I noticed many Blue Wrens busy among the shrubs and water-weeds.

Z.McT.

* * * *

In the introduction to the first of a series of papers on Rocky Mountain Bees (*American Museum Novitatis*, 433, October, 1930), Professor T. D. A. Cockerell commends the study of wild bees as "an excellent occupation for the amateur, who can carry it on through many years." Even in the United States, large and handsome species, unknown to science, may be found. How much richer is the field in Australia. Professor Cockerell's talk at one of our Club meetings will long be remembered. He has described numbers of Australian bees, and during his visit to this country collected in many localities.

THE WILD FLOWER AND NATIVE PLANTS PROTECTION ACT.

By EDWARD E. PESCOTT, F.L.S.

By the passing of this Act in December, 1930, one of the aims of the Field Naturalists' Club of Victoria, adequate protection of our native flora, a work that we have always aimed at, was achieved. The Act is being administered by the Forests Commission, and in order to assist the Commission in its work a sub-committee was appointed. There are six members of this committee, four being members of the Club.

The Act provides protection for any native plant that appears in the list as under, the protection being extended for the whole of the year. As soon as the list is proclaimed it will be illegal to "pick, gather, pluck, cut, pull up, destroy, take, dig up, remove or injure the flower or plant or any part thereof."

Such removals or destruction may not take place on any Crown land or State forest or any land reserved under the Land Act and the Closer Settlement Act, or on any private land, the owner or lessee of which has not given his permission.

In any prosecution, proof of possession shall be the *prima facie* evidence that defendant picked such wild flower or native plant.

Further, anyone who sells or offers or exposes for sale any protected wild flower or native plant, shall be guilty of an offence. In this section, it shall be a sufficient defence in any prosecution to prove that the plant was growing on private land and was picked with the consent of the owner, or was picked in a place not included in any proclamation.

The Minister may issue licences authorising the holders to pick the protected wild flowers for scientific purposes; and honorary rangers will be appointed to assist in the carrying out of the Act. With regard to botanical specimens, the Act will be administered sympathetically.

The following is a list of the plants to be protected, and the list may be added to from time to time, if it be found necessary to give protection for any plant:—

Vernacular Name.	*Botanical Name.*
Hill Banksia	*Banksia collina*
Boronia	*Boronia*, all species
Baw Baw Berry	*Wittsteinia vaccinacea*
Cabbage Palm	*Livistona australis*
Red Correa	*Correa rubra*
Silver Daisy	*Celmisia longifolia*
Ferns	All species, except Bracken

Finger Flower	*Chiranthera linearis*
Blue Howittia	*Howittia triocularis*
Blue Tinsel Lily	*Calectasia cyanea*
Myrtles	*Calytrix Darwinia* *Thryptomene* and *Lhotzkya*, all species *Micromyrtus ciliatus*
Sea Box	*Alyxia buxifolia*
Gippsland Waratah	*Telopea oreades*
Wattles	All species of *Acacia* except *A. armata*
Waxberry	*Gaultheria hispida*
Waxflower	*Eriostemon*, all species,
Murray Lily	*Crinum flaccidum*
Garland Lily	*Calostemma purpureum*
Blotchy Mint Bush	*Prostanthera Walteri*
Orchids	All species

There are other plants that might be added, but it was not considered desirable to make the list too cumbersome at first. In addition, it should be noted that *all* plants growing in the Grampians and the National Park at Wilson's Promontory are fully protected by the proclamations governing those areas. Trees are excluded from the list, but it is to be noted that *all trees* are sufficiently protected by the provisions of the Forests Act.

Plants catalogued by florists and seed merchants are, as a rule, excluded from the list; and plants popular with excursionists but common and widespread are also excluded for the present if no scenic damage results.

EXCURSION TO CAVE HILL QUARRY, LILYDALE.

About 25 members of the Club assembled at Lilydale Station on March 7. The afternoon was pleasantly warm, but sultry at times. Great inroads on the limestone were seen to have been made since our last visit, in 1928. After a description of the limestone, its geological position and contents had been given by the leader, most of the party descended by a steep, but safe, ladder to the quarry floor.

The fossil specimens were found chiefly in the half-decomposed parts of the limestone, and many made their first acquaintance with honey-comb corals (*Favosites*), reef building stromatoporoids (*Clathodictyon* and *Stromatoporella*). About 20 species of fossils were noted, the best find being an almost complete shell of *Craspedostoma lilydalensis*. Crinoid stem joints were fairly common, and a small portion of the cup of one of the sea-lilies was secured. The supposed continuation of the original cave has not yet been explored, although some anxiety was experienced when a diminutive member of the party endeavoured to make history by momentarily disappearing into a hole in the quarry wall.

The results of a few hours' collecting in this quarry show that interesting and valuable fossils may still be found, and it might be well in the interests of science for the Museum and University authorities to keep in touch with the manager with regard to any striking specimens that may turn up from time to time.

ETHNOLOGICAL NOTES.

Mankind is the title of the official journal of the Anthropological Society of New South Wales, to be published triannually. The first number, March, 1931, contains notes and articles of general interest, and the editors, Messrs W. W. Thorpe (ethnologist, Australian Museum, Sydney) and Keith Kennedy, are to be congratulated on providing such good fare for the amateur. The little journal deserves success, and one hopes that its size (24 pages) may increase as a result of numerous subscriptions (the price is 1/- a copy). There is no real necessity for articles on the aborigines, their customs, art, and implements of peace and war, to be crowded with technical terms, to be tedious because of infinite detail. Facts may be presented in a readable manner, without losing any of their value. And facts are preferable to elaborate theories.

"Primitive Art in Australia" is the subject dealt with by Mr. B. L. Hornshaw in *Mankind*. The author for many years has been a keen student of rock carvings in New South Wales, and has described many hitherto unrecorded examples around Sydney and farther afield. His collection of photographs is extensive and unique. "Rock carvings," he writes, "are generally found on large flat surfaces of Hawkesbury sandstone, mostly overlooking fine scenic views. . . . Often we find a group of birds, mammals, fish and reptiles surrounding the ancestral figure (*Baiamee*): also the various weapons used by the ancient hunters are sometimes depicted. Some of these 'pictures' are thirty feet long, others are very small. Associated with them are geometrical designs of straight, curved, or angular lines, which may be classed as religious emblems."

A Melbourne collector of aboriginal stone implements, who rarely travels far on his ethnological forays, has made many finds along the beaches of Port Phillip, even at Middle Brighton and near Point Ormond. After a gale, he picked up a perfect stone axe, at the foot of a Brighton Beach dune. Where a veteran Banksia had been uprooted, several stone knives and nicely-flaked scrapers, together with the two halves of an axe, were discovered. Out beyond Darling, on a creek bank, the collector found another stone axe. Most of his hunting for relics of the lost tribes is done within a dozen miles of Melbourne, and he has a fairly large collection.

A catalogue of the Horne-Bowie collection of stone implements, etc., is being prepared at the Australian Institute of Anatomy, Canberra. The collection, which was presented to the Institute by the late Dr. Geo. Horne and Miss H. Bowie, comprises approximately 25,000 specimens, the bulk of them being Australian. Mr George Aiston, co-author with Dr. Horne, of *Savage Life in Central Australia*, recently classified the collection, which is one of the finest of the kind ever formed in the Commonwealth, and includes many rare and highly interesting specimens.

The Victorian Naturalist

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THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary monthly meeting of the Club was held in the Royal Society's Hall on Monday, May 11, 1931. The President, Mr. C. Barrett, C.M.Z.S., occupied the chair and there were about 120 members and visitors present.

ELECTION OF MEMBERS.

The following were duly elected on a show of hands:—Miss D. Schultz, Alphington; Miss M. Barnard, B.A., Toorak; Miss I. Rodan, Hawthorn; Mrs. Hinge, Hawthorn; Miss L. Rider, Melbourne; Mr. K. M. Niall, Melbourne, as ordinary members; and Miss Margaret Evans, Malvern, as associate member.

NOMINATIONS FOR OFFICE-BEARERS, 1931-32.

The following were nominated:—

PRESIDENT: Mr. J. A. Kershaw, F.E.S.

VICE-PRESIDENTS: Mr. G. Coghill, Mr. V. H. Miller, Mr. G. N. Hyam.

HON. TREASURER: Mr. J. Ingram.

HON. LIBRARIAN: Dr. C. S. Sutton.

HON. EDITOR, "The Victorian Naturalist": Mr. C. Barrett, C.M.Z.S.

HON. SECRETARY: Mr. A. E. Rodda.

HON. ASSISTANT SECRETARY AND LIBRARIAN: Mr. A. J. Swaby.

COMMITTEE: Miss J. W. Raff, M.Sc., F.E.S.; Dr. H. Flecker; Messrs. C. Daley, B.A., F.L.S.; E. E. Pescott, F.L.S.; A. S. Kenyon, M.I.E., Aust.; F. E. Wilson, F.E.S.; P. R. H. St. John; Tarlton Rayment, F.E.S.; and J. W. Audas, F.L.S.

HON. AUDITORS:

Messrs. A. G. Hooke and A. S. Blake were elected.

LECTURE.

Dr. E. McLennan, D.Sc., of the Botany Department of the Melbourne University, gave a very interesting address on the subject of "Australian Fungi." Confining her remarks mainly to the three chief groups of the Saprophytes, she showed many excellent lantern slides which were clearly explained, and also models, dried

and spirit specimens, from the Botany School. Club members also assisted by staging exhibits of living and dry fungi. A hearty vote of thanks was accorded to Dr. McLennan.

EXHIBITS

By Mr. T. S. Hart.—Earth Star Fungus, *Geaster;* one of the vaulted species. Found by Mr. Thompson, Bairnsdale, on the sand hummocks at 90-mile Beach. Rust Fungus on a native *Lobelia* and also on a Garden Daisy; from Bairnsdale. Fungus attacking Prairie Grass; a common, but out-of-season, specimen. Specimen of silicified wood, from Nicholson, near Bairnsdale, per Mr. Stephenson.

By Mr. A. J. Swaby.—Berries of *Eugenia paniculata;* garden grown. Fresh specimen of *Correa bauerlenii.* Specimens of various Fungi and Lichens.

By Mr. T. O. Kerr.—Dried specimen of Rice plant, showing root, stem, leaf, and grain. Grown at Griffith, N.S.W.

By Mr. G. N. Hyam.—Fasciated stems of *Asparagus plumosa* and flower of *Hakea laurina.*

By Mr. P. R. H. St. John.—Blooms of *Epacris longiflora,* from Melbourne Botanic Gardens. (A record of this heath growing naturally within the Victorian borders is required.)

By Mr. C. J. Gabriel.—Specimens of Victorian Fresh-water Mussels, including *Unio australis* Lam., from Diamond Creek; *U. depressus* Lam., from Wooriyallock; *U. nepeanensis,* Conrad., from Mitchell River; *U. Glenelgensis,* from Glenelg River; and *Corbicula angasi* Prime., from Hamilton and Chalka Creeks, near the Murray River.

By Mr. W. Hanks.—Fossil Leaves, apparently of Jan-Juckian age, collected at Pascoe Vale, from under the older basalt.

By Mr. C. Daley.—Blue-gum Moth, *Mnesampela privata,* and Case-moth, *Thyridopteryx Huebneri;* also home-grown specimens of *Correa speciosa, C. speciosa,* var. *rubra,* and *C. Lawrenciana.*

By Miss A. Flecker.—Nest of Striated Thornbill. (A beautiful specimen.)

By Mr. C. French, Junr.—Remarkable specimens of Lerp insects, *Tyora sterculiæ,* on leaves of Kurrajong. The larvæ of these insects cover themselves with slender white threads.

By Miss F. E. Smith and Miss B. Bolton.—Photographs taken at the Easter excursion to Daylesford.

By Master Donald Barrett.—Fungi from Kinglake: *Tricholoma rutilans, Mycena Banksiæ, Stropharia semiglobata, Polystictus versicolor, Clavaria pulchra.*

FOOD OF THE AUSTRALIAN ABORIGINES.

By C. DALEY, B.A., F.L.S.

(Read before Field Naturalists' Club of Victoria, April 13, 1931.)

The chief occupation of primitive man in all ages is concerned with getting sufficient food for his needs. The character and abundance of food are dependent upon the nature of the country and the climatic conditions; and these factors also determine in great measure the manner of life and the habits of the race concerned.

In Australia, with its vast areas in which rainfall is so uncertain, and both animal and vegetable life in consequence subject to extremes, the native races were of necessity nomadic hunters, wandering afar within tribal limits, in search of means of subsistence.

In this ceaseless conflict with nature, their perceptive powers became phenomenally keen, and their knowledge of animal and plant life, as subservient to their needs, wonderfully comprehensive and accurate.

Both from force of circumstances and from choice, the Australian aborigines acquired great variety in food, varying, as Professor Baldwin Spencer writes, "from clay to kangaroo, nardoo to honey." Nothing edible came amiss to their omnivorous taste. In animal food there were marsupials, a few mammals, birds, fish, reptiles, sea-creatures, grubs, insects, etc. In vegetable food were yams, roots, fruits, seeds, stems, leaves, tubers, pith, etc., of certain indigenous plants.

Sea and land, earth and water ministered to the native's food requirements, which were modified by season, and dependent upon supplies available.

Tribal customs also imposed certain and sometimes arbitrary restrictions as to food; a virtual taboo of certain foods according to age, sex, and status. Certain rules regulated the distribution of game. In a social system of which the old men were the arbiters, they, in accordance with human experience, provided for their own comfort and good living at the expense of the other tribal units, who accepted their ruling unquestionably.

Children in general were unrestricted as to food, until initiation into the adult state brought limitations and penalties, *e.g.*, young men were not allowed to eat the flesh of the emu. If one transgressed, boils or eruptions on the skin would be his portion as a result. Certain foods were taboo to women during child-bearing and until the child was weaned. Much of native ritual in magical ceremonies was propitiatory and designed to ensure increase in a particular food supply.

Meals were eaten without any respect to time, periods of repletion, or of enforced abstinence from food often alternating. Food was eaten in the open or in the camp. As a rule flesh was prepared by the men, the women obtaining and preparing roots, nuts, shellfish, yams, etc., and small animals.

In regard to animal food, kangaroos, at one time in millions, were a regular source of supply. They were secured by creeping, stalking, or making use of cover until the spear could be used for a kill. Occasionally a kangaroo would be followed by a hunter until it was exhausted. Sometimes they were driven into converging enclosures and then killed, or under favourable conditions surrounded and forced to go in narrowing circles until confused they became an easy prey. Pitfalls were also made, and pointed stakes placed at frequented fording places.

Kangaroos, like many other wild animals, are very curious, and a party of natives would divide, one section to excite the curiosity, the other to take advantage meanwhile of the same in order to approach within striking distance. Wombats were smoked in their burrows and then dug out.

Opossums were usually located at their hiding places and captured or cut out with the stone hatchet from their nests in the hollows of trees. Wallabies were taken in nets, cages, or pits. Snakes were captured in their haunts or taken from burrows.

Emus were stalked, captured in nets up to 50 feet long, driven into alley-ways and speared, or run to a stand-still with dogs. Pelicans and turkeys were lured or taken with a noose. Scrub-birds were trapped. Pigeons in the north were netted or snared, or, when flying in flocks at certain times on known lines of flight, knocked down with throwing sticks.

For snaring waterfowl large nets, sometimes up to 60 yards long, were skilfully used on streams and lakes; or, from under the surface of the water a native would drag bird after bird noiselessly beneath, wringing the neck, and attaching the birds to a belt or string encircling the waist. Against a flock in rising flight the boomerang could be effectively used.

In Northern Australia, crocodiles are secured with a slip noose, or speared, as also are tortoises, turtles and dugongs. The flying-foxes are speared with a long three-forked spear as they hang head downwards from the trees wherein they rest in company during the day. Iguanas and smaller lizards, and frogs were easily captured. Mice and bush rats were a delicacy.

Some years ago a friend of mine had an official position in Queensland, necessitating a journey in a very dry year to the Diamantina River. There were five in the party including a black boy. They camped on an eminence some distance from the empty river-bed. During the night a roaring noise was heard in the dis-

tance, and in an incredibly short space of time a sea of water extending miles from the river-bed surrounded the camp, which was isolated for a week. The party had completed their mission, and were returning next day before being thus marooned. Provisions ran short and in two days were practically exhausted. The black boy, however, fared well, devouring iguanas, lizards, snakes, and such small game. Then the bush-rats swam in, and he started on these with gusto, eating the tails as if they were radishes. The hungry men followed suit in eating the rats. My friend said he would die first before eating rat; but on the fourth day he was standing near the camp. A frying-pan was on the fire, in which a full complement of rats was frizzling. A gust of wind blew the tantalizing odour to his nostrils. "I went," said he, "and ate the lot, and then got a stick to kill more."

Fish were caught in many ways on the sea verge, in streams and lakes, by transfixion with spears, sometimes by poisoning a pool by placing certain plants as *Duboisia myoporoides* in the water. A common practice was to muddy the water by trampling it, when the fish would come to the surface. Eels were caught in traps, and in the swamps the gins felt for them with their feet, and transfixed them with several spear prongs. At night lighted torches or flares were often used in canoes to attract fish and eels to the surface to be speared. Hollow logs, woven cages, baskets, and frames in the running streams were made use of in taking fish. Nets, sometimes very many yards in length, were used in the rivers. Artificial weirs and stone dams, as at Brewarrina, on the Darling, the most notable example, were constructed, often with much labour and judgment, advantage being taken of places where the passage of the water was at right angles to intrusive rocks in the bed of the stream.

It is interesting to note that "each division of the tribe and the families composing it" had proprietary rights, and separate portions of the fishing grounds allotted to them, each with its distinct name. At several places in the Western District of Victoria, as at Lake Condah, are the remains of these stone weirs, which, when supplemented with traps and frames, were most effective in securing a plentiful supply of fish.

In some cases movable fences or screens of brush or tea tree interlaced were used, as at Bream Creek, which kept back the fish after the tide had receded. In killing animals like the turtle or dugong strong spears or harpoons with detachable heads were used. The presence of the dugong in the water was ascertained by using the remora or sucking-fish with a line attached thereto. The remora adhered to the dugong. Fish-hooks of bone, shell, or wood, barbed, or pointed at both ends with line attached to the centre, were in use.

Besides marsupials, reptiles, fish, and birds, some species of ants, as the green ant of Queensland, and the white larvæ, termites or white ants, the honey-ant of Central Australia with its sweet burden in the enlarged abdomen, and larvæ of wasps, etc., were articles of food. Many insects, grubs, beetles, flies, especially the March fly, were welcome morsels. Eggs of birds and reptiles, irrespective of their stages of development, were appreciated.

In Alpine Victoria, where at certain times the Bogong or Bugong Moth, *Agrotis spina*, or *A. suffusa*, is in millions, the blacks assembled in numbers, collected the moths, kindled fires, and placed the moths on the heated ground in order to scorch off the down and wings. After winnowing to get rid of dust, the bodies were eaten. Sometimes they were pounded in a vessel, smoked, and kept for a week or more before being used. They have a nutty taste, and are very fattening. It is safe to say the Australian blacks exclude nothing edible on the ground of being "common or unclean."

The sea-coast and river-mouths provided never-failing sources of food supply. As in other lands, all round the Australian coast lie kitchen middens, some of great extent where for untold generations aborigines came to take their toll of food from the sea. Shrimps and prawns were scooped up, crayfish and crabs caught in rock holes, the former being roasted, but it was from the molluscs that the chief supply was obtained. Roth enumerates 79 species found in North Australia. These feeding grounds were usually near the coastal fringe, and remains of the broken and cleaned shells, charcoal, bones of birds and animals, stones and chips in successive layers intermixed with sand, sometimes 20 or 30 feet in height and a mile or more in length, tell of the immense quantities obtained and the age of many deposits.

In Victoria, Altona Bay, Brighton, Tarwin, Torquay, Port Fairy, Bream Creek, Wilson's Promontory, etc., were noted feeding places. The stones in the kitchen middens are usually hammer-stones, anvil-stones, and stones chipped for detaching shellfish from the rocks. The anvil-stones have depressions where the harder shells were broken. Fire-stones, small and large, for cooking purposes, are also numerous. The shell remains vary with locality. In Victoria the Mussel, *Mytilus rostratus, M. planulatus*; the Mutton-fish, *Haliotis naevosa*; Oyster, *Ostrea angasi*; *Donax deltoides*; *Voluta undulata*, *Arca lobata*, *A. fasciata*, *A. granosa*, *Austo cochlea striolata*, *Purpura succincta*, *Lunella undulata*, *Patella tramoserica*, *Cardium tenuicostatum*, etc., are found. *Cypræa angustata* and *Turbo undulata* and Scutum frequently form densely mixed or separately packed heaps. Many shellfish were probably eaten raw, but Turbo and Voluta shells are generally charred from fire. On one occasion near Lake Bunga I saw some

Lake Tyers blacks, male and female, having a meal of Turbo, the shells being placed on a small fire for cooking. Shells, it is evident, were often carried some distance inland to certain camps. Usually at the back of the middens or some distance away were the chipping-grounds where stone implements were made.

These middens were not occupied continuously but at certain seasons, being abandoned at inclement periods, or for sanitary reasons, or when abundance of other food elsewhere called the natives.

Brough Smyth somewhere relates that on one occasion a whale was stranded on the coast. The bush telegraphy of the blacks, anticipatory of our wireless, was set going, and the tribes assembled and camped for several weeks in great enjoyment of the profuse banquet of blubber so bountifully provided for their delectation. Stranded seals were also avidly devoured by the blacks, the flesh of both animals being most acceptable, as is sometimes the case with the white man's venison and game, when the offensive odour persistently proclaimed its presence and its stage of decay.

In cooking the flesh of animals there were two chief methods—open cooking on the coals and baking in the oven. The meat, whether fresh or tainted, was sometimes cut up, and might be roasted, baked, boiled, or grilled. In baking in earth ovens, stones or the clay of ant-beds were heated. Fire was made to heat the ground, leaves placed over the hot ground, then hot stones, next the animal, then more leaves, grass, or paper-bark if procurable; then more earth and stones; a method fore-shadowing the "paper-bag cookery" of recent times.

A kangaroo or large animal was usually cooked and eaten where it was killed. The sinews were first removed, the lower limbs dislocated, the body freed of intestines, and a kind of bundle made of it. It was then covered with bark and roasted in hot ashes. Hot stones were sometimes placed within the body. Smaller animals were roasted or baked in ashes. Larger fish were caked with clay and baked, the food being served on sections of bark as plates or placed in bark wrappers. Frequently animals such as the opossum, etc., were singed, and only partly cooked on the embers.

Native ovens, so-called, were usually made in clay ground, beside streams, lakes, swamps, or wells. Holes were excavated for the reception of food, then filled with fuel. Lumps of clay taken out were heated in the fire made. The hole was cleaned out, damp grass, etc., placed therein, on which the animal was laid, then more damp grass, above which were deposited the heated clay nodules. The finer earth or sand was then closely packed over the whole. After the cooking for the requisite time the oven was cleaned out for use when again required.

The blacks had an intimate knowledge of the properties of their

plant foods, and skill in eliminating injurious elements, e.g., Zamia nuts, poisonous as such, were rendered edible, raw or roasted, by being shelled, broken, pounded, and soaked. Roots were eaten raw, roasted, or baked with earth previously heated. The fruit of the Mangrove, *Avicennia officinalis*, a plant, extending round our South Coast intermittently to Altona Bay, was heated and baked.

The Bean tree, *Castanospermum australe*, seeds were well steeped, pounded, and baked in cakes for eating. Seeds of the native flax, *Linum marginale*, were also used, and fruit of the Kangaroo Apple, *Solanum aviculare*, were prepared for consumption. Lily stalks were eaten raw, the roots cooked, and the seeds pounded.

The so-called Blackfellow's Bread, *Polyporus mylitta*, a kind of truffle, growing just beneath the surface in irregularly rounded lumps, was eaten raw, the dirt being shaken off it.

Preparations for cooking vegetable food were according to its nature, various. There was the washing in running water to remove bitter tastes and injurious elements; the grinding of seeds into a meal or paste; pounding with a stick or stone to loosen the fibres and to remove acid tastes; straining, usually through a dilly-bag, sand or fine grass, and grating with a piece of sandstone or a piece of rough bark.

In many cases the animal to be cooked was first singed, then eviscerated, the body closed up tightly with wooden pegs, so that when baked, the flavour and the juices would be effectually retained. Where boiling was done, bark troughs, or in Northern Queensland, large shells, *Melo*, were used as receptacles for water.

Occasionally in tribal conflict, or on special occasions, human flesh was eaten; but cannibalism was not at all a common practice among the aborigines.

The dilly-bag, of which the lady's handbag of to-day is a dainty adaptation, was invariably carried by the lubra—truly a receptacle for "unconsidered trifles." Major Mitchell, 95 years ago, describes the contents of one examined in Australia Felix. "Three snakes, three rats, about 2 lbs. of small fish like whitebait, crayfish, and a quantity of the small root, tao, usually growing on the plains with a bright yellow flower, *Microseris Forsteri*. Also in the bag various bodkins, colouring stones, and two 'Mogos' or stone hatchets."

Of the cooking of vegetable food near the Murray, the Major writes:—"It," a kind of rush, "was placed between hot embers until heated and softened. Balls of dry fibre from the roots of a large reed were then treated. The outer rind was stripped off, the ball was laid before a fire, then twisted to loosen the fibres, after which the gluten was shaken out like dry flour."

Plant food was extremely varied. W. E. Roth, in his articles

on Ethnology enumerates 240 plants from North Queensland alone, of which some part was used as food:—Rhizomes, roots, stalks, yams, fruits, berries, tubers, shoots, or seeds. Gray (afterwards Sir George) in South-Western Australia, mentions about 200 kinds of food eaten, animal and vegetable. This gives some indication of the immense number of plants, amounting probably to more than a thousand, edible in part, which supplied food to the natives throughout Australia, varying from the tropics to the temperate zone, from the desert to the Alpine snows.

Many kinds of seeds were ground and made into a paste. Of these may be mentioned the seeds of the narrow-leaved Mulga (tabla) also small black seeds of an acacia, and of a spinifex in North-West Australia.

These are said to be sweet, palatable, and nutritious. Grinding mills of a gneissic rock are used, with a hard oval-shaped stone with one flat side to move with a rolling, rubbing motion on the seed fed on to the mill-stone.

The meal gravitates from the edge into an oval-shaped wooden receptacle. If dry, the seeds are moistened with a little water.

Purslane, *Portulaca oleracea*, seed is collected and ground in many places, and is nutritious, also Parakylia. The plant best known and most widely distributed is *Marsilea quadrifolia*, from the seeds of which Nardoo, an occasional article of aboriginal food in dry seasons, is made. The plant grows in clay pans, and resembles a four-leaved clover. It sheds its black seeds or spore fruits, which are swept up, sifted, then ground in a mill, usually about 9 inches by 4 inches. The meal is collected in a wooden trough, and made into a paste of an ash colour, rather sodden in appearance. Burke and Wills found the meal innutritious and hard to digest.

Seeds of the Bladderwort Saltbush, Mulga, Box-tree, and Stuart's Desert-Pea, *Crotolaria Cunninghamii*, among others, are also pounded for food. It would seem that the word Nardoo, applied to the Marsilea, was also loosely used for the meal obtained from other edible seeds. The Munyeri, a fleshy root of the sandhills, and the root of the Currajong were other articles of diet appreciated.

As in the case of animal food, places are visited in due season by native tribes when fruits, seeds, or roots are plentiful. Thus in Queensland, the Bunya Bunya Pines, *Araucaria Bidwelli*, growing in a restricted area, were visited in January once in three years for their seeds, which are sweet before ripening, when they have a taste like roasted chestnuts

Tribes came long distances for the Bunya season, and it is interesting to note that each tribe had its own special trees, of which a certain number was reserved from generation to generation for

each family of a tribe, the only instance of hereditary proprietary interest known among the aborigines, and protected by law. The roasted seeds were eaten in large quantities, and were nutritious and fattening. Sometimes the aborigines stored surplus seeds in a waterhole for two or three months, using them when they germinated.

Major Mitchell relates that on the Lachlan River the Belyan or Bulrush root, *Typha angustata*, was the chief food, prepared in kilns or mounds, so frequently seen along the Murray River system. These are of clay and ashes, and are considerable in extent.

In South Australia from January to April the blacks resorted to the coastal fringe in order to feast on the fruit of the Pigface, *Mesembryanthemum equilaterale* (Kaukalla) which grows in abundance. In the Grampians and Victoria ranges the succulent leaves as well as the fruit were also eaten.

Pods of certain coastal acacias, *e.g. A. sophorae*, roasted in the ashes were also used.

The lower part of the Xanthorrhea or Grass tree stem, not yet grown above ground was eaten, also the tender tops of the Cabbage Palm, the succulent parts of ferns, etc. The fruits of the Santalum or Quandong, small berries of species of Epacris, and fruit of the Nitre bush, *Nitraria billardieri*, were edible, as also that of the Ficus, Capparis, Sambucus, and Solanum or Kangaroo-Apple. Berries of Native Currant, Raspberry, Cranberry, and fruits of the *Persoonia* or Geebung, and the fleshy pedicels of the Native Cherry or Ballart were also eaten.

The Queensland Nut-tree, *Macadamia ternifolia*, bears hard-shelled edible nuts of good flavour, and nutritious as food. The Government protects these trees in the interests of the aborigines.

In Australia, with its many dry areas and its long periods of drought, the existence of water supplies has been and is still of the utmost importance. Natives in these arid parts carefully preserved and knew every well, soak, or stony receptacle in which water might be procured. They carefully noted the rushes and signs indicative of moist places where water might be found beneath the earth or sand. In many places they constructed primitive dams. They could collect the water from dew laden herbage. In Mallee country, when need arose, they could cut the long lateral roots of the gum scrub, *Eucalyptus incrassata*, *E. dumosa*, *E. oleosa*, into short lengths, which when placed on end in a receptacle would yield a welcome if moderate supply of the precious fluid. The Needle-bush, *Hakea leucoptera*, *Casuarina Decaisneana*, Desert Oak, and *Eucalyptus microtheca*, were also serviceable in the same way. Water was also obtainable from the bulging base of a species of *Melaleuca*, itself an indication of water.

From *Sterculia rupestris* in Queensland, by cutting holes in the

trunk where water would collect, a sweet drink could be got. Strips of bark were placed around the *Pandanus* to conduct rain showers down the branches and stems into large shells. Water was carried in shells such as Haliotis, or larger ones like Melo, and sometimes in skulls, or in wooden receptacles. Skins, especially kangaroo, were also used, and in Central Australia rabbit skins are made into water bags. From the sugary manna of the Lerp insect dissolved in water a drink was made, and in Queensland from the *Pandanus* a fermented drink was obtained.

The blacks were very fond of honey from the hives of wild bees which they were skilful in discovering, often placing a piece of white down on a captured bee and following its flight to the stored honey. The honey was sometimes mixed with water, or the honied Banksia flowers steeped in water. Although no strictly intoxicating drink seems to have been known or produced among the aborigines, they had the Pituri or Pitcheri made from the leaves of the *Duboisia Hopwoodii*, a Queensland plant of the solanaceous order. Its leaves, half green, half yellow, like tea-leaves, were roasted, wetted, and teased. With them were mixed burnt leaves of *Acacia salicina*, Native Willow. When powdered the Duboisia irritates the nostrils, causing sneezing. The tops and leaves are gathered in autumn and hung up to dry. The Pituri is made into quids, about 2½ inches by ⅝ inch, which are carried behind the ears. A quid is sometimes chewed in company. Pituri is also smoked; the leaves, being damped, are mixed with potash from burnt plants and rolled up like a cigar. In small quantities it is a powerful stimulant, checks hunger, and lessens fatigue. The chewing of it is said to produce a dreamy voluptuous sensation. Another species, *D. myoporoides*, Corkwood, in N.S.W. and Queensland, according to Dr Woolls, has an intoxicating property. The natives make holes in the trunk, in which they place water, which, if drunk next day, causes stupor. The Pituri is an article of extensive barter over a large area, especially in Northern and Central Australia.

In some parts of Australia, notably Queensland, clay is eaten as a delicacy. Clay (Kappai) from the outside of ant-hills is taken and elaborately prepared, also white clay, or Kaolin. This is freed from all grit, made into a smooth stiff paste, dried, wrapped up, subjected to heat, and it is much appreciated as an article of diet.

As a rule, the aborigines, like most primitive people, did not exercise providence in regard to food supplies, but in some places they did at least encourage and protect certain plants.

The "superiority complex," which so readily besets us in our ordinary consideration of the aborigine, is wholly subdued when in direct contact with the resourceful native in his natural environment.

"THE WATCHER AT THE DOOR."

Halictus mesembryanthemi Cockerell.

By TARLTON RAYMENT

I think I told you that, at Sandringham, we have a garden on the foreshore, the contours of which may be quickly described. Two or three hundred yards apart are two small capes, consisting of a rock-like formation of sand and clay, cemented into a more or less compact mass with iron-red material which has also stained the whole a shade of rich brown. In between, the softer "country" has not resisted the thumping of the waves so effectively, and a small cove has been formed. The cliffs are sixty feet or so in height.

A landscape gardener came along, and laid out a plan that utilised the capes by converting them into ornamental moles. To gain rounded contours, the capes had to be built up on the "face" with rock-work at an angle; terraced, in fact. Behind the stones a rubbish of clay, tree clippings, street sweepings and other municipal debris was filled in to maintain the rising levels. On top, finer soil was laid over all and grass lawns were sown down. *Coprosma* hedges are planted along the very edge to shelter the garden from the ferocity of the south and westerly winds that scorches the "softer" plants until they resemble brown paper. Even the Norfolk Island Pine, sea-lover that it is, burns under the tempestuous trial, so much for the garden on the top, in the sheltered and soft soil of which the striped bee, *Halictus seductus*, lives.

Now if the conditions on top are, well, hard on plant-life, what must they be on the face of the terraced cliffs? The weather batters away at the ground, and tears at every shrub so viciously, that only the very hardiest can survive. The clay shows bare in patches, and only plants that cling tight to mother earth can maintain a foothold, but even under such inhospitable treatment the Pigface thrives, and during October and November the pink, mauve, white, yellow, and red flowers dress the rock faces with blazing colour. It is an unforgettable picture.

The Pigface clings tightly to the ground, but scrambles over the stones, and clothes most of their nakedness. Once the area is protected by the stout, fleshy, stemlike leaves, the earth no longer fears the onslaughts of wind and rain, and settles down in peace to recuperate its strength.

As I have already said, there are patches so barren, so thrashed by wind and rain and sea, that it seems as though every particle of plant-food were leached out forever. Even the Pigface thrusts forth its growing-points slowly and reluctantly. It will master it in time, but there are small areas of a square foot or so that still refuse to acknowledge the spreading dominion of the plant, and

The Sandringham climate is, owing to its geographical position, subject to sudden and rather "trying" variations due to cyclonic and anti-cyclonic influences, and while the day at noon might be clear and warm, with a northerly breeze, within ten minutes the sky will cloud over, and the wind veer sharply to the cool south. At such times the Pigface closes up, and in the flower I can often find half a dozen or more males huddled up together, higgly-piggly. Gone is the sleek alertness of the courting lovers, for they do not attempt to fly, but seem to be under a trance that requires warm sunlight to break the evil spell. Poor miserable creatures of the sun! Hide Sol's rays, and the joy of life departs from them. Let us leave them, for they have not a trace of the beautiful clustering of the Hive-bee to interest us.

But what of the industrious female? as I have already said, her abdomen on the top part is brown, and it is ringed with a lighter tan, but the under-part is of a warm, rich tint. An artist would reproduce the colour with raw sienna and a trace of orange. Her length is slightly over a quarter of an inch, for she is larger than her consort. On the last abdominal segment is the furrow that is the family brand. Her legs are fairly well clothed with hair, but it is chiefly on the tibia and femur—shin and thigh—that she carries her large load of creamy pollen. In addition, she carries a little on the under-part of her abdomen on a ventral scopa. I am glad that the pollen is of pale colour, for otherwise I would miss her altogether; it assists me to follow her to her home.

The homes of the *Halictus* are in amongst the Pigface.

Well, the outside of the nest is just the merest black hole, from which a small stream of sand has been poured. At any rate, it looks as though it had been poured out. The shaft is only 2 mm.

in such arid soil one will find the burrows of this black and tan bee.

Forget the name for a while, and I will relate what little I know about them. My field note-book tells me that I may see the first bees in September, when they are working on the Veronica, but at that early date there are very few about, for they are the virgin mothers which passed through the winter.* However, I do not find many of this *Halictus* until the Pigface puts forth its multitude of blooms in October and November.

About the first week in October we have a small-flowered species of Pigface covering stones and ground with a lovely amethyst-pink, and I note many hundreds, nay, thousands, of tiny black bees darting from flower to flower in rapid flight. They take a sip or two from the nectaries, then off again. They alight frequently on the flowers, combing their antennae with much gusto, and are evidently highly satisfied with everything. Since they are so watchful I cannot move without the resting bees taking immediate flight. It occupies a lot of time to get one inside the killing-bottle. He is black in colour, and without much hair, and measures about 5 mm. in length. His iridescent wings provide the hues of the prism.

Just so, he is plainly a gallant, and I must see more of him for there are hundreds of his kind, every one of which is spruced up, combed exquisitely, and alert for conquest. The darting flight tires my eyes, but not my patience. I triumph, for after much delay I find myself sitting beside a "blaze" of Pigface.†

I watch, I wait. Presently a slightly larger bee, with a tan-coloured abdomen, alights in the maze of anthers that comprise the centre of the flowers, and at once begins to dive into the floury mass, raking with her legs, and squirming her whole body into the creamy pollen. The bee is so businesslike; plainly she has a house and a family to provide for, and the worker wastes no time. Her behaviour is in direct contrast to that of the little black-fellows.

Presently three or four of the gallants flip into the flower, and endeavour to win the industrious tan female. It is violent love-making, with much "horse-play" on the part of the males. Soon one is successful.

Ordinarily, after the nuptials, the male zips away, as though in search of another bride. The female continues her industrious searching for and harvesting of pollen. Fresh males arrive. I am not absolutely certain, but think I have seen females mated more than once, and I have observed the same phenomenon among other *Halicti*. However, I know that these *Halicti* males do not yield up their lives as the price of love, and thus they diverge from the dread sacrifice of the hive-drone.

*The two sexes of this species pass through the winter in larval form, and both may be observed to emerge in spring, within a few minutes.

†The botanical species *Mesembryanthemum*.

or so in diameter. I examine quite a number, and a quarter of an inch down inside I see that the shaft is completely blocked with a black head. Ever and anon this living stopper moves forward, and protrudes sufficiently to permit of an observation of the surroundings. The slightest move on my part, the faintest rustling of the feet of a passing ant, the swish of the wings of a large fly, and the stopper retreats instantly. There is a momentary pause, and the head comes forward for another examination.

It is a dull day, and only a few laden bees are returning, so I watch them enter holes at which there is no door-keeper. Plainly, then, it is the worker herself that keeps such a vigilant guard. When she is abroad there is no watch kept. Remember, it is yet spring, and the black males and tan females now flying and loving are children that were carried over the winter wrapped close in their cradle chambers. At first I was overjoyed to find, as I thought, that the old grandmother was keeping guard, just as lovable Fabre described.

The first females were observed on September 10, and surely a month is all too short for a bee to emerge, evacuate her tube, provision her pantry and deposit her eggs, and disappear without leaving any trace. The Cliff-bee has this habit of sitting just inside her portal, so that her black head effectually closes the aperture, and I do know that she passed through the winter in her shaft as a larval baby.

Is the tube of this Australian *Halictus* coated with the beautiful porcelain of the French species? I can see no lining whatever, and the workmanship is of the crudest kind. One might just as well compare the Australian aboriginal with a modern Frenchman, for the gulf that separates the two bees is just as wide.

The "Sandhopper" of the top of the cliff is a *Halictus*, too, and she has the furrow of the family, and her gallery is also entirely without lining so far as my eyes can tell. I have seen her waiting at her door, but since she nests close to a grass-root, her habits are more difficult to observe. But the sun is down, and a lone sail is all that shows over the wide waters of Port Phillip; it is the Italian fishermen returning with their catch of Schnapper, and I wish that a toothsome pink beauty graces my table when I reach home. Good-night.

. . . . . .

To-day the temperature is 90 degrees in the shade, and dozens of my tan females are carrying creamy-yellowish pollen. Unlike the Sandhopper's rule, "one bee to one shaft," I note five of these females go in the same door, one after another, the keeper obligingly moving aside. Indeed, it is now the door-keeper herself who flies out, her place being taken by another, who, after a short

period as sentry, also emerges, and darts away to harvest her granules. There is sharp divergence here from the habit of the *Halictus* of Fabre. There is no grandmother watching patiently over the mouth of the tunnel. While the entrance is usually filled with a black head, the owner will presently vacate the task and fly away, her place being taken by one of her sisters: of that I am certain. Here, then, is a great advance towards the social character of the Hive-bee.

The shaft is a winding one, and, *Halictus*-like, it is the main corridor used by all the sisters that have rooms opening off from it. At present there is only one room to each female, and it is poorly furnished. There is no tapestry for wall-drapings, neither is there any porcelain glaze, or even white-wash: just a smooth, oval, earthen chamber containing a small pudding slightly less in size than the head of a small match. Its aggregate is about equal to two loads of the Hive-bee. It is more golden in colour than I expected to see, for the pollen is creamy-yellow.

There is a tiny, white egg, slightly curved, stuck on the top. The chamber is not sealed up in any way, and Fabre thought that the mother continued to nurse her baby until it was ready for metamorphosis. Perhaps this one continues to give additional food. Why not? But the pudding should be sufficient, for it seems an ample supply for so small a bee.

During November, these females are so conspicuous that three or four, perhaps more, may be seen in a single Pigface flower. Of course, this botanical species is then in its full glory, so that one might be pardoned for calling November the "month of Pigface." As you are aware, the centres of the flowers are just a tangle of pollen-laden *anthers*, and a common spectacle is a few dark spots representing the tips of the bodies of the tan females, which seem to stand on their heads to reach the nectar. So intent do they become that one may stroke the bees without causing a cessation of sweet-gathering.

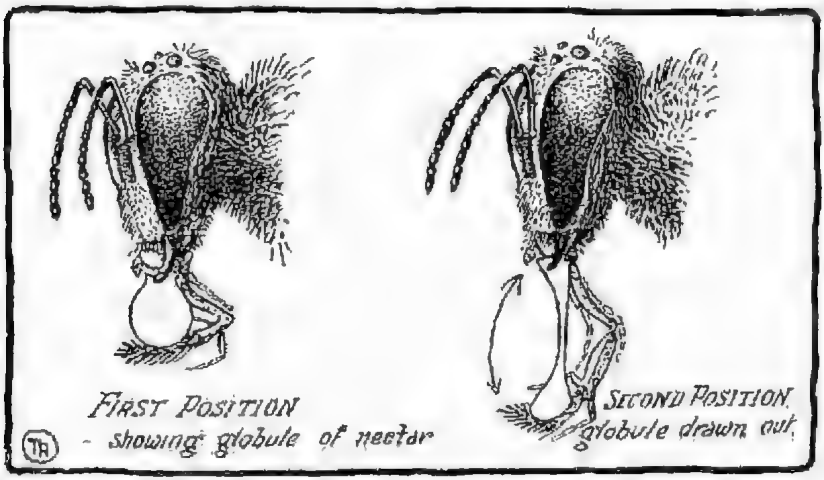
After ten minutes in that reversed position, the female executes a performance that is certainly very singular. I have never read of anyone recording the action, and the only other bees that use the method are minute ones, with colours of opalescent iridescence.*

With its load of pollen already packed on the tibia, femur and belly, the bee mounts to the edge of the petals in the full warmth of the sun. She then extrudes her tongue, and puts a "kink" in it. A very small globule of thin nectar is regurgitated, and held between the tongue and the jaws. At once the tongue begins a fairly rapid pulsating movement, up and down, in regular beats.

*H. raymenti, H. victoriae, H. veronicae, and other species.

that result in the globule being alternately stretched out into a thin thread, and then allowed to contract into its globose form.

At first the significance of the manœuvre escaped me, for I concluded that it was the usual clearing of the tongue from any embarrassing pollen-granules, for in all bees this is always performed by the front pair of legs. But when so engaged, these bees hold their heads well forward and up, with the front legs well back, and this posture is necessary to give the tongue full play. This organ is bent into the shape of a < lying on its side. The bee's jaws are at the highest point, and the tongue-tip is the lowest; the conjunction of the lines represent the bend or "kink" which works with a hinge-like movement.



The *Halictus* female "whips" her thin nectar in the warmth of the sun to ripen it into honey.

When the jaws are wide opened, the nectar has a tendency to fall, but just at that moment the tongue catches it up again. The movement is rapid, and continued for five minutes or more at a time: one can actually see the nectar becoming thicker and thicker. The denser material receives additional thin liquid from the honey-sac, so that when the process is completed there is quite a large globule of thickened honey. The wisdom of the creature is shown by its starting with only a tiny amount of thin nectar, for a large drop at that stage would be uncontrollable. The stretching out of the liquid exposes a greater area to the warmth of the sun, and evaporation is materially hastened. The labour of the organ becomes more difficult as the density of the sweet increases, and the movement slows down perceptibly before the conversion is

satisfactory to the bee. Loaded with cream pollen, and with her sac full of ripe honey, she wings away to her chamber to knead both foods into a tasty nutritious pudding that will neither mould nor ferment to endanger her young ones' lives.

I have recounted, in another essay, how the Honey-bee subtracts from new nectar much of the superfluous water, and of the manner in which she voids it while winging homeward, but I must leave it to you, reader, to discover why these Australian *Halicti* must bask in the hot sun to whip the thin nectar into thick, ripe honey for their cakes just as the farmer's girl beats the thin cream into the clotted mass that forms such a delectable addition to our cream-puffs.

It seems that five or six females work from one entrance, and about November 16 I find that many of the burrows are completed, for they are then closed with a plug of sand. Furthermore, as though to prove that the grandmother of the *Halictus* does not render a last loving service by keeping the door, I find many of these mothers dead in the tangled centres of the Pigface. Their life's work is completed when the nest is provisioned and egged, so they creep away into a flowery coffin to die.

The co-operative service of watchman has reached a much higher plane in the Australian *Halicti*, for every one of the inhabitants undertakes a period of duty. There are half a dozen sisters, and this is communal service of an order much higher than the "keeper" duties of the French *Halictus* grandmother. The Australian female guardians, sisters all, may be compared with the workers of the bee-hive carrying out the patrolling of the door. These bees demonstrate that within a single species are family traits that not only form connecting links between genera, but also mount in innumerable gradations that obviously bind the whole into one indivisible family.

So common is this sentinel duty among my local bees that even the Cliff-bee, with her lone shaft and solitary skin purse of honey, sits for hours at the doorway. It is an elemental duty undertaken by many bees of widely-diverging genera, and had it been claimed by any other observer but Fabre that only the grandmother served as watcher, I should have concluded that the observer was in error.

But what I am really interested in is the elemental character of the home of the Australian *Halicti* as compared with the magnificent porcelain walls of the French *H. zebrus*. On the other hand, what an advance on the social side, where every sister willingly gives up a period of her time to undertake a beautiful co-operative task for the benefit of the family. *Halictus*, I salute you for your advance towards the evolution of an admirable co-operation.

DAYLESFORD EXCURSION, EASTER, 1931.

The Club excursion to Daylesford for the Easter Holidays was well attended, the party consisting of sixteen members and friends. We arrived at that elevated township on Friday afternoon in dull, cold weather and were informed by the advance guard, who had arrived the previous day, that they had been greeted by a snowfall. However, the weather continued to improve and we were able to spend the rest of the afternoon very pleasantly in exploring the fine gardens on Wombat Hill and enjoying the extensive view of the hilly timbered country opening up in a wide panorama to the north, with the extinct volcano, Mt. Franklin, in the immediate foreground. The gardens are characterised by an exceptionally fine growth of conifers, particularly Sequoias, Spruces, Cedars and Pines, for which the rich volcanic soil and the elevated position are very suitable. Many of the smaller trees and shrubs were displaying the exquisite tints of autumn, and of the Australian flora, a single tree of the Crimson *E. ficifolia* bloomed out of season and attracted many nectar-loving birds.

Our place of abode was situated on the shore of the newly-constructed Lake Daylesford, which has replaced what was formerly a dismal swampy area with a fine sheet of deep water, amply stocked with trout, whose rising ripples were visible when the sun was off the water. An early morning view, when the blanket of mist covering the surface was illuminated by the rising sun, was memorable. Just below the outfall of the lake are the Hard Hill and Sutton Springs where the mineralized water can be obtained, both by pumping and by natural flow. The water is crystal-clear and cold, and holds in solution compounds of calcium, magnesium, sodium and iron, and is charged with carbonic acid gas. Iron oxide is participated when the water loses the gas and this is instanced by the rusty colour of the creek bed and the universal screw-topped bottles of the hydro devotees. To carry an unstained bottle is to be branded as a newcomer.

Following down the Wombat Creek, in which are situated several mineral springs, all made easily accessible to the public, a siding track, probably an old water race, leads for a distance of about three miles above a picturesque gorge to the Tipperary Spring. The gorge is deep and narrow with numerous huge outcroppings of dyke rocks and full of timber which has not yet reached maturity, since it was originally cut out for mining purposes. From Tipperary, a track over the ridge leads back almost directly to Daylesford, passing close to the old workings on the famous Ajax line of reef. A few hours were spent exploring the deserted sites of the several Ajax mines with their huge mullock dumps, rusted machinery, and engine foundations. An examination of the dumps revealed some interesting quartz-vein formations and slickensides, but no fossils.

Mt. Franklin was visited and proved to be an excellent example of an extinct volcano. Entering by a gap on the eastern side where the lip has been worn down by an extensive flow of lava, the crater is easily accessible to vehicles. It is an almost circular amphitheatre containing numerous well-grown eucalypts and a plantation of Cork Elms, as well as a shelter shed and water tanks. We ascended to the rim, noting the scoriaceous nature of the loose rounded stones, some of which contained crystals of tachylyte and olivine. The crater rim is highest on the north side and offers an extensive view of the surrounding country on all sides. The timber is almost entirely of eucalypts, but on the highest point a few ancient Casuarinas survive, and one solitary lichen-covered Banksia. Some rock turning here exposed

numerous colonies of ants, including pugnacious "Bull-dogs" and "Jumpers," centipedes and millipedes. Some of the latter were collected, and after fasting for three weeks in a matchbox, fed ravenously on a scrap of raw fish. A specimen of the wingless female of a fly of the genus *Boreoides* was also secured.

Hepburn was visited twice; once at night time when the bright electric lighting and the gaiety at the Pavilion and elsewhere suggested an exotic setting. The prevailing lure of gold affected one of our party who brought along a prospecting dish. Samples of wash dirt were tried from various places but with negative results. However, when visiting the beautiful Jubilee Lake, some genuine prospectors were discovered working an alluvial lead on the creek flat, who obligingly panned a few dishes and disclosed visible colours of the precious metal.

A visit was also paid to the Stony Creek Basin, situated just beyond Jubilee Park, which also boasts some fine conifers. The origin of this remarkable amphitheatre opening only on to the dry bed of Stony Creek is somewhat of a mystery to geologists. The basin is about 100 feet deep and about 50 acres in extent. It is generally considered to be a "block subsidence" subsequently filled with water since diatomaceous earth and fossiliferous lignitic clays are found to a considerable depth below the now dry surface. Some rock specimens were collected but the prolific growth of blackberries, thick with ripe fruit, proved more attractive to most of the party.

The season was unpropitious both for wild flowers and birds. One notices the prevalence of the English and Cape Brooms, which grow thickly on unoccupied areas and are "proclaimed" plants for the district. The timber is almost universally second-growth Eucalyptus of several species, with a few Lightwoods and Silver Wattles. The latter grow rather thickly in the gullies, but Sweet Bursaria somewhat scantily. The European Bramble is universal but hardly a pest as it is in moister localities.

During our stay we joined in with the members of the Leach Memorial Club and spent a pleasant afternoon among the birds. Mrs. W. T. O'Neill has kindly furnished me with a list of the 28 species of native birds identified on this excursion, the principal ones being the Red Wattle Bird, Yellow-winged and Yellow-faced Honeyeaters, White-naped Honeyeater, Red-browed Finch, Golden Whistler, White-browed Scrub Wren, Spine-tailed Swift, Grey Bell Magpie, Grey Butcher Bird, Noisy Miner, White-throated Tree Creeper, Brown and Yellow Thornbills, and Little Grebe and Black Swan on the lake. To these may be added the Spotted Ground Bird, a pair of which we observed near the Ajax mine, and the White Cockatoo, a flight seen from the train near Trentham.

A. E. R.

ROBIN FIGHTING REFLECTION.

At Hopton House, during the Easter Excursion to Daylesford, we were interested in the antics of a Scarlet-breasted Robin, which, infuriated at his reflection in a window pane, gallantly and tenaciously fought his mirrored image. For about two hours he endeavoured to punish his supposed rival, being encouraged by the presence of his mate, perched in an adjoining lightwood tree. So engrossed was he in his attacks that some members of our party were able to approach almost within touching distance as he clung, pecking, to the window frames.

M. S.

The Victorian Naturalist

Vol. XLVIII.—No. 3. July 8, 1931. No. 571

The Annual Meeting of the Club was held in the Royal Society's Hall on Monday, June 15, 1931. The President, Mr. C. Barrett, C.M.Z.S., occupied the chair, and about 90 members and visitors were present.

ELECTION OF MEMBERS.

On a show of hands the following were duly elected:—As ordinary members: Mrs. F. H. Salau, Clarinda, and Mr. F. S. Colliver, Essendon.

GENERAL BUSINESS.

Attention was drawn to an exhibit of skins of the Blue-tongue Lizard, and it was stated that these had been taken at French Island with the object of testing their suitability for the manufacture of leather goods. In view of the possible extermination of these and other useful and defenceless reptiles, it was resolved that representations be made to have protection declared for all species of lizards in Victoria, with the exception of the Monitors or "Goannas."

It was also resolved that the Federal authorities be approached regarding protection for the Australian Bustard or "Wild Turkey" in Central Australia, as recently advertised tours to the interior for sportsmen have held out the inducement that these birds are plentiful.

The President congratulated Mr. D. J. Mahony on his recent appointment as Director of the National Museum. Mr. Mahony, in reply, outlined a scheme for adding to the attractions of the Children's Room at the Museum by exhibiting, periodically, living insects, etc, which could be collected close to Melbourne. He asked for the assistance of Club members in securing specimens of both the flora and fauna.

ANNUAL REPORT AND BALANCE SHEET.

The Annual Report was read by the Hon. Secretary and was received and adopted. The principal items of receipts and expenditure were stated by Mr. A. G. Hooke (Hon. Auditor), who congratulated the Club on a very successful financial year. On the motion of Mr. Hooke, seconded by Mr. G. Coghill, the Balance Sheet was taken as read and adopted.

ELECTION OF OFFICE-BEARERS AND COMMITTEE.

The following were declared duly elected:—President, Mr. J. A. Kershaw, C.M.Z.S.; Vice-Presidents, Messrs. H. V. Miller

and G. N Hyam; Honorary Treasurer, Mr. J. Ingram; Honorary Librarian, Dr. C. S. Sutton; Honorary Editor of *The Victorian Naturalist*, Mr. C. Barrett, C.M.Z.S.; Honorary Secretary, Mr. A. E. Rodda; Honorary Assistant Secretary and Assistant-Librarian, Mr. A. J. Swaby; Committee, Miss J. W. Raff, M.Sc., F.E.S., Messrs. C. Daley, B.A., F.L.S., Geo. Coghill, P. R. H. St. John, and A. S. Kenyon, M.I.E.Aust.

PRESIDENT.

The newly-elected President, Mr. J. A. Kershaw, C.M.Z.S., then took the chair and expressed his thanks to the members for his election.

VOTE OF THANKS.

On the motion of Mr. J. H. Harvey, seconded by Mr. F. Pitcher, a vote of thanks was accorded to the Officers and Committee of the past year.

LECTURETTE.

Mr. C. Barrett, C.M.Z.S., gave an interesting talk on the Giant Earthworm, *Megascolides*, specimens of which he recently assisted in collecting in the Bass Valley. His remarks were illustrated by lantern slides from photographs showing the worms in their haunts and the method of collecting them.

EXHIBITS.

By Mr. H. P. McColl.—Garden-grown flowers of *Hakea laurina, Grevillea rosmarinifolia, Eugenia Smithii, Stenocarpus sinuatus, Thryptomene sp., Hardenbergia monophylla* (white and pink).

By Mr. A. J. Swaby.—Luminous fungus from tea-tree scrub, Beaumaris.

By Mr. A. N. Burns.—Case of Australian saw-flies, representing some of the principal genera, *Perga, Pterygophorus*, and *Philomastrix*. Also growing specimen of Tassel Fern (Clubmoss) from Tully River, North Queensland.

By Mr. T. S. Hart, M.A.—Specimen of Mistletoe, *Phrygilanthus eucalyptifolius*, growing on Oleander, from Beaumaris.

By Mr. A. E. Rodda.—Pupa cases and emerged Butterflies of *Jalmenus evagoras* Don. Collected on Silver Wattle at Daylesford.

By Mr. H. Whitmore.—Aboriginal Stone Axe, found in a garden at Camberwell, 18 inches below the surface.

By Mr. E. E. Pescott, F.L.S.—Fruit of Wine Palm, grown at Camberwell.

By Mr. D. J. Mahony, M.Sc.—For National Museum. Eggs of Banded Stilt, collected at Lake Callabonna.

By Mr. J. A. Kershaw, F.E.S.—For National Museum. Spirit specimen of Giant Earthworm.

By Master Pat Flecker.—Nest of Weaver Bird. Jaws of Barracoota, and Razor Shell, from Bay beaches.

By Mr. A. S. Kenyon.—Garden-grown Australian flowers.

By Mr. C. Barrett.—Living specimens of Gold (Stag) Beetles, *Lamprima rutilans*, from Genoa River, Vic.

By C. J. Gabriel.—Land Shells from Stanhope, Vic. *Hallonia pulchella* Müll., introduced from England. Marine Shells. *Humphreyia strangei* A. Ad., Vic. *Dacosta multangularis* Tate, Vic.; *D. australis* Sby., N.S.W.; and several species of Genus *Brechites*.

By C. French, junr.—Skins of Southern Blue-tongue Lizard. These skins, collected at French Island, Western Port, were sent to the exhibitor.

By Jas. A. Kershaw, for National Museum.—Giant Earthworm, *Megascolides australis* McCoy. Locality, Poowong, Victoria.

By D. J. Mahony, for National Museum.—Clutch of Eggs of Banded Stilt, *Cladorhynchus leucocephalus* Vieillot. Locality, Lake Callabonna, South Australia.

ANNUAL REPORT.

To the Members of the Field Naturalists' Club of Victoria.

Ladies and Gentlemen,

In presenting the Fifty-first Annual Report, for the year ending April 30, 1931, your Committee desires to express its gratification that, despite general adverse conditions, the Club has continued to make progress.

The membership roll now stands as follows:—Honorary Members 3, Life Members 8, Ordinary Members 287, Country Members 89, and Associate Members 24, making a total of 411, and showing an increase of 25 members above the total of 386 for last year.

It is with deep regret that the deaths of four members have to be recorded. The Club mourns the loss of Mr. H. B. Williamson, F.L.S., who passed away suddenly in the midst of his scientific activities. His great services to the Club and his popularity with all who come in contact with him well merited the appreciation published in the March issue of *The Victorian Naturalist*. Mr. W. Scott, who died at the advanced age of 82 years, on August 30 last, was a member for 46 years, having been elected in 1885. A reference to his connection with the Club appears in the October issue of our journal. The sympathy of the Club has also been extended to the families of Mrs. R. Virgoe and Mr. N. G. McKenzie.

The attendances at our monthly meetings have exceeded the average of last year, and at times the accommodation in this hall has been overtaxed. The exhibits, which have always been a feature of our meetings, have been particularly good, especially when members have responded to the request for specimens to illustrate a lecture. It is to be regretted that some interesting exhibits have not been recorded in the *Naturalist* through the failure of exhibitors to hand in notices of them. Lectures and papers have been contributed by Messrs. L. L. Hodgson, F. G. A. Barnard, D. H. Fleay, F. Chapman, A.L.S., E. E. Pescott, F.L.S., W. H. Nicholls, H. B. Williamson, F.L.S., A. H. E. Mattingley, F. Lewis, Tarlton Rayment, J. A. Kershaw, C.M.Z.S., P. F. Morris, and C. Daley, B.A., F.L.S. A wide range of subjects was discussed, nearly all being illustrated by lantern slides or epidiascope projections, and with suitable exhibits, which were fully explained. For the March meeting, a programme of moving pictures illustrating interesting phases of bird life was held in the memorial hall of the Emily McPherson College of Domestic Economy. The pictures were introduced by Mr. C. Barrett, C.M.Z.S., and by Mr. R. T. Littlejohns, R.A.O.U. The innovation was very popular and attracted a large audience, including representatives of kindred societies.

The excursion programme for the year has been almost completely carried out. Two outings were missed on account of adverse weather and other unforeseen circumstances. In addition to those set forth on the syllabus, an excursion to the Botanic Gardens was held under the leadership of Mr. P. R. H. St. John, and one for shrub planting, at the Austin Hospital, led by Dr. H. Flecker. Leaders of excursions are asked to send in their reports for publication. Of the year's excursions 24 were held on Saturday afternoons, 10 were whole day outings, and two were week-end holiday trips, to Kinglake and Daylesford respectively.

This year sees the completion of the 47th volume of *The Victorian Naturalist*. Notwithstanding the high cost of production, our journal has been maintained at the standard of recent years. The Committee is pleased to announce that arrangements have been made whereby a considerable saving in the cost of publication will be effected without any reduction in the size of our magazine. A very interesting series of articles has been published dealing with the subjects of Botany, Entomology, Ethnology, Zoology (terrestrial and marine), Palæontology, Herpetology, Ornithology, and General Natural History. An indication of the popularity of our paper is evinced in the demand for it by kindred societies, both interstate and overseas.

The influence of the Club in outside matters, chiefly concerning the protection of our flora and fauna, has been sought in many

instances. During the year a protest was made to the Victorian Forest Commission regarding the destruction of trees in the vicinity of the Sherbrook Falls, and elicited a reply that this had been done to check the spread of mistletoe. Instances of the wanton destruction of bird life by youths armed with pea-rifles were referred to the Chief Secretary's Department, and were acknowledged, but no action was taken. Information having been received that a very considerable destruction of native birds was being carried on by alien immigrants, representations were made to the Italian Consul, who replied sympathetically and promised that a notification would be published in an Italian journal circulating throughout the State, conveying a warning against this breach of the law. The practice of illegally killing opossums by placing poison on mutilated tree-ferns in the Belgrave district, was noted by some of our members, and information was sent to the Chief Inspector of Fisheries and Game.

A report having been received that fossil bones had been discovered in a cave at Buchan, a request was made to the Surveyor-General's Office that these be preserved. A reply was received that this would be done. To a request from the United Progress Association of the Shire of Ferntree Gully, for co-operation in preserving 1000 acres of the Monbulk State Forest as a sanctuary for native flora and fauna, the Club accorded its hearty support. A letter was received from the executive of the Australian Natives' Association, assuring the Club of the support of that institution in all matters concerning the protection of native flora and fauna. The passing of the "Wildflower and Native Plants Protection Act" is a matter of much interest to the Club. A sub-committee, consisting of Messrs. St. John, Daley, Pescott, Williamson, Coghill, and Dr. Sutton, was formed with a view to assisting the Forests Commission in this work. At the conference, held on April 14 last, the majority of representatives were members of the Club. A list of plants requiring protection was drawn up.

A sub-committee, consisting of Messrs. P. R. H. St. John, J. W. Audas, F.L.S., and P. F. Morris, was appointed to continue the revision of the "Plant Census of Victoria," and it is expected that a supplement will be issued shortly.

By invitation of the Victorian Tree Planting Association, the President and the Hon. Secretary of the Club attended an excursion to Mount Dandenong on August 2 last, when many trees were planted at the arboretum, one by Mr. C. Barrett as a representative of the Club.

The past year has established a record for the Club for the number of public shows and exhibitions held, all of which were highly satisfactory, both financially and from a popular point of view. The Jubilee Exhibition, held for three days in the middle

of July, was a fitting commemoration of the Club's 50 years of progressive existence. A special feature was the official dinner at which foundation members, representatives of kindred societies, and distinguished citizens were the guests. In the St. Kilda Town Hall a fine series of exhibits was staged, and although a large financial return was not aimed at, the profits amounted to £92. The annual Wildflower Show was also held in the hall, on October 7. A very excellent display of native flora was exhibited, with the added attractions of living animals and specimens under microscopes. This show returned a net profit of £142. As a culminating effort a Wild Nature Exhibition was held in the Melbourne Town Hall on November 18 and 19, with the object of assisting the Lord Mayor's Charitable Fund. Exhibits in great variety were staged by Club members and others, by the National Museum, and other institutions, and public patronage was accorded to an unexpected degree. After paying all expenses, including £80 for the hire of the hall, the sum of £380 was handed over to the fund. The thanks of the Club are due to the metropolitan daily press for the generous publicity given to these several functions.

The desirability of establishing an Endowment Fund for the future benefit of the Club was brought forward by Mr. E. E. Pescott in Committee, and subsequently approved at an ordinary meeting. An amount of £350 was expended in the purchase of Commonwealth Bonds bearing interest at 6% as a nucleus for the fund. To this will be added part of the proceeds of future shows and exhibitions from time to time as circumstances will permit.

Cash donations for special purposes have been thankfully acknowledged to Messrs. F. Chapman, J. E. Dixon, and A. E. Keep. Other gifts to the Club include a notice board by Mr. V. H. Miller, who also generously made rebates on the accounts for expenses with his firm; a large series of back numbers of *The Victorian Naturalist*, by Mr. A. L. Scott; a photograph of the Baldwin Spencer memorial tablet at the University by *The Argus* Pty.; albums of pressed New Zealand ferns by Miss M. Llewellyn and Mr. H. Whitmore; and a copy of Mr. Russell Grimwade's book *The Anthography of the Eucalypts*, by the publishers, Messrs. Angus & Robertson.

The Club is again indebted to Messrs. Coghill & Haughton for the use of their office in which to hold the monthly committee meetings. Members much appreciate this central and convenient position. Twelve Committee meetings were held, at which the attendances were as follow:—Messrs. V. H. Miller and A. E. Rodda, 12; Miss J. W. Raff, 11; Messrs. C. Barrett, G. Coghill, and C. Daley, 10; Mr. J. Ingram, 9; Messrs. H. B. Williamson and F. E. Wilson, 8; Dr. C. S. Sutton, 7; Mr. P. R. H. St. John, 6; Mr. E. E. Pescott, 4; Messrs. L. L. Hodgson and A. J. Swaby,

3 The sympathy of the Committee has been extended to Mr. L. L. Hodgson, who has been unable to attend the meetings for the last nine months on account of ill-health. The position of Hon. Assistant Secretary and Librarian, becoming vacant through the death of Mr. H. B. Williamson, Mr. A. J. Swaby was nominated and consented to act in that capacity. In addition to the ordinary Committee meetings, several special ones were held in connection with the several shows and exhibitions. In these the ordinary Committe was augmented by other members of the Club, with excellent results.

In conclusion, the retiring Committee desires to express its thanks to members for the confidence reposed in it, and also to all those who have assisted so ably in furthering the interests and activities of the Club. It is confidently hoped that the incoming Committee will have the benefit of the same loyalty and co-operation during the ensuing year.

CHAS. BARRETT, President.
A. E. RODDA, Hon. Secretary.

HABITS OF BLUE-TONGUE LIZARDS.

I was most interested in Mr. D. Fleay's article on the habits of Blue-tongue Lizards in the May issue of the *Naturalist*. Although the Southern Blue-tongue is very numerous in the Foster district, and other localities in East Gippsland, I have never seen a young example of the species.

My observations on Blue-tongues have revealed several interesting facts. I have no wish to designate "Bluey" as a "beast of prey"; his manner does not suggest that, but I am certain that he likes bird-flesh as food. On St. Margaret's Island, near Port Albert, I found a Blue-tongue Lizard dining on Quail. At first, I thought that he was the killer, but an examination of the bird showed that it had been dead for some time, so Blue-tongue benefited by a verdict of "not guilty," with apologies!

The incident raises the question: Would not this lizard prey upon helpless nestlings, if opportunity offered? Another query: What is Blue-tongue's disposition in regard to entering water? Several years ago, when rowing in Lake Reeves (which is more a channel than a lake), I was surprised to meet a Blue-tongue in mid-stream! The lizard seemed pleased when I took it "aboard." Was the lizard accidently adrift, or journeying with a purpose?

My belief is that Blue-tongues are not afraid of water. Once, I disturbed a big one at a water-hole; facing me, he gradually backed into the water and slowly wriggled—"swam" is hardly applicable—to the other side and climbed out.

The destruction of these harmless reptiles by motor-cars is, unhappily, only too obvious in this district; recently I counted four victims along a stretch of road not two miles in length. In the track of bush-fires I have met lizards cruelly scorched, quite incapable of movement, but possessing such tenacity of life that they probably lingered for weeks. Bush-fire is undoubtedly the most cruel and wholesale destroyer of wild nature.—FRED BARTON.

FIELD NATURALISTS' CLUB OF VICTORIA.

STATEMENT OF RECEIPTS AND EXPENDITURE FOR THE TWELVE MONTHS ENDED 30th APRIL, 1931.

RECEIPTS.

To Balance at Banks on 1st May, 1930—									
English, Scottish and Australian Bank					£46	17	10		
State Savings Bank					19	10	11		
								£66	8	9
„ Subscriptions—Arrears	£37	0	0						
Current	239	8	0						
In Advance	11	13	6						
					288	1	6		
„ Jubilee Receipts					202	15	8		
„ Wildflower Show Receipts					235	9	5		
„ Wild Nature Show Receipts					496	2	0		
„ Plant Census Sales					0	7	0		
„ Cash Sales of *Victorian Naturalist*					10	11	3		
„ Advertisements in *Victorian Naturalist*					4	1	0		
„ Sale of Badges					4	17	8		
„ Donations					4	2	0		
„ Char-a-banc Fund					0	18	0		
„ Interest—Best Fund	2	10	0						
Savings Bank Debentures	10	3	5						
Savings Bank, Current Account	5	2	5						
					17	15	10		
								1265	1	4
„ Transfer from Savings Bank Investment Account, towards investment in Commonwealth Bonds								137	13	7
								£1469	3	8

EXPENDITURE.

By *Victorian Naturalist*—									
Printing	£197	12	6						
Illustrating	11	5	3						
Wrapping and Despatching	29	5	2						
					£238	2	11		
„ Jubilee Expenses					110	16	9		
„ Wildflower Show Expenditure					92	12	8		
„ Wild Nature Show Expenses	118	7	6						
„ Wild Nature Show, Amount Donated to Lord Mayor's Fund	380	0	0						
					498	7	6		
„ Library					4	4	8		
„ General Printing					11	3	6		

„ Rent and Caretaker	13 10 0		
„ Lantern and Epidiascope	2 1 0		
„ Postage, Petty Cash, and Bank Charges	15 3 8		
„ Donation to Advisory Council for Fauna and Flora	4 4 0		
		£990 6 8	
„ Purchase of Commonwealth Bonds, 6%, due 1932		350 0 0	
„ Balance at Banks on 30th April, 1931—			
English, Scottish and Australian Bank	72 19 3		
State Savings Bank	55 17 9		
		128 17 0	
		£1469 3 8	

SPECIAL TRUST ACCOUNT.

To Balance on 1st May, 1930	£19 11 3
	£19 11 3
By Expenditure in year	£0 5 0
„ Balance on 30th April, 1931	19 6 3
	£19 11 3

STATEMENT OF ASSETS AND LIABILITIES ON 30th APRIL, 1931.

ASSETS.

Arrears of Subscriptions, £137/12/-, estimated to realise, say		£45 0 0	
Bank Current Accounts—			
E.S. and A. Bank	£72 19 3		
State Savings Bank	55 17 9		
		128 17 0	
State Savings Bank, Special Trust A/c.	12 15 3		
Cash in Hand, Trust A/c.	6 11 0		
		19 6 3	
Investments—			
Best Fund, E.S. & A. Bank, Fixed Deposit	50 0 0		
State Savings Bank Debentures	200 0 0		
Commonwealth Bonds	350 0 0		
		600 0 0	
Library and Furniture, Insurance Value		400 0 0	
Stock on Hand of—			
Plant Census, at Valuation	25 0 0		
Club Badges, at Cost	6 1 11		
		31 1 11	
Accounts owing to Club, Advertisements		2 5 0	
		£1226 10 2	

LIABILITIES.

Subscriptions Paid in Advance					£11	13 6
Late Mr. Dudley Best Fund	£50	0	0			
Late Mr. Dudley Best Fund, Interest in Hand	5	0	0			
				55	0	0
Balance of Char-a-banc Fund				2	15	0
Special Trust Account				19	6	3
Outstanding Accounts—						
Rent and Caretaker	13	10	0			
Printing, April *Naturalist*	17	6	2			
				30	16	2
				£119	10	11

Examined and found correct.

A. S. BLAKE
A. G. HOOKE } Hon. Auditors.

12th June, 1931.

J. INGRAM, Hon. Treasurer.

THE LATE MRS. BAGE.

It is with deep regret we record the death, on June 18, of Mrs. Mary C. Bage, one of the oldest members of the Field Naturalists' Club of Victoria, and always a good friend in its many activities. Mrs. Bage was elected a member in September, 1884, and afterwards became a life-member by subscription. She was a frequent attendant at our meetings, though in late years her time was very much occupied by other movements in which she took an active interest. Her husband, Mr. Edward Bage, who died in 1891, was an "original" member of the Club, elected in June, 1880, and later became a life-member, and was Hon. Treasurer for the years 1885-6 and 1886-7. He was interested in pond-life, and at the October meeting, 1880, contributed a paper on that subject, which was published in the first volume of the *Southern Science Record*. Their eldest daughter, Miss Freda Bage, who became an active member of the Club, and following a University career, took the degree of D.Sc. She was appointed, some years ago, principal of the Women's College of the University of Brisbane, and so became lost to Victorian science workers, though still remaining a member of our Club. Her sister, Miss Ethel Bage, is also on our members' roll.

EXCURSION TO PASCOE VALE.

A party of 18 members met the leader at Pascoe Vale on Saturday, May 8. The weather was perfect and a very pleasant afternoon was spent amid picturesque surroundings in inspecting the Tertiary sands and clays underlying the older basalt. Overlying the older basalt were more tertiary sands, the whole being capped with newer basalt. The latter part of the afternoon was occupied in collecting specimens of fossil leaves, etc., from the beds underlying the older basalt, in the bed of the Moonee Ponds Creek.—W. HANKS.

RECOLLECTIONS OF FOSSIL HUNTING.

By W. H. Ferguson.

Is it not surprising what a small incident may influence one's whole life? When I was a boy, perhaps about 13 years of age, my mother went to live at Albert Park, and immediately started a garden. Spade, rake, and hoe were purchased, and I was unanimously appointed gardener-in-chief. Well, the ground had to be dug, and in one part there was a small portion of ironstone, and in breaking this, to my amazement, I turned up a well-preserved fossil shell—possibly a *Natica*.

I was bewildered; had I unearthed a living fish I could not have been more surprised. I had heard of fossils, but thought that they were confined to Great Britain, or, at least, that none had been found in Australia. Between my first fossil find and my second discovery there intervened possibly thirteen years. I was sheep-farming at Talgarno, on the Upper Murray, and there studied Dr. Page's Text Book of Geology. Though in a district of schist, gneiss, and other metamorphic rocks, I found impossible fossils in chiastolite, schist, etc.

A little later, for a Wodonga syndicate, I was prospecting for a silver lode at Wombat Creek, on the Mitta Mitta River, close to the junction of the Gibbo River. A member of the syndicate had visited the locality and had mistaken a prominent limestone band for a mineral lode; and I was to find rich chloride ore, on the foot or hanging wall, he was not particular which.

Well, I got precious little silver, but I revelled in fossils. Small casts of shells in the mudstones of Limestone Gap, splendidly preserved spirifers weathered from the mudstone adjoining a limestone band on the Mitta, solid corals from the limestone; such a harvest of fossils as I had never even dreamed of reaping. After leaving the new Broken Hill unfound, I rode back to Talgarno—and sheep. Soon afterwards, Duncan Gillies, then either Premier or Minister for Railways, visited the Upper Murray, and one of the company with him was a charming Member of Parliament, A. W. Craven, the man who, with wonderful exactitude, surveyed in mountain country an underlay shaft to strike the lower levels in the Long Tunnel mine at Walhalla. Another member of the party was Reginald Murray, then Government Geologist, and for many years afterwards my well-liked chief.

To Murray I showed some of the Wombat Creek fossils; he was pleased with them and took them to Melbourne to be identified. He mentioned that his Department (Mines) needed a specimen collector; I applied for the position, and, about 1891, was appointed. Murray told me that, if the money lasted, I might

be there for twelve months—I was "there" for thirty-five years. Soon after my appointment I collected at Bacchus Marsh and found plant remains, *Schizeneuria*, in the Bald Hill beds; and, what pleased me better, casts of fossil fruits in the lower tertiary ironstone beds near Kirkuperrimal Creek; also leaves of *Laurus Werribeensis*. A year or two ago I got Laurel leaves in sand rock in an old lead at Lilydale.

I took the sandstone fossils to the University, and submitted them to Professor Sir Frederick McCoy, and that rotund, genial, conservative Englishman was very interested in the new Triassic fossils. Shortly afterwards I was at Wombat Creek again, and collected about a hundredweight of fossils for Sir Frederick. I made a new and important find. While tracing the silurian slates and sandstones up stream, I came to a heavy bouldery coglomerate, and joining it were upper Ordivician folded slates, which contained several pieces of graphtolites, including *Diplograptus foliaceous* Munrch., and *Climacograptus* sp. This junction is unconformable. There is between the conglomerate and the slates a great gap in the life history of the times, though the missing chapters may be read in leaves of rocky books from other parts of Victoria.

Unfortunately, I know of no other geologist who has studied this very interesting junction.

Corals from Wombat Creek were *Favosite*, sp. and *Tryplasma* sp. Heathcote is a happy hunting ground for geologists. Many years ago, when Ernest Lidgey was making a survey of the district, I was sent up to collect. In an extremely rough micaceous claystone, I found a new trilobite, it was described by Etheridge as *Denesus Ida*, the specific name after the local mountain, Mount Ida. Later the fossil was examined by Professor J. W. Gregory, and by him named *Notasaphus Fergusoni*, the asaphus of the south.

These little trilobites, which are supposed just to touch the Cambrian, have caused a great deal of interest, and more should be collected. At Heathcote I also found *Bryograptus*, sp., T. S. Hall.

Gregory improved the geological survey while he was Director; he brought with him British knowledge and a University "atmosphere," but, above all, encouragement. Any man who did a good bit of work received full credit for it; and if some bushman helped him to carry a bag of rocks to the hotel, in the Director's next report this help was duly acknowledged.

Later I was at the geologically unknown Grampians, and staying at Hall's Gap with a member of the well-known D'Alton family. A picnic was arranged, and I was invited. At first I declined, as, with me, the day was not a holiday. However, thinking that I might gain some local knowledge from the D'Alton brothers, I

went with the party to the Goat Rock, or Mount Rosea. Half-way up the mountain the zig-zag track took a sharp turn to the right, and here, in a few fragments of shale, I collected the first fossils found in the Grampians. They were submitted to Mr. F. Chapman, A.L.S., and identified as a fish spine, *Physonemus*, sp., and a brachiopod, *Lingula squamiformis*, var. *Borungensis*. They are considered to belong to the lower carboniferous period.

This is an extremely interesting determination, because certain porphyries and granodiorites are intrusive to the Grampian sandstones, and therefore younger than lower carboniferous. This is very revolutionary for Victorian granites, and quite unexpected. Another find near Hall's Gap was a good exposure of sun-cracked surface. During a very pleasant fortnight spent in the Grampians with Professor E. W. Skeats, D.Sc., I had the pleasure of showing that geologist the interesting Sun Crack Gully.

I have been fairly successful with graptolites. When I started my survey of the Dunolly goldfield, these fossils had not been found west of Ballarat. I located them at Dunolly, and my assistant, Mr. E. Egglestone, who underground could follow a thread through to China, tracked them well up towards Inglewood. I think it was at Dunolly that I first got the graptolite, *Tetograptus approximatus*, then new to Australia; and I was extremely interested on finding this important Lower Bendigo zone fossil in a minute outcrop of lower ordovician strata at Boolarra, in Gippsland.

One day, in a cliff on the coast at the Eagle's Rest, at Inverloch, I got the toe of a reptile, some bones, some coprolites, and teeth of *Ceratodus*, the Queensland lung-fish. It is interesting to know how this strange fish has lingered on in Australia, from Jurassic times to the present day. A queer fossil I got in an ironstone bed at the Wannon Falls was a feather of an aquatic bird.

Fossil hunting has a charm all its own. One never knows what may be discovered next. Working in a band of slate, you may find graptolites, and ten minutes later get another band with totally different fossils, indicating that there has been a marvellous change in the animals, and establishing the fact that one band is hundreds of thousands of years younger than the other. It is thrilling on splitting a piece of slate, to expose a fossil new to science, and to know that you are the first to see the animal since it left the hands of the Creator. I have had some very tense moments when finding new fossils in some of our outback places, but never have I experienced one more exciting than that when I broke out the Albert Park *Natica* in the 70's of the last century.

WARRIORS OF THE WEST.

By ANNIE M. RAINBOW.

The plant life of the Far West of New South Wales has an interest all its own on account of its constant struggle against unpromising conditions. Here are extracts from a letter which well illustrate the quick changes of nature with which it has to contend.

Monday, September 22, 1930.

"Yesterday at 7.30 a.m. we set off for Langawirra lakes, returning in the evening by Lake Coogee. The wonder and beauty of the day are difficult to put on paper. Sturt Peas were found in profusion in places. Swainsonas were in full bloom for miles—acres and acres of *S. procumbens*, then a patch of *S. phacoides* or *S. oligophylla*.

"The White Daisy, *Brachycome ciliocarpa*, is always a picture, and with *Helipterum floribundum* and *H. corymbiflorum* (Everlasting) covered areas in extent. It was all one big flower garden. The red water weed on Lake Langawirra extended far into the water, and, with ducks, swans, and other birds, made a pretty picture."

Tuesday, September 23.

"The dust came up in clouds about 5.30 p.m. yesterday. It seemed as if the whole country was moving."

These extracts from a letter from the Far West give a typical picture of life in that area; floral beauty to amaze one after a good rain, but always—the dust storm. Some experience of the heat, drought, and dust storms which go to make up a western summer left the writer of this paper with a profound admiration for the fighting qualities of these bits of life which literally make the desert rejoice and blossom as the rose.

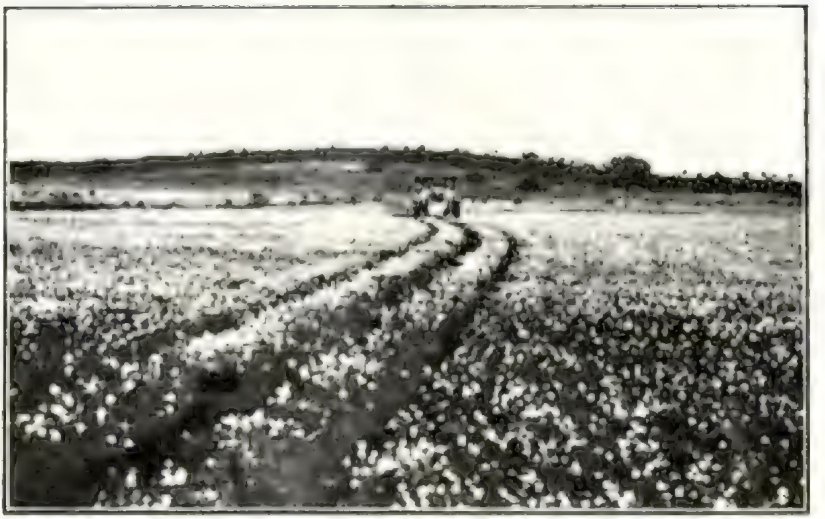
Curiosity as to the means used in this perpetual warfare against adverse conditions is not easily satisfied, for the interesting study of the desert flora in Australia remains almost untouched, particularly the chemical and microscopical sides of it.

In 1918 Dr. Cannon was sent to Australia by the Carnegie Institute of Washington to visit the desert areas for investigation of the flora, but inadequate equipment handicapped his scientific investigation and made it necessary to draw largely on experience in similar areas in other countries where the problems of the flora of arid regions have been more thoroughly studied. The result of his work was published under the title of "Plant Habits and Habitats of South Australia." The Murray-Darling lowlands receive brief mention.

A Russian scientist, Maximov, in a book entitled "The Plant in Relation to Water" (1929), gives results of much research work on plants growing in areas not unlike our far western plains. In some cases the plants used were closely related to our species; in others, as the *Salsola Kali* (a common western saltbush) the same

species was the subject of experiment. Workers quoted in Maximov's book have divided plant life into xerophytic and non-xerophytic types. A modern definition of xerophytes is given as "those plants which, with the help of certain structural modifications, can continue to perform their normal vital functions when exposed to atmospheric or edaphic drought, or both."

The problems of the supply and use of water and of protection from sun and wind are acute in arid regions, and the plants which survive in the Far West are those plants which have evolved some means of handling these problems efficiently.



BROKEN HILL "SNOWFIELDS." BLENODIA LASIOCARPA (Cruciferae). A desert ephemeral, which avoids drought by its rapid life cycle. Shrub on Right: "Dead Finish" (ACACIA TETRAGONOPHYLLA). Shows reduced leaf surface and stunted growth.

Photo—Mr. and Mrs. Morris, Broken Hill.

In most plants, in addition to the actual water content of the tissues, large amounts of water are needed in transpiration, and, in experimental work quoted by Maximov, it was found that many xerophytes transpired much more freely when water was available than the non-xerophytic plants did. This applied particularly to certain plants with an extensive and somewhat shallow root system, and it was considered that the excessive transpiration was of use in drawing the water through such a relatively large root system to the other parts of the plant.

Some workers quoted by Maximov have divided desert flora into four main groups—(1) Drought escaping. (2) Drought evading. (3) Drought enduring; and (4) drought resisting.

If we consider some of the work done on these groups and view our own plant life in the light of the results of that work, some idea of the interesting structural and chemical adaptations of xerophytic plants will be gained.

ONE OF THE "WARRIORS." OLEARIA PIMELIOIDES (Compositae). A hardy Western "Daisy," showing very reduced and tomentose leaves.

Photo—Mr. and Mrs. Morris, Broken Hill.

The first group, the drought escaping plants, are our desert ephemerals, such plants as members of the Composite family mentioned in the letter quoted; some of the Cruciferae, as *Blennodia lasiocarpa* and some of the Lepidiums; certain members of the Geraniaceae, as *Erodium*, sps. (commonly called Wild Geranium), and many other plants which escape drought by the power of rapid development after a Spring rain. The life cycle of these plants is sometimes completed in from four to six weeks, but neither these nor the fourth group, the drought-resisting type, come under the heading of true xerophytes. The fourth group provides for its needs by a system of storage in root tubers or leaf structures, and long periods of drought are thereby weathered effectively. The common western "Ice-plant," *Mesembrianthemum crystalinum*, the common Mesembrianthemum with pink and purple flowers (Pigface) and some Calandrinas, are typical of the succulent leaf type—the latter is so efficient that flowers and seeds may be developed and set after removal from the ground.

Underground tuber storage is represented in the western areas by the "Darling Lily," *Crinium pedunculatum*, and *Marsdenia australis* (Native Pear). The "Darling Lily" is a beautiful large white lily, the tubers of which remain underground for long

periods awaiting a suitable rainfall. It combines the powers of water storage and rapid growth to a remarkable degree. I have personally seen a well-developed specimen in full leaf and bloom one week after the first tiny shoot appeared above the ground.

THE "DESERT ROSE." GOSSIPIUM STURTII (Malvaceae). A beautiful and rather rare Western Shrub.

Photo—Mr. and Mrs. Morris, Broken Hill.

Marsdenia australis has slender twining stems and a small, somewhat pear-shaped fruit which would not suggest the large tuber which is found on further investigation. The fruit is eaten by the aborigines.

The second and third groups, the drought-evading and drought-enduring plants, are true xerophytes and have structural and chemical adaptations which enable them to meet adverse conditions without either rapid growth or water storage by a more efficient use of the water that is available from time to time.

A number of our western plants, largely of the families of Leguminosæ and Chenopodiaceæ (Saltbush family), would come under the second group. Of the Leguminosae many species of the genus Swainsona are typical, with their reduced and divided leaf surface, and the better known and more spectacular Sturt's Pea, *Clianthus speciosus*, with soft grey-green, hairy leaves of prostrate habit, from which the vivid red and black flowers stand erect on short stems, are typical examples.

These plants, by an efficient use of water and restricted growth, when necessary, evade desiccation until such time as they have provided for the continuation of the species.

The third group, the drought-evading, are those plants which can maintain life even when no water is available for growth. Many of our Eucalypts, Acacias, Eremophilias and "saltbushes" come under this heading. They are characterised by their ability to stand an extreme degree of wilting without permanent injury,

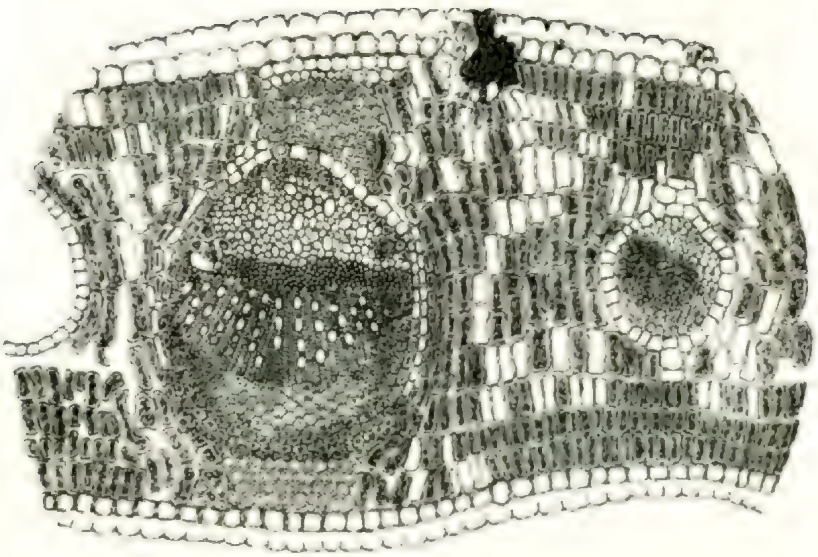


Fig. 1.

Transverse Section of Leaf of *Eucalyptus ligustina.*

The apparent cellular formation of the cuticle is only evident in the region of the mid-rib. X. 120.

From a section by Mr. M. B. Welsh, Technological Museum, Sydney.

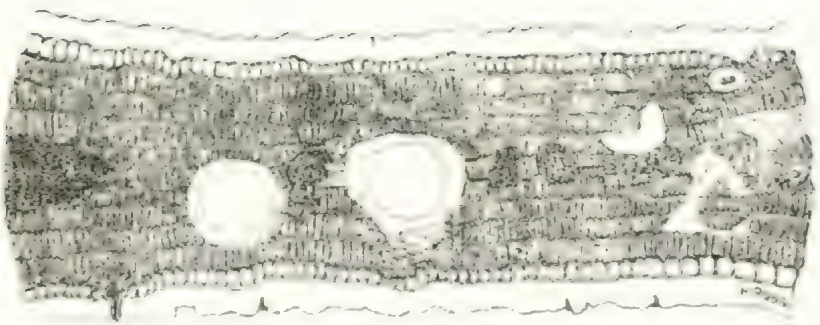


Fig. 2.

Transverse Section of Leaf of *Eucalyptus eochrophloea.* X. 120.

The drawing represents 1-24th in. from a section by Mr. M. B. Welsh, Technological Museum, Sydney.

and when water is once more available, the plant develops rapidly. Maximov holds that wilting, which has usually been regarded as a pathological phenomenon is, in xerophytes, one of natures' most important means of protecting the plant against loss of water. One of the first effects of wilting is the closing of the stomata. This, of course, reduces transpiration to a minimum, especially in such plants as have eliminated cuticular transpiration by thickened cuticle, varnish, tomentum, or scales. In non-xerophytes, which lack the chemical adaptations necessary for effective wilting, excessive heat injures the guard cells of the stomata to such an extent that they are unable to close. This, of course, allows the free interchange of hot air and moisture, which quickly kills the plant. The chemical and structural adaptations which allow xerophytes to develop rapidly in times of plenty, and endure the lean seasons effectively are most interesting. Cannon describes the "internal elongation of the chlorophyll-bearing cells at right angles to the surface of the leaf," thus accounting to some extent for the more efficient carbon assimilation of xerophytes.

Maximov mentions the denser venation and more numerous (though smaller) stomata, and also states that the free circulation of water is aided by the less sinuous lateral walls of the epidermal cells, while the lessened dimensions of the palisade and epidermal cells also make for more efficient use of the water supply.

A higher osmotic pressure in the cells of xerophytic plants has been noted by many workers. This enables the plants to obtain and use the more highly concentrated soil solutions of the arid areas, and is also a factor in the process of wilting, the altered chemical composition of the cell contents, enabling them to withstand great heat without injury.

The more obvious adaptations of xerophytic flora, such as reduced or divided leaf structure; the complete absence of leaves, hairs, scales, varnish, tomentum, bloom, thickened cuticle, inturned edges of leaves, etc., while being noticeable features of much Australian flora, are all found to a greater extent in the Far West, and will well repay any time spent in observing them.

Much work is there to be done and there are few to do it. In the meantime many valuable species of our unique native flora become extinct at the hands of men who prefer to destroy rather than study them.

The drawings (Figs. 1 and 2, p. 58), by Mr. H. Ross, of Coogee, Sydney (from microscopic slides lent by the Technological Museum), illustrate the structural differences in the leaves of trees grown in moist and arid (or semi-arid) habitats respectively.

ADVISORY COUNCIL FOR FAUNA AND FLORA.

The Annual Report (1930-31) of the Victorian Advisory Council for Fauna and Flora states that at the request of the Council the valuable addition of ten square miles was made to the reservation at Wyperfield Park as a sanctuary and breeding-place for the Mallee Hen. Later in the year, Mr. V. Miller visited this area and gave a satisfactory report as to its condition. Among other matters discussed during the year and on which representations were made to the official authorities were the reported ruthless slaughter of birds by aliens in several districts of the State; inquiry as to the conditions affecting the Koala at Phillip Island and elsewhere and as to the probability of re-introducing it in suitable forest areas; also the frequent despoilation of the vegetation by campers on the river fronts, the illegal removal of ferns from valleys on State reserves, the introduction of Angora rabbits, the export of native birds, the introduction of birds from other countries, etc. The desirability of rod and gun licenses was affirmed. A request was made to the Melbourne University to consider the undertaking of biological research in regard to our native fish. While sympathetic to the suggestion, the University authorities could not at present undertake the work. Mr. A. H. E. Mattingley read a paper advocating the protection of the Cormorant. Mr. F. Lewis, Chief Inspector of Fisheries and Game, present by invitation, opposed the idea. No action was taken, the opinions expressed giving the impression that "much might be said on both sides" of the argument.

CAMP-OUT IN MALLEE NATIONAL PARK.

The Royal Australasian Ornithologists' Union proposes to hold its annual camp-out this year at the Wyperfield (or Lowan, as we prefer to call it) National Park, from September 26 to October 5.

A cordial invitation to attend is extended to members of the Club, and it is hoped that a number will accept. The camp will be under canvas, marquees and tents being hired for the purpose. Stretchers will be supplied for lady members. It is expected that the cost will be approximately £7/10/- to £8 per head. The greater the number attending, the smaller will be the cost.

Those desirous of attending and requiring further information should apply to the Hon. General Secretary (Mr. D. Dickison), 170 Latrobe Street, Melbourne, or to the Hon. Editor of *The Emu* (Mr C. E. Bryant), 394 Collins Street, Melbourne. An early intimation of intention to attend would be appreciated as it will aid considerably those organising the camp-out in making the arrangements.

While every opportunity for studying plant and animal life in the Park area will be afforded, no collecting will be allowed. Guns may not be taken into the reserve.

CLUB EXCURSIONS.

The new Syllabus of Club Excursions is being prepared and suggestions from members will be welcomed; also offers of leadership. Please communicate with the Hon. Secretary.

WILDFLOWER SHOW AND NATURE EXHIBITION.

This annual Club event will be held on October 6, 1931, in the St. Kilda Town Hall. Further particulars will be announced in due time

The Victorian Naturalist

Vol. XLVIII.—No. 4. August 8, 1931. No. 572

THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary monthly meeting of the Club was held in the Royal Society's Hall on Monday, July 13, 1931. The President, Mr. J. A. Kershaw, C.M.Z.S., occupied the chair, and there were about 105 members and visitors present.

CORRESPONDENCE.

From Sir Colin MacKenzie, enclosing a copy of a letter from the Acting Secretary of the Department of Home Affairs, stating that the Australian Bustard is partly protected by a close season, extending from the first day of March to the last day of August in each year. Arrangements are now being made by the Department to bring this matter under the notice of the Commonwealth Railways authorities, who are organising the Big Game Shooting Expeditions to North Australia, and also to the Administrator at Darwin.

From the General Secretary of the Royal Australasian Ornithologists' Union, inviting members to join in a Spring Camp-out at Wyperfield Park, and giving details of the arrangements.

ELECTION OF MEMBERS.

On a show of hands the following were duly elected:—As ordinary member, Miss V. Cox, Surrey Hills; and as country member, Mr. D. Aitken, St. Arnaud.

GENERAL BUSINESS.

The matter of the proposed closing of the Melbourne Aquarium was discussed, and suggestions were invited which might tend to popularise this institution. The President stated that a representative committee had been formed of Club members and others to consider the position.

The President referred to the excursion programme for the next period, and asked members for suggestions and offers of leadership.

It was resolved that an enlarged photograph of the late Mr. H. B. Williamson, F.L.S., suitably framed, should be hung in the Club's rooms.

LECTURE.

Mr. J. A. Kershaw, C.M.Z.S., gave an interesting talk on Bower-birds which was illustrated by lantern slides and mounted specimens, and dealt with the principal species and their habits.

EXHIBITS.

By Mr. T. S. Hart, M.A.—Fossil Bone of Whale, from Beaumaris.

By Mr. F. S. Colliver.—Recent and tertiary specimens of Mollusca, showing similarity of shape, etc., comprising genera *Voluta, Cypraea, Trivia, Nerita, Panopaea, Trigonia, Solen, Cari, Tellina, Siliquaria,* and *Vermetus.* Recent specimens from Victorian and Tasmanian waters, and fossils from Balcombe Bay, Muddy Creek, Grange Burn, Table Cape, etc.

By Mr. F. S. Colliver.—Hermit Crab, from Tasmania: also specimen of common Marigold with some of the central florets developed into perfect heads of good colour.

By Mr. A. N. Burns.—Case of Butterflies, including two Moths, from North Queensland. The Butterflies included several rare Lycaenidae, notably three species of *Arhopala;* a probable new species of Lycaenid of genus *Protialmenus; Miletus rovena,* a great rarity, taken only near the Barron Falls; *Cyaniris tenella,* also a rarity, confined to the Kuranda district; *Philiris kamerungae,* rare: and *Thysonotis serapis,* one of the most beautiful, though common, northern Lycaenidae. Large skipper, *Euschemon rafflesia,* one of the largest and most beautiful Australian Hesperids; *Delias ennia nigidus,* a rare Pierid, from Cairns district, and usually found at about 1000 feet above sea level. Large brown Nymphalid, *Cynthia ada,* also confined to the north. The Moth, a species of *Agaristid,* is, unlike most moths, a day flyer, is very active, and frequents flowers like a butterfly. It is very hard to capture and revels in bright sunshine. Collected by exhibitor in April, 1931.

By Mr. J. A. Kershaw, C.M.Z.S., for the National Museum.—Specimens of Australian Bower-birds, in illustration of lecture.

FORESHORE ADVISORY COMMITTEE.

In response to a request from the Sandringham City Council the Committee of the Club has appointed a Foreshore Advisory Committee. Messrs. T. S. Hart, G. N. Hyam, and A. J. Swaby will act for this year. All are residents of Sandringham.

The Committee will advise on present planting, plan for future operations, guide experimental planting, and control a special F.N.C. botanical collection. The undertaking is a new departure

for the Club; but peculiarly fitting. Constant observers of plants and their environment should be in a position to advise on their care. The present members desire to establish the precedent that the Committee is merely a collector of the best information the Club can provide, and consults specialists in any branch where problems arise.

Considerable progress has been made. Councillors are aware of the asset they possess in the foreshore, and of their trusteeship for the State. Intelligent replanting of tea-tree has been proceeding for several years. All suggestions by the Committee have been adopted immediately. In view of the times a very modest beginning has been made in establishing testing plots, and a picturesque site has been selected for the F.N.C. collection.

The Advisory Committee will welcome selections by members of plants—preferably Australian—suitable for any of the following purposes:—Sand binders, erosion checkers on clay banks, and wind-resisting trees and shrubs.

The Council has agreed to co-operate in the inaugural planting, and to ask nature lovers of the city to assist, under the auspices of the Club. The site is at the foot of Harold Street, and is best reached from Royal Avenue—the end of the first section on the Black Rock tramway. It is a depression, and fairly sheltered. The slopes provide a great range of soil conditions and aspects. No area yet chosen for extensive planting of native flora presents such variety. It is easy of access, yet away from the crowded picnic areas.

The first planting day has been fixed for Saturday, August 29, at 3 p.m. The first trees will be planted by councillors and distinguished members of the Club. Members are cordially invited to share the honours of inauguration. Only hardy and well-known plants will be planted this season. Members who wish to plant are asked to communicate with the Committee at the August meeting, or by letter to Mr. A. J. Swaby, 52 Littlewood Street, Hampton, S.7. Failure to notify will *not* exclude anyone. The Committee will select a suitable plant for any Club member who forwards 1/6, and will have it ready for planting.

Suggestions in regard to this will also be received with pleasure before or after establishment of the F.N.C. collection.

JUBILEE HISTORY.

Owing to circumstances quite unforeseen, it has not been possible to complete the Club's jubilee celebrations by publication of a special number of *The Naturalist* devoted to a detailed record of its history. However, one of the principal articles prepared for that purpose is published in the present issue, together with the jubilee year President's "Introduction." Mr. Daley, in his very interesting survey of "Fifty Years of Science," has mentioned many distinguished workers. His own name deserves a foremost place. Mr. Daley has served for many years as an office-bearer, and has also done much in other ways to further the Club's interests and maintain its popularity.—Editor.

THE CLUB TO-DAY.

BY CHARLES BARRETT.

Founded fifty years ago by a small band of men with vision, some of whom, happily, are still alive, the Field Naturalists' Club of Victoria to-day ranks among the foremost bodies of its kind in the Empire. It has indeed few rivals in any country. No similar club or society has had more enthusiastic workers, and few have done so much to foster a love of wild nature in a great community.

Our Club has always stood for nature study as well as the advancement of scientific knowledge. Many of the members have gained international recognition by their published work in different branches of natural history and botany. Others are widely known in the Commonwealth as field naturalists, some as writers of popular articles on bird, plant, and insect life. We took all Nature for our province, and at least have cultivated corners in every portion of it.

Looking backward over half a century, we take pride in a record of achievement; and, looking forward, we see the Club still greater than it is to-day. We are not at the peak of success. A Naturalists' Club, with headquarters in a city of over a million inhabitants, should have a thousand members, and more. It should have its own home, not only a rented hall. But that is a gift of the distant future. To-day we have hope, nay, are confident that the Club's centenary will be celebrated in its own building, a Hall of Natural History on a central site in Melbourne. That is the goal, and we have advanced a stage towards it with our Endowment Fund.

The Club to-day is recognised as an institution whose objects are of good report alike in town and country. It has helped charitable appeals by its wildflower and wild nature shows; has championed conservation of forests and plant and animal life, and been instrumental in having two great reservations made. It is ever-vigilant in guarding wild life; unofficial, truly, but recognised as a body whose views deserve official consideration. We do not always prevail, but have gained notable victories against powerful opposition. Our strength lies in the fact that we are nature lovers, defending Nature's gifts to all, not a monopoly. The people, excepting those who exploit wild animal life for their own profit or pleasure, commend the Club's efforts to save the fauna of Victoria.

In all its fifty years of being, the Club has not strayed far from the highway of success that may be called Popular Natural History. At times it has been tempted into byways that have little charm for the field naturalist, because they are thick with thorny technicalities. To-day, more than ever, it is realised that only the broad highway should be followed.

The great majority of the members favours true natural his-

tory, and while the Club provides "popular evenings" it will continue to flourish. May those who are entrusted with the Club's management and guidance in the future *keep to the highway.*

The Club exists not only for its members; it is also serving the public, and will enlarge this sphere of its activities. Our monthly meetings have become so attractive that members alone crowd the hall. We have outgrown our meeting-place. That is the price of success. Some members almost regret that the Club has become so popular. They miss the charm of small gatherings, but is the pleasure of seeing your friends among a hundred less than that of meeting them where only two score are assembled? Our meetings of to-day are small compared with those that to-morrow will bring, a to-morrow that will dawn when the clouds of depression have gone from our sky.

We ended our jubilee year in a time of trial for Australia, but with hope's mirror undimmed. The Club to-day, when the national income has crumbled and prosperity is just struggling from the ruins, is more stable than ever it has been. A notable year for a Club which deserves success, because for half a century it has fostered "live" natural history.

AMATEUR ASTRONOMERS.

Copies of the *Amateur Astronomer*, published by the Amateur Astronomers Association, New York, U.S.A., have been received from the President, Dr. Clyde Fisher. The Association was founded in 1927, and has done much to foster an interest in the greatest of all the sciences. Its headquarters are at the American Museum of National History.

The object of the Association is "to promote the study of astronomy by non-technical methods; to emphasise the cultural and inspirational value of the stars; to enable all interested in the sky to become acquainted; and to help make New York City the great astronomical centre it should be."

Illustrated astronomical lectures open to the public are delivered by amateurs as well as by professionals, the latter including some of the leading astronomers of the world. When weather permits, telescopes are taken to the lawns of the Museum for direct observation of celestial objects. The public is invited to attend the lectures and to use the telescopes.

Could not more be done in Melbourne for the layman who desires to gain knowledge of the southern stars? Sir James Jeans' notable books have made thousands of nature lovers watchers of the skies.

FIFTY YEARS OF SCIENCE.

By CHAS. DALEY, B.A., F.L.S.

In looking over this period, contemporaneous with the life of the Field Naturalists' Club of Victoria, one is struck by the evidence of unexampled and continuous progress made in every department of natural science, bringing an ever-expanding outlook on the world, a quickening of human thought, a revelation of the subordination of nature's forces to man's service, and a wider knowledge and conception of the plan and purpose of life and the inter-relationship of all animate nature.

Scientific discoveries during that period have greatly changed altogether man's outlook, belief, modes of life, activities, and interests.

The Club took its rise from the natural desire of certain gentlemen interested in various departments of science and field work to have a rallying-place, where mutual help, intercourse, and the stimulus arising from common interests would be fostered. Messrs. C. French and D. Best were the immediate promoters. The first meeting was held at the Melbourne Athenæum on Thursday, May 6, 1880, Dr. T. P. Lucas being Chairman. A subsequent meeting approved of rules submitted and appointed officers. Professor McCoy, Melbourne University, was the first President, Mr D. Best first Secretary, and with a strong and representative committee the Club was launched on its long and useful career.

The aims and objects of the Club were the helpful encouragement of the study of all branches of natural science more by individual and collective work in the field, particularly the communication of discoveries and results of research, and the definite description and record of new species resulting therefrom. The means employed to effect these aims have proved singularly appropriate and abundantly justified. These were a monthly meeting, at which papers on some subject or phase of natural science were read, or lecturettes given, open for discussion or comment; then the regular exhibition of natural history specimens, with brief remarks in explanation or description; and the reading of short nature notes on objects or phenomena observed. Enquirers could also obtain information sought in regard to nature studies.

In addition a regular syllabus, providing for field excursions under capable leadership in various departments of science was instituted. Supplementing these at opportune times and in suitable localities, there have been extended camping and research expeditions.

Early in the existence of the Club the advisability of having a magazine or journal as the medium and record of Club activities was recognised. The *Southern Science Record*, edited by J. Wing,

was published on December 1, 1880, to be replaced in January, 1884, by *The Victorian Naturalist*, which Mr. A. H. S. Lucas, M.A., B.Sc., edited until December, 1892.

At first annually, but later at longer intervals, conversaziones were held, at which experts in some scientific branch gave popular lectures on aspects or features of their special study. These functions were ultimately displaced by the holding of wildflower and wild life shows, which had a wider appeal and were of a more directly educative character.

A useful and helpful adjunct, which in the course of time has become extensive and valuable is the library of the Club on subjects of Nature Study and Science. This has been of great service to members for reference and instruction. The library has received many gifts of suitable works, among which may be specially mentioned the valuable and comprehensive work, *Birds of Australia*, in twelve handsome morocco-bound volumes.

The operations of the Club on the lines mentioned have been eminently successful. To its ranks during the half-century have been attracted nature-lovers and men of science whose researches have added lustre to the Club, and have enriched science in various ways.

The journal of the Club, the repository of valuable work carried out by its members, has maintained a high standard, and has deservedly won a world-wide reputation in kindred circles.

Among members whose work has been outstanding, and who have had the interests of the Club at heart, are many eminent men. Among these were Professor F. McCoy, the distinguished zoologist and palaeontologist, whose great contribution to science was the *Prodromus of the Zoology of Victoria*, a standard work. Mr. Charles French, for many years Government Entomologist, surviving many contemporaries, is still with us, and his son now worthily fills the position in succession to his father. Baron Ferdinand von Mueller was a patron and active worker in the Club, whose labours and enthusiasm in botanical research were a stimulus and inspiration to many students in that domain.

It was at the suggestion of the Hon. Dr. Dobson, M.L.C., President in 1884, that the Baron brought out the *Key to Victorian Plants*, a work which proved of great value to botanical students. The Reverend J. J. Halley was an early worker in Protozoa, and in other directions.

In 1887 Professor Baldwin Spencer commenced his long and helpful connection with the Club, pursued his successful biological career, and began the valuable Australian ethnological research which has made his name famous.

Another foundation member, Mr. F. Pitcher, still with us, has given close attention to the study of Victorian vegetation, especi-

ally the ferns. Mr. C. A. Topp, M.A., was another able member, a botanist, ready lecturer, and conspicuous in Club matters. Dr. T. S. Hall, biologist and geologist, was a distinguished member, whose labours gave prestige to the Club. His work on the Silurian and Ordovician measures was of great practical value in determining auriferous zones on our gold fields.

Mr. F. G. A. Barnard, an ardent naturalist, Club chronicler, and tireless worker, after the departure of Mr. A. H. S. Lucas in 1892, most capably edited, until retirement from the office a few years ago, *The Victorian Naturalist*. Mr H. T. Tisdall, F.L.S., was indefatigable in botanical research. Professor A. J. Ewart, D.Sc., of the University, was closely associated in useful service to the Club in many ways for some years.

In the subjects of geology and palaeontology Mr. F. Chapman, A.L.S., has prosecuted extensive research, the great value of which is widely recognised. Dr. J. A. Leach must also be mentioned as one who, in the department of ornithology, did exceptional work, his *Australian Bird Book* being one of the most useful and popular nature books yet published in Australia.

The Club has always been closely in touch with the National Museum, of which Mr. J. A. Kershaw, our new President, was for so many years Director (until May, 1931), as well as an authority on so many aspects of faunal life, ever willing to impart information to enquirers, and to assist the Club in its objects.

Mr. G. A. Keartland, a noted ornithologist, was for a long period connected with the Club, and, accompanying Professor B. Spencer had the distinction of being naturalist on the Horn expedition to Central Australia. In botanical research the name of our late member, Mr. H. B. Williamson will be long remembered for his wide researches in the field and the study, and his contributions in descriptive and revisional work of signal value in botanical science.

Space does not admit of the enumeration of many other members, whose labours have been of the utmost service to the Club and the advancement of science.

Rightly, the Club has attached much importance to field work as the main plank in its programme, and there is scarcely a spot in the State which has not been once or more frequently visited by parties or individual members in prosecution of the study of natural history under capable leadership. Among some of the most important may be mentioned the expedition to Eastern Gippsland under Sir Baldwin Spencer and Mr. C. French; excursions to King Island, Furneaux Islands, Kent Islands in Bass Strait; Phillip Island, in Western Port, the Mornington Camp; a series of excursions and biological surveys in Wilson's Promontory; excursions to Buffalo Mountains, the Grampians, Mallacoota Inlet,

Mitchell Gorge, Otway Forest; a series to Bendigo district; and the expedition of recent years to the Grampians, the last rendered possible by the generosity of Senator Elliott. These and many other excursions less pretentious were fruitful in interest and results, providing additional knowledge of our fauna and flora and the physiography and geology of the State.

Unofficial excursions of members, sometimes alone, have covered a wide area and have been likewise productive in results.

It is noticeable that fluctuations of interest take place in regard to the subjects of nature study. In the first decade entomology occupied much attention, then shore and pond life, bird study, occasionally biology, ethnology, or geology have respectively taken precedence. Botany, perhaps, on the whole, has been the most popular subject with the greatest number of students, with ornithology and entomology not far behind. The latter subject has become increasingly popular during the last few years.

Another point is worthy of remark. That is the increasing tendency of nature-lovers and scientific workers to specialise on a certain science, and even in a certain section, rather than to take too wide an interest or range for their province.

The result is the acquirement of more definite knowledge with economy in time and division in labour. This is especially noticeable in botany, entomology, and biology. In the Club work, for instance, the study of Orchids, of Ferns, Eucalypts, Mosses, Acacias, etc., have respectively separate votaries. In Entomology, Butterflies, Buprestids, Coccids, Ants, etc., claim their special adherents

Yet another point may be mentioned; that is, the increasing application in later years of these studies to practical uses and economic needs. What were fifty years ago often looked upon as merely "hobbies" have become means of solving problems affecting food supplies, public health, and human industries. This implies the inter-dependence of the sciences in getting results by close observation and experiment; the biologist, botanist, and entomologist each contributing to the results, and their success being rendered possible by chemical and mechanical progress in other directions. What an advance, for instance, has been made in the use of the microscope and the photographic lens, with their accessories, now indispensable adjuncts in research and demonstration. With wider knowledge, closer study, and improved methods have come more practical views. In studying birds the once common practice of collecting eggs has been discountenanced Photography of birds has replaced or displaced in great measure the shooting of specimens. A bird-lover could hardly be a bird-slayer. The present generation has been educated to protect birds, and to study the living species.

The Club, whilst widely disseminating information in regard to the fauna and flora, has endeavoured also to protect and conserve them. In this direction from time to time it has successfully advocated reservations as sanctuaries for fauna and flora. Due to its suggestions and active influence, despite opposition and indifference, Wilson's Promontory was reserved as a National Park for the purpose mentioned. Minor reservations have also been secured. Greater protection has also been obtained for our fauna generally, and every effort made to preserve distinct species from extinction.

For several years the wildflower shows held by the Club, among the most popular of its functions, were most attractive, successful, and educative, and a source of additional revenue; but it is recognised that with so much ruthless destruction of the more accessible and beautiful native flowers, the time has come to enforce an Act designed to preserve the native flora from this fate.

In consequence, it will be inconsistent to continue such shows, except as subsidiary to the wild life exhibitions which will take their place. Two of the latter which have been held were, in the variety of exhibits, their educational value, and the keen interest aroused, extremely successful. The many wildflower shows held by the Club, always popular attractions, well-organised, and instructive, have during many years familiarised the public with the beauty of the native flora, informed them of the scientific and vernacular names, indicated the plants that readily respond to garden cultivation, and stimulated and encouraged city nurserymen to undertake the growth of such plants for ready sale, in this way inducing conservation of native flora by the very best means —cultivation. Many species of native plants are thus readily procurable.

Among many directions in which the influence and the advice of the Club have been consistently directed with good effect, are in such subjects as the retention of forest areas, re-afforestation of denuded lands, the prevention of despoliation of vegetation on river frontages, the control of noxious plants, the extension of sanctuaries for fauna and flora, the prevention of pollution of streams, the fixation of drifting sand on sea-coasts and in the Mallee, and the preservation of the "sand-stay" vegetation of Port Phillip. Then, as regards the fauna, the protection of opossums, koalas, seals, mutton-bird rookeries, marsupials generally, and many interesting birds, such as the lyre-bird, emu, and mound-building mallee hen, have been consistently urged and considered with satisfactory results. Legislation in regard to game protection, shooting seasons, use of the pea-rifle, fishing in streams and sea, also the importation of animals, and the export trade in birds and furs, has been induced, modified, or amended at the representations of the Club.

Members generally have been alert in noting infringements of the laws affecting fauna and flora. Some members as honorary inspectors have in this connection rendered useful service.

It will be seen from this brief survey that the contribution of the Club to the cause of science during its half-century of existence has directly and indirectly been both considerable and substantial. It has also fostered and encouraged the scientific spirit and habit of mind, whilst presenting its objects in a pleasing and attractive way, thus inviting membership, which is often long-continued, purposeful, and productive of good results.

The Club has made the study of Australian plants and animals popular and wide-spread, the recognition of species easier, and their habits and environment better known. Many new species have been described and named, and the distribution, classification and nomenclature of both animals and plants carefully recorded. Many Club members have written works on Nature subjects which are useful and informative.

The interference of the balance of nature by man, by other animals, by introduced plants, by climatic factors, has been carefully studied, and the results, injurious or helpful, on fauna and flora noted. The knowledge of the physiographic features and geological structure of the State has been materially supplemented, and the whole State traversed in the interests of field work.

Only brief reference can be made to the chief sections of nature study.

Botany.—A special article will deal with the progress in botany under the Club's auspices. Suffice it to say that there has never been lack of diligent observers and students. Valuable and consistent work has been done in systematically recording the flora of Victoria, many new species have been described, and a lasting contribution made to scientific knowledge. Many years were taken by the Plant Names Committee of the Club in carefully compiling a *Census of Victorian Plants* with their regional distribution and the vernacular names, a work which has been of great assistance to Victorian workers and botanists in general. General descriptions of the flora of Victoria, taxonomic and ecological, have from time to time appeared in the Victorian Year-Book under the names of Messrs. C. A. Topp, G. Weindorfer, Professor A. J. Ewart, and Mr. J. Audas, all members, past or present, of the Club.

Geology.—Sir F. McCoy's palaeontological research in the earlier years was of great value, and a succession of skilful observers has added much to the knowledge of the geology of Victoria. In an exhaustive geological survey of Gippsland, Mr. A. W. Howitt, the eminent scientist, an honorary member of the Club, dealt with the structural and petrological features of that little-known province. Dr. T. S. Hall, in his careful work on the

fossiliferous strata of the Ordovician and Silurian measures, showed the connection of the occurrence of graptolites with auriferous zones. Mr. F. Chapman, A.L.S. geologist and palaeontologist at the National Museum, and later in the Federal service, as a recognised authority on fossil remains, has done much in the determination of geological periods in Victoria.

Dr G. B. Pritchard also was a painstaking worker in palaeontology. These three members, besides their elucidation of the geological and palaeontological features of Victoria, have outlined most attractively and completely the physiography of a large area of the State. Among other members prominent in geology may be mentioned Messrs. Dennant and J. Stirling. Messrs. E. O Thiele and Sir Albert E. Kitson did useful work in Alpine Gippsland and the North-East. The latter, now knighted, is on Imperial service in Western Africa. Several Club members have been actively connected with the geological survey of Victoria, a work which has been carried out with great thoroughness and skill, and has done much for the development of the mineral resources of the State.

Entomology.—This section is dealt with elsewhere. Its value in relation to agriculture has received full recognition. Many of the younger members of the Club have done fine work in this field, and its record is very creditable.

Ornithology is a subject of common interest. Among the earliest making it a special study were Mr. A. J. Campbell, whose book on Birds and Eggs is a standard work. Messrs. D. Le Souef and A. H. Mattingley were among our keen observers in the field, followed later by Dr. J. A. Leach, and Messrs. A. J. North, Robert Hall, C. Barrett, and others, who, in their congenial work, have greatly increased the knowledge concerning our native birds, the recognition of species, nomenclature on approved lines, migration, and the ordinary and nesting habits of the different species.

Ethnology arises as a definite section in the Club only during the last few years. In this subject Dr. A. W. Howitt's comprehensive work, *The Tribes of South-East Australia*, and Professor Spencer's works on the Central and Northern Tribes of Australia are of the utmost value. Dr. G Horne was also keenly interested in the stone age man of Australia. During the past few years several evenings have been set apart at the Club for consideration of Australian Ethnology, some good papers on the vanishing native race, appropriately illustrated by exhibitions of native work and remains, have been read.

Biology.—In this more technical subject, the Club has always had the assistance of the trained scientists from the University *e.g.*, Sir Baldwin Spencer, Dr. T. S. Hall, Professor Agar, Miss J. Raff, M.Sc., and others, who have in lectures and demonstrations made the subject an interesting and fascinating one.

Zoology.—Closely allied and sometimes overlapping the study of the biologist, that of the Australian fauna, has been closely and carefully followed. Dr. T. S. Hall, Messrs. J. A. Kershaw, Le Souef, C. Barrett, W. H. Davey, D. Fleay, and others, have by their observations thrown fresh light on its features, the structure, lives, and habits of our distinctive Australian animals. How important a place they occupy in connection with anatomical work and evolutionary processes is seen in the keen scientific interest in the study of the Monotremes, the Platypus, and Echidna, survivors of primitive forms nowhere else existent, and also in the Phascolomys or Wombat, and other members of the Diprotodont marsupials.

Arising out of botanical research, forestry during the last twenty-five years has had special consideration. The disappearance of our extensive Gippsland forests, the reckless destruction of valuable timber-trees, the deforestation of watersheds, the increasing scarcity of timber, have directed attention to the imperative need of action. Among members who have given special attention to the subject are Drs. C. S. Sutton, Heber Green, and R. Patton, also Mr. P. H. St. John, whose knowledge of forest trees is unrivalled. Through the Club's representations, certain forest areas have been reserved, restrictions placed on the destruction of trees, and the need of re-afforestation emphasised.

Marine Life has had a number of votaries. Mr. J. A. Kershaw has dealt with Fish Fauna, and others with the various forms frequenting the shore and rock pools, whilst from time to time the results of dredging operations in deeper waters have been under observation.

Perhaps the greatest contribution in this section is that of Messrs. J. H. Gatliff and C. J. Gabriel, who made a feature of conchology, have collected very extensively, and described many new species of shells, including land forms. Mr. A. H. S. Lucas was one of the earliest exponents of the wonders of shore life, and is still engaged in the aim to collect all species of Algae on the Australian coast line. Messrs. H. Watts and A. D. Hardy also gave attention to Algae and other forms.

Pond Life, a popular study among its observers, has had many ardent followers, among whom may be mentioned Messrs. J. Stickland, J. Shepherd, J. Searle, Wilcox, etc. These forms, like those of shore life, lend themselves readily to microscopic representation and illustration by the lantern.

These are the chief subjects of direct observation, although many subsidiary objects of interest allied thereto are also taken, no phase of natural science being outside the province of the Club.

From time to time, as certain sections have become stronger independent societies and clubs have been formed for special or wider study. Thus we have the Bird Observers' Club, Entomo-

logical Society, Microscopical Society, Forest League, League of Tree-lovers, Wattle League, etc., many members of which retain membership of the Field Naturalists' Club.

With the Royal Society of Victoria a warm feeling of reciprocity has always existed, dual membership and common interests often being associated with this connection. A source of strength to the Club in its career has been the intimate and valued connection and collaboration with the National Museum, the National Herbarium, the Botanical Gardens, and the Geological Museum, such relations being mutually beneficial and helpful. The directors and responsible officials, with very few exceptions, have been active and useful members of the Club.

From the inception of the Club also the co-operation of the Professors and lecturers in the Biological, Botanical and Geological Schools at the University, has been fully accorded, many of them, as members, freely giving the benefit of their special knowledge and experience in the Club's interests.

In connection with kindred societies, in other States and in Victorian provincial towns, the Club has always extended its co-operation, sympathy, help, and advice if required. As a rule, provincial clubs, however active for a while, lack the quality of permanence. Of these may be mentioned the Ballarat Field Naturalists' Club of the "nineties," and in later years the Ballarat Science and Field Club, the Mortlake Field Naturalists' Club, founded by Mr. H. B. Williamson, and the Bendigo Science Club, of which Dr. McGillivray was the moving spirit.

The Geelong Field Naturalists' Club, founded in 1880, although subject to vicissitudes, has been the most tenacious of life, and has much useful work to its credit. About 25 years ago it organised the first Nature Study Exhibitions in the State with much success. For many years it published the Geelong *Naturalist* with useful recorded work, the writer being editor for six years. Cordial relations always existed with the Victorian Club, but the activity of the Geelong Club has been very restricted of late years and needs revival.

During later years, owing to the enthusiasm and personality of one of our members, the Rev. George Cox, a juvenile Field Club affiliated with the Victorian Club has been carried on with marked success and great benefit to the young people who have so heartily taken up Nature study.

At many functions of the Club in Melbourne, either State or Federal Governors have been present, but two may be specially mentioned for personal interest in the Club—His Excellency Sir Thomas Gibson Carmichael, an ardent entomologist, and Sir Ronald Munro Ferguson (Lord Novar), well versed in Forestry, who attended a Club meeting, and also a field excursion to Sherbrooke

LITTLE KNOWN VICTORIAN FISHES.

By J. A. KERSHAW, C.M.Z.S.

Among Victorian fishes there are many which, although they cannot be regarded as rare, are very little known even to experienced fishermen. The usual marketable kinds are well known and readily recognised, but it not infrequently happens that fish are captured, which, although long known to inhabit our waters, prove a puzzle to the local fishermen.

Such an instance occurred quite recently, when a fisherman of long experience submitted a specimen of the well-known Crook-spined Dragonet, *Callionymus calauropomus,* which he had captured at Portarlington. The fishermen to whom it was shown stated most decidedly they had never seen one like it before, and yet it is occasionally taken on the line by amateur anglers, while young ones, from two to three inches long, are common in the rock pools along our shores.

This fish grows to a length of about ten inches, and in general appearance suggests a small Flathead, from which it may be readily distinguished by its small mouth and gill openings and the characteristic strong, hooked spine extending from the hinder angle of the operculum. The male is remarkable for its brilliant colouring, which, however, is variable, and the caudal rays being produced for some distance beyond the membrane. The general colour of the male is brown above, with a greenish tinge, and whitish below. The sides of the head and body and the membrane of the dorsal fins are beautifully ornamented with numerous fine yellow lines, the first and second dorsal fins with purple blotches and the membrane of the caudal pale yellow, the lower portion dark slate colour. The female is usually dull brown above, mottled with pale pinkish spots, and is devoid of the yellow lines of the male. The caudal fin is rounded and the rays never produced into filaments.

Another species which, from its grotesque appearance, usually excites much comment, is the Stone Lifter, *Kathetostoma laeve.* It belongs to a widely distributed group of fishes generally known as "star-gazers" from the fact that the eyes are situated on the upper surface of the head and directed upwards. The head is very broad and massive, and flattened on top, its bony armature sculptured into strong ridges, with a prominent spine projecting from the operculum on each side. The gape of the broad mouth is vertical and furnished with numerous sharp teeth. The body is devoid of scales and is usually of a dirty yellowish colour, with two broad, dark bands across the body and one on the tail. The ventral fins are particularly large and strong and are used principally to assist it in burrowing. Its usual habit is to lie concealed in the sand or mud of the sea bottom with only its eyes and mouth

exposed ready to snap up the small unwary fishes which form its chief food. This species is not uncommon in Port Phillip and Western Port, where it sometimes attains a length of more than two feet. It also occurs in New South Wales, South Australia, and Tasmania.

Coral Fishes, which are noted for their brilliant colouration and conspicuous markings, attain their greatest development among the coral reefs of tropical seas. Two species, however, occur in our southern waters, and are by no means common. The Six-banded Coral Fish, *Vinculum kershawi*, was recorded by me (*Vict. Nat.*, xxviii, 1911, p. 95) under the name of *Chaetodon sexfasciatum* Richardson, by which it had long been known. Whitley, however, considers it distinct from Richardson's species, and has recently re-named it as above. It is whitish in colour, with six very pronounced dark cross bands, and has been taken in Victoria at Mordialloc, Western Port, and Split Point. It attains a length of about ten inches and is considered a good table fish.

The second species, *Chelmonops truncatus*, has the long narrow snout of so many of the coral fishes, the body high and laterally compressed and the hinder margins of the dorsal and anal fins terminating in a vertical line. Across the head and body are four very definite blackish bands.

It has been recorded from Victoria, but I have not seen a specimen. It, however, occurs fairly commonly in New South Wales as well as in South and Western Australia.

The Herring Cale, *Olisthops cyanomelas*, although recorded from Victorian waters as early as 1872, by Count Castlenau, only rarely occurs among our marketable fish. It inhabits rocky situations and is stated to feed largely upon gelatinous seaweeds. There is a very marked difference in colour and markings in the sexes, the male being of a uniform dark bluish-black with a rich blue band near the outer margins of the upper and lower lobes of the caudal, and near the upper margins of the pectoral fins.

The female is of a rich olive brown above, with orange and bluish markings on the sides, each scale with a prominent dark blue central spot. The sides of the head are richly ornamented with orange and blue wavy streaks. The dorsal, pectoral, anal and caudal fins are reddish-brown, with dark blue lines and spots, the ventral pale orange, blotched with olive. The colour and markings of the female are subject to considerable variation, while Stead has recorded a male possessing all the colours of the female. The range of this species extends from Southern Queensland to Western Australia and south to Tasmania.

The Red Perch, *Caesioperca rasor*, is another little-known species, occasionally captured in Hobson's Bay. It is regarded as an excellent table fish and attains a length of eight or nine inches.

AUSTRALIAN TIGER BEETLES.

By F. E. WILSON.

Tiger beetles are found in most parts of the world, and by reason of their graceful form and richness of colouring, are very popular with beetle collectors. They are extremely active, being strong fliers, and also able to run along the ground at great speed. All species are furnished with long, thin legs, slender antennae, and very prominent curved toothed mandibles. Being predaceous, these beetles are terrors of the insect world. Their larvæ live in tunnels in the earth, and lie in wait at the entrance, ready to seize any passing object that takes their fancy.

The family is richly represented in this country, some 64 species having been recorded to date. No doubt, a few more still remain to be discovered. Our species are grouped under seven genera, of which the most important are *Cicindela*, with 30 species; *Megacephala*, with 18; and *Distipsidera*, with 10 species. The genus *Megacephala* contains the largest and most brilliantly coloured of our Cicindellidae.

We know of only two species occurring in Victoria, and one of these has been taken on only one or two occasions. The fine large *Megacephala australis* Chaud, a study in metallic green and yellow, is found in the north-west of the State rather plentifully, but to catch many is usually no easy task. You may look for them in salt pan country, and particularly around the margins of our salt lakes. Some years ago, when Mr. Charles Barrett and I visited the Pink Lakes, near Linga, I obtained several specimens from beneath pieces of timber lying embedded in the crystallised salt. I also secured one example, under similar circumstances, at a salt lake on the Little Desert, south of Nhill. When we were at the Pink Lakes, several examples were attracted to light one stormy night. They came in with a great rush, and, immediately on alighting, began tearing about all over the place, so that bottling them kept one busy.

The other Victorian species, *Cicindela ypsilon* Dej., was recorded, many years ago, from the Ninety Mile Beach, but the only Victorian example I have seen was captured last summer at Mallacoota by our fellow member, Miss J. Raff. This species is, however, a very common beach-frequenting form along the shores of New South Wales and Queensland. It is well known from its habit of rushing along the sand for some distance, and then taking wing just when one has almost overtaken it. It alights a short distance farther on, and will repeat the performance many times. A capture often entails much active exercise. A handful of sand thrown accurately just as they are about to rise will sometimes upset their calculations, and in the ensuing disorganisation a capture may be effected.

A very handsome insect is *Megacephala cylindrica* Macl. As its name implies, it is cylindrical in form, and its colouration is bright metallic blue green, with legs of dark reddish brown. It is a lover of the inland parts of New South Wales and Queensland, and at times contributes to the bill of fare of the Australian Bustard, as I found remains of several examples in the stomach of one of these birds. Another nice *Megacephala* is *crucigera* Macl., found in Queensland. Its elytra are yellow and are ornamented with a large green cross.

Tiger beetles of the genus *Distipsidera* are mainly confined to the northern parts of the continent. Their general colouration is black and yellow, and their eyes are very prominent. They are usually found running about on the trunks of trees, where, no doubt, they obtain most of their food.

One of the rarest of our "tigers" is *Nickerlea sloanei* Lea, a small species, found in Western Australia. One apterous species only we have in Australia, so far known only from the Cape York district, although it occurs commonly in New Guinea. It is *Tricondyla aptera* Oliv., a remarkable-looking insect of a dull blue colour. I have recently received other species of this genus from the Philippine Islands.

Seventeen authors have contributed to our knowledge of the Australian tiger beetles, and of these by far the most noteworthy worker has been Mr. T. G. Sloane, of Young, N.S.W., a member of our Club. A list of species names reads like an honour board of Australian entomologists, the following names having been associated with different species:—A. M. Lea, Rev. T. Blackburn, H. Hacker, Geo. Masters, F. P. Dodd, Chas. French, senr., T. G. Sloane, Horace Brown, John Clark, H. M. Giles, Count Castelneau, Geo. Helms, A. W. Howitt, also the late Sir Baldwin Spencer.

EXCURSION TO SCHOOL OF AGRICULTURE.

About thirty members and friends visited the University School of Agriculture on the afternoon of Saturday, June 20, for the study of Entomology. With the aid of models and specimens, previously set out in the laboratory, features in the life-history and general biology of several insects were noted.

The insectarium was visited, its construction explained, and a few "pot" and "cage" experiments were demonstrated. The Museum also was open for inspection, where visitors saw exhibits of general agricultural interest.

During the afternoon a hive of bees was opened up for a few minutes, the time of year not being suitable for a long inspection. Frames covered with bees, and showing both capped honey-cells and brood-cells, proved to be of interest, especially to those seeing them for the first time. The leader was assisted during the afternoon by Mr. A. O'Brien, whose help was greatly appreciated.—J. W. RAFF.

THE NEW FLORA OF VICTORIA.

Seeing that no work dealing comprehensively with the plants of this State has appeared since the *Key to the System of Victorian Plants*, by Baron Ferdinand von Mueller, in 1888, the publication of *The Flora of Victoria*, by Professor Ewart, for a copy of which we are indebted to the University Press, will be most heartily welcomed by all our botanists.

In the interval between these two works some 300 species have been added to our flora, as, for examples, 73 to the Orchidaceae, 15 Pultenaeas, as many Acacias, and 28 Eucalypts. The author, we think, is very properly conservative in denying specific rank to a great many forms of the last named species described by the Sydney eucalyptologists, but is apparently rather too much so in crediting the genus with only 200 species.

In all, 2200 native species are described, and 460 naturalised aliens as against 170 listed in the Key. The Leguminosae are dealt with by our late lamented member, Mr. H. B. Williamson, who also helped in the revision of the whole work, and the Gramineae, by Mr. F. Morris, of the National Herbarium. Mrs. D. Thomson assisted in the orchid section, and the many helpful illustrations are the work of several assistants under the supervision of Dr. McLellan. The vernaculars used are those given in the *Census of the Plants of Victoria*, issued by this Club.

The general distribution of the species is given as in the north-eastern, southern, north-western, and south-western districts, and special mention of those species occurring in the National Park at Wilson's Promontory, the Grampians, and the Alps is made. Those plants occurring in the vicinity of Melbourne are stated as being in the basalt, silurian, or red sands areas.

Professor Ewart takes a gloomy view of the future of our flora, and thinks that, by reason of human interference and the relentless spread of introduced aliens, steadily increasing at the rate of rather more than five a year, less than half of our species will survive within the next century.

A very useful index of scientific and vernacular names, including the introduced aliens, glossary, and derivations is given.

—C.S.S.

LATE MR. L. L. HODGSON.

The death of Mr. L. L. Hodgson, which occurred on July 31, has deprived the Club of one of its leading members, and all of us who knew him mourn a good friend. An account of our late member's services, his contributions to *The Naturalist*, etc., will appear in the next issue.

The Victorian Naturalist

Vol. XLVIII.—No. 5. September 8, 1931. No. 573

THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary monthly meeting of the Club was held in the Royal Society's Hall on Monday, August 10, 1931. The President, Mr. J. A. Kershaw, C.M.Z.S., occupied the chair, and there were about 80 members and friends present.

CORRESPONDENCE.

From Fisheries and Game Department.—Mr. F. Lewis, Chief Inspector, in reply to communications from the Club, stated that samples of tanned lizard skins had been submitted to well-known tanners, who expressed the opinion that none of our lizards were sufficiently attractive in appearance and texture for shoe making. There was no need, on this account, to place lizards on the protected list. Mr. Lewis also announced that the following Finches are now on the protected list for the whole year, viz.:—Beautiful Firetail (Firetailed Finch), Diamond Firetail (Spotted-sided Finch or Diamond Sparrow), Plum-headed Finch; and the two following for the period September 1 to January 31, viz.:—Zebra (Chestnut-eared) Finch and Red-browed Finch (Waxbill).

The Secretary, Queensland Naturalists' Club, asking for wild-flowers for their show in Brisbane on September 5, and offering to send some for our show.

The Secretary, Mitcham Nature Lovers' Club, asking for leaders for excursions and addresses.

ELECTION OF MEMBERS.

The following were unanimously elected as ordinary members: Miss C. Reid, South Yarra; Miss A. Watt, South Yarra; Miss J. G. Sutherland, Middle Brighton.

EXPRESSION OF SYMPATHY.

The President voiced the sense of loss sustained by the Club in the death of Mr. L. L. Hodgson. Members paid the tribute of remembrance in silence.

The President also announced, with regret, the illness of the Secretary, Mr. A. E. Rodda, and a resolution of sympathy was passed.

GENERAL BUSINESS.

Reports on excursions were given by Mr. A. G. Hooke—Sherbrooke, Lyrebirds—and Mr. W. Ingram—Geology School, University. Both excursions were well attended and thoroughly appreciated.

Members were informed by Mr. V. H. Miller that arrangements for the Exhibition were progressing.

Mr. F. G. A. Barnard drew attention to the sale of *Banksia collina* by florists, but was assured that cases had been investigated, and that vendors had written permission from private owners of property.

Mr. Blake, referring to a note in the August *Naturalist* on Astronomy, announced that he would be pleased to introduce members to the Astronomical Society of Victoria, whose membership contribution is 10/6 per annum.

Dr. H. Flecker suggested that the Boy Scouts Association be asked to preserve the Australian character of the vegetation in their newly-acquired camp site at Mount Martha. A letter is to be sent.

Dr. C. S. Sutton brought under notice *The Gumtree*, and called attention to the League of Tree Lovers, offering to enrol members.

Mr. G. N. Hyam made an appeal for the support of members in the inaugural planting on Sandringham foreshore.

LECTURE.

Dr. S. Perry entertained members with an account of African snakes. He exhibited many beautifully-marked skins, and referred to closing incidents in the lives of their former owners. Interesting points of observation concerning "mentality," locomotion, ejection of poison, and antidotes were touched upon.

EXHIBITS.

By Master P. Flecker.—Vertebra of a whale found at Rye, but probably carried from the neighbourhood of Cape Schanck.

By Mr. A. J. Swaby.—A naturally-rooted layer of *Alyxia cunifolia* (Sea-box) Sandringham. Of special interest, since this plant is in danger of extinction.

By Mr. T. S. Hart.—Timber of Gippsland Waratah, *Telopea orcades*, east of Orbost. Galls on *Banksia marginata* (Silver Banksia), near Heathcrton. Calcite in basalt from Ascot shaft, Ascot, near Creswick.

By Mr. D. Orchard.—Large specimen of a head of a Trilobite, from Kinglake. Eggs of a lizard with embryos developing.

By Mr. J. A. Kershaw.—Skull of Python, Malay Peninsula.

By Mr. F. S. Colliver.—A series of Cephalopods, fossil and recent, comprising:—*Aturia australis*, Muddy Creek, Balcombe Bay, Beaumaris; *Nautilus geelongensis*, Batesford; *Nautilus pompilius*—all showing similar suture structures. To show variety in the group:—*Ammonites*, from age Lias, Germany; *Belemnites*, from age Cretaceous, Queensland; *Spirula australis*, recent, Port Phillip; *Sepia apama*, recent; Squid (Sea pen.). Marine Shells:—*Polinices lineatus* Linn.; *Cafrarium scriptum* Linn.

By Mr. W. Hanks.—Fossil bone of a large kangaroo, left humerus, as long as that of *Macropus titan*, but not quite as thick. South of "pavement," Merri Creek, Coburg, in Pleistocene.

By Mr. C. G. Gabriel.—Marine shells from New Zealand—*Chlamys scolandiæ* Gray; *C. convexus* Quoy and Gaim.; *C. radiatus* Hutton; *C. dichrous* Suter.

By Mr. A. S. Chalk.—Fragment of Silurian Coral Reef Cave Hill, Lilydale, collected on Club excursion, March 7, 1931, containing:—(a) A coral new to Australia, but genus occurring at Wenlock Edge, England; Finland, and Gothland, viz.:—*Acervularia chalkii*, aff *A. ananas* (Linné), equals *A. luxurians* M. Edwards. (b) a Stromatoporoid (*Stromatoporella sp.*), determined by Mr. F. Chapman.

THE LATE MR. L. L. HODGSON.

Mention was made in the August *Naturalist* of the death of Mr. L. L. Hodgson, on July 31. Mr. Hodgson was elected a member of the Club in September, 1921, and soon became a congenial spirit. His natural history tastes were varied, birds and plants being foremost. He became a successful grower of native plants. In June, 1926, he allowed himself to be nominated for the position of hon. secretary, for which from his business experience he was well suited, and, being elected, he at once began to infuse vigour into his office, but failing health two years later compelled him to ask the Committee to find a successor. Mr. A. E. Rodda responded to the desire of the Committee, and at the next annual meeting, June, 1929, was re-elected.

Besides acting as leader of excursions on several occasions and furnishing reports of the same, he contributed the following papers to *The Naturalist*:—"Rambles in the Lorne District," vol. 43, p. 131; "On the Buffalo Plateau," vol. 44, p. 188; and "Nature Gleanings from the Prince's Highway," vol. 47, p. 59. On his retirement from office Mr. Hodgson was presented with a valuable barometer as a mark of the esteem in which he was held by his fellow members.

THE *CAULERPAS* OF VICTORIA.

By A. H. S. Lucas, M.A., B.Sc.

The genus *Caulerpa* (creeping stem), founded by Lamouroux in 1809, and as yet not merged or subdivided, is perhaps the most remarkable type in the vegetable kingdom. It consists of somewhere about 80 known species, though the lists of different botanists who have studied the genus vary in their numbers, according to the personal opinion of each as to which forms are to be considered as varieties or sub-species, and which are to be accorded full specific rank.

Of labelled species, Australia can boast more than half the whole number, and Victoria of sixteen. This last fact is a little remarkable, since *Caulerpa* is generally regarded as being characteristic of tropical or sub-tropical seas. Thus a single species occurs in the Mediterranean, and no others on the Atlantic coasts of Europe. Harvey listed 15 species, apart from varieties, from the Friendly Islands, and Svedelius, also liberal with varieties, recorded 21 from Ceylon. Both collected carefully and wittingly over a considerable time. It comes then as a surprise to find Victoria so rich in forms. Only five species are recorded from New Zealand.

The plants of the genus are characterised by possessing a long cylindrical surculus, or creeping stem, which sends downwards bunches of fine, branching, colourless rhizoids, by means of which it attaches itself to the rocks or sand among which it creeps, and sends upwards green fronds, or assimilators, of the most varied shape. The fronds of the smallest are an inch or two high, and those of the largest are over a foot in length, but, small or great, each plant consists of but a single cell, the branchings of which constitute the rhizoids and the assimilators. There are no cross-walls, and there is no aggregation of the protoplasmic matter into separate small masses. The firmness of stem and frond is secured by a system of trabeculæ or narrow beams composed of something very like, but apparently differing from, cellulose. These beams or fibres branch and anastomose, and are in places largely developed, and passing from wall to wall of the long cell, they maintain its shape and stiffen it.

The rhizoids are entirely organs of support and take no part in the nutrition of the plant. All seaweeds, except the few parasites, obtain their nourishment from the gases and salts dissolved in the surrounding sea water. Hence the much-divided rhizoids, though they resemble the fibrous roots of grasses, have a much simpler function. They cling to the rocks or grains of sand, or, more rarely, anchor the plant in a muddy bottom. They are colourless and are given off at irregular intervals by the creeping surculus.

The surculus itself, like a strawberry runner, is long, appar-

ently of indefinite length and growth, and usually gives off branches, which go on growing, and, if accidentally or naturally severed, still continue to give off fresh rhizoids and green fronds. As at present known, this is the only way in which new plants are produced. The surculus is cylindrical, green where exposed to light, and may be quite smooth or be clothed with small scales, according to the species. It is slender in some species, but may have a diameter of a quarter of an inch in others. Naturally those kinds which grow in rough water have the stoutest stems.

It is the fronds of *Caulerpa* which are most remarkable. Nature seems to have shown what a variety of forms she can produce out of a single cell, foreshadowing most of the types of the higher many-celled plants, just as the one-celled Foraminifera foreshadow the designs and patterns of the Mollusca. There are pro-types, as it were of Charas, Mosses, Ferns, Horsetails, Clubmosses, Cypresses, and Araucarias, Stonecrops, Cactuses, and Phanerogams with broad simple leaves. To such an extent has this diversification been carried out that all botanists accept J. G. Agardh's classification of the genus into sections according to their likeness to the more elaborated groups. It will be seen that the Victorian species show the widest diversity of external form, yet by their identity of structure and habit, and the absence of sexual or non-sexual spores, they are all properly and naturally brought together as members of but one genus.

Following is a list of described Victorian species:—

Section FILICOIDEÆ. Like Ferns.

1. *C. alternifolia* J.Ag., 1887.
2. *C. scalpelliformis* (R.Br.) C.Ag., 1811.

Section HIPPURIDEÆ. Like *Hippuris* (Mare's Tail).

3. *C. longifolia* C.Ag., 1824.
4. *C. trifaria* Harv., 1863.
5. *C. Harveyi* F.U.M., 1859.
6. *C. Cliftoni* Harv., 1863.
7. *C. obscura* Sond., 1845.

Section LYCOPODIOIDEÆ. Like *Lycopodium* (Clubmoss).

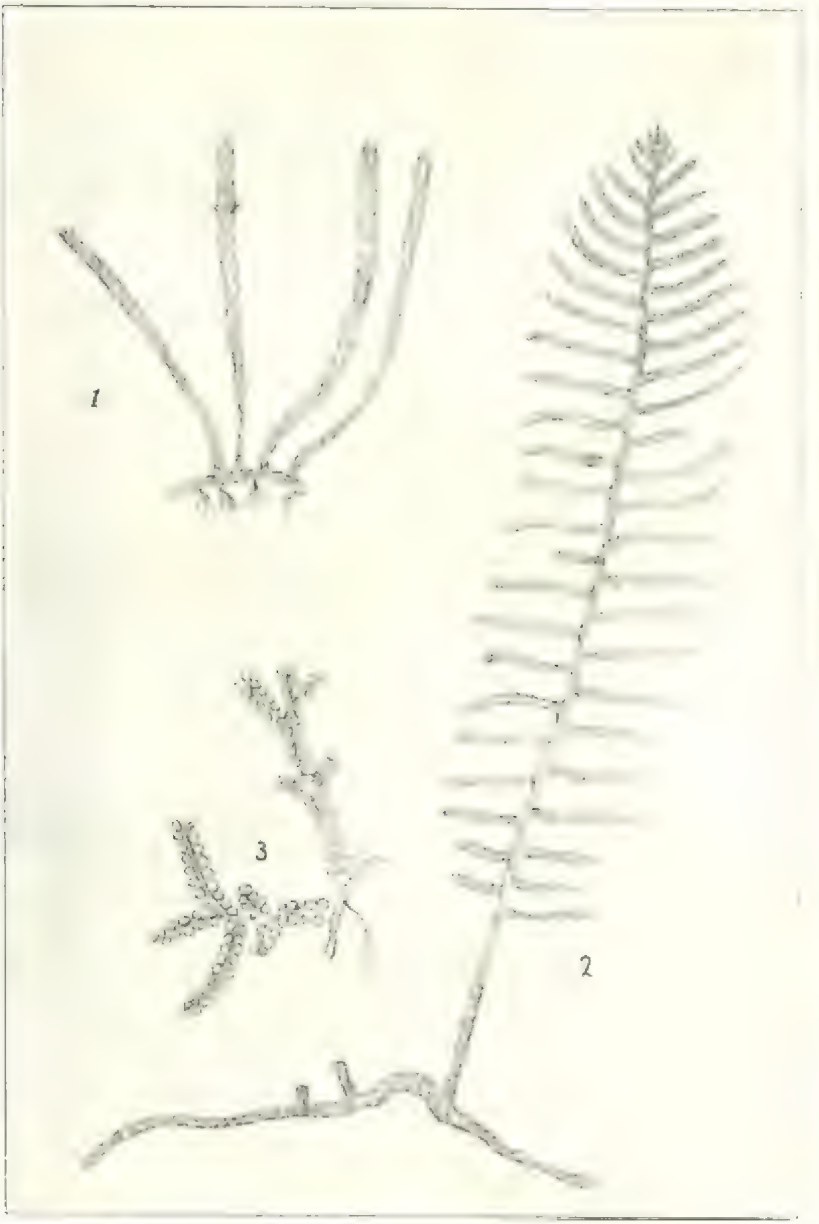
8. *C. Brownii* Endl., 1840 circ.

Section ARAUCARIOIDEÆ. Like *Araucaria* (Firs).

9. *C. hypnoides* (R.Br.) C.Ag., 1824.
10. *C. Muelleri* Sond., 1850 circ.
11. *C. Abies* Areschoug, 1854.

Section SEDOIDEÆ. Like *Sedum* (Stone-crop).

12. *C. sedoides* (R.Br.) C.Ag., 1811.
13. *C. vesiculifera* Harv., 1860 circ.
14. *C. simpliciuscula* Ag., 1824.
15. *C. papillosa* J. Ag., 1872.



(1) *Caulerpa Brownii;* (2) *C. hypnoides;* (3) *C. sedoides.*

Section OPUNTIOIDEÆ. Like Cactus.

16. *C. cactoides* (Turn.) C.Ag., 1811.

Section FILICOIDEÆ.

1. *C. alternifolia* J.Ag.

This form, described by Agardh requires more complete investigation. Agardh's material consisted of fronds, *without a surculus,* sent to him by J. Bracebridge Wilson, and was probably dredged by Wilson. The fronds are erect, slender, and filiform, *repeatedly dichotomous,* and distichously pinnate throughout their length. The length of the frond is 4 to 6 inches, and that of the pinnæ from one-fourth to one-third of an inch. The pinnæ taper from a rather thicker base and are subulate tipped with a mucro. Below they are almost regularly alternate, but above, where they are closer together, less so. (The italics mine.)

2. *C. scalpelliformis* (R.Br.) C.Ag.

This is a conspicuous and elegant species, and was noted by the earliest collectors. It is one of the three which received their specific names from Robert Brown himself.

The surculus is smooth and glossy but becomes furrowed when dry. The fronds are stalked and erect, half an inch to an inch apart, a few inches, rarely a foot, high, and about half an inch wide. They often start a fresh growth by constricting and then gradually widening out again. They are linear-lanceolate in outline, flat with a thickened rachis, and closely pectino-pinnate, with alternate, linear, incurved, sub-acute, flat teeth or lobes. The lobes are about as long as the width of the rachis and come off at an acute angle.

The plant grows on the sides of rocks, a few feet below low-water mark, and is occasionally dredged from deeper water. It is not confined to Victoria, but occurs on the coasts of West Australia, at least as far north as Dongarra, near Geraldton, and in South Australia and Tasmania. It is not found outside Australia, as is stated by Harvey, but there is an allied species, *C. denticulata,* which resembles it in outline, but in which the lobes of the frond are markedly denticulate. This is recorded from the Red Sea and from both sides of the Atlantic.

Fragments of *C. scalpelliformis* are not infrequently met with cast up on the beaches.

Section HIPPUROIDEÆ.

In the Section *Hippuroideæ* the green fronds are large and conspicuous, each consisting of an elongated rachis bearing long slender ramenta, much in the same way as the vertebral axis of a horse's tail bears the hairs.

The five species are all Australian, in fact are all limited to the southern coast of the continent and Tasmania. They may be recognised from the following key:—

A. Ramenta not arranged in distinct longitudinal rows but spreading brushwise in all directions.
  (a) Ramenta simple. *C. longifolia.*
  (b) Ramenta pinnate, *C. obscura.*

B. Ramenta arranged in distinct longitudinal rows.
  (a) Ramenta simple in three rows (tristichous). *C. trifaria.*

C. Ramenta in five rows (pentastichous).
  (a) Ramenta simple. *C. Harveyi.*
  (b) Ramenta forked or sub-pinnate. *C. Cliftoni.*

3. *C. longifolia* C.Ag.

Surculus slender and smooth. Fronds 4 to 8 inches high, naked below, above bearing long simple ramenta in a graceful pencil. The rachis angular with ridges and furrows. The ramenta an inch long, dark green.

Encounter Bay (S.A.); Warrnambool, Point Lonsdale (V.); Tasmania.

4. *C. trifaria* Harv.

Surculus rough with minute teeth. Fronds to one foot high, in rock pools shorter, with a petiole denticulated like the surculus, bearing simple ramenta in three vertical series. The rachis round. The ramenta to a quarter of an inch long, light green.

Point Lonsdale, Portsea, Cape Schanck (V.); Tasmania.

The specimens dredged in 4 to 5 fathoms at Southport, Tasmania, were a foot long; those of the rock pools are short, 4 to 5 inches.

Agardh classed *C. trifaria* with the *Filicoideæ* because of a resemblance to *C. plumaris* with distichous ramenta. This is, however, a much smaller tropical plant with quite different habit. Harvey, on the other hand, went so far as to suggest that *C. trifaria* might be merely a depauperated form of *C. Harveyi.* But it is certainly quite a different plant, distinguished from *C. Harveyi* by the rough surculus and constant arrangement of the ramenta in three rows. I have accordingly ranked it among the *Hippuroideæ* next to *C. Harveyi.*

5. *C. Harveyi* F.V.M.

Surculus robust, smooth and glossy, with stout rhizoids. Fronds to two feet high, the lower two or three inches nude and forming a petiole, bearing crowded simple ramenta in five vertical rows. The rachis wrinkled, yellowish, herring-bone like. The ramenta ¾ to 1 inch long, coarsely setaceous, deep green.

Rivoli and Guichen Bays (S.A.); Portland, Port Fairy, Warrnambool, Port Phillip Heads, Westernport (V.). More scrubby in rock pools, noble plumes from deeper water.

6. *C. Cliftoni* Harv.

Syn. *C. abies-marina* J.Ag.

Surculus robust, smooth, with stout rhizoids. Fronds to six inches high, without naked petiole, bearing crowded dichotomous ramenta in four, or more often five, vertical rows. The rachis somewhat wrinkled, green. The ramenta an inch long, setaceous, repeatedly forked, deep green.

Harvey gave the name to a single specimen collected by G. Clifton in W.A.; Madame Weber Van Bosse, the recognised authority on the genus, identifies it with Agardh's species from the south.

Fremantle (W.A.); Investigator Strait, Encounter Bay (S.A.); Point Lonsdale (V.). More delicate than *C. Harveyi*.

7. *C. obscura* Sonder.

Surculus very stout, as thick as a pen-holder, covered with short stiff forked scales. Fronds six inches to a foot high, bearing scales at the base which gradually pass into crowded pinnate ramenta arranged spirally and not in vertical rows. The rachis rounded or somewhat angular, pale green. The ramenta about an inch long, setaceous, pinnate with slender linear pinnæ, three or four lines long, dark green.

Rottnest I., Cottesloe, King George's Sound (W.A.); Port Adelaide, Encounter Bay, Macdonell Bay (S.A.); Port Fairy, Port Phillip Heads, Port Phillip, Westernport (V.); Tasmania.

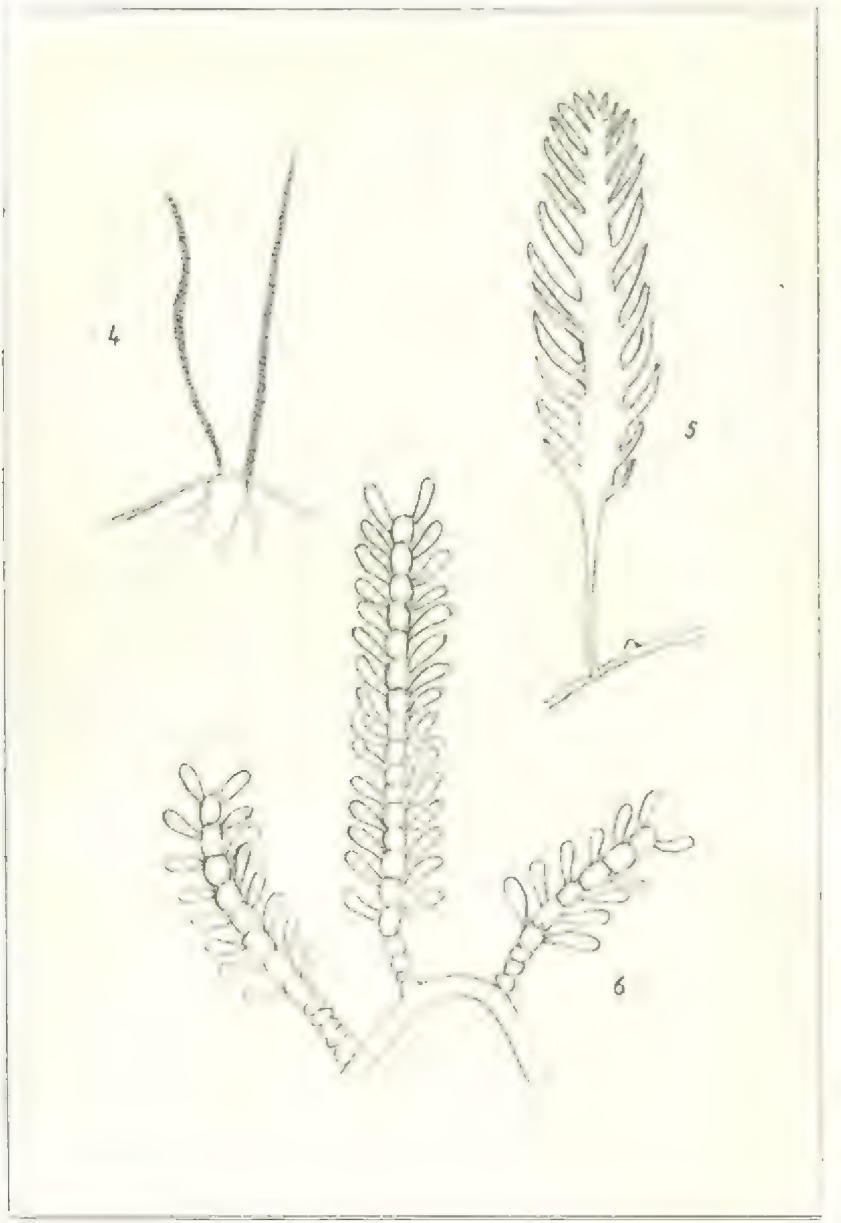
This species is identical with *C. Sonderi* F.V.M., described nine years after Sonder had published *C. obscura*. Sonder's specimens were very small and dense growing, while Mueller's were more typical of the plant. After identifying *C. Sonderi* and *C. obscura*, Harvey curiously deliberately adopted Mueller's name in spite of the rights of priority, and De Toni in his great *Sylloge Algarum* has followed Harvey. But the species must, of course, bear the name given to it by the earlier founder.

Section LYCOPODIOIDEÆ.

Fronds long, cylindrical, closely beset with short imbricated ramenta.

8. *C. Brownii* Endl.

Surculus stout, shaggy, with brown ramenta. Fronds clavate-cylindrical, simple or sparingly branched, up to one foot high, but usually much shorter, beset throughout their length by imbricated ramenta. The rachis rounded. The ramenta disposed all round the rachis, indiscriminately, or in verticils near the apex, simple or forked, appressed, short, two or three lines long, dark green.



(4) *Caulerpa simpliciuscula;* (5) *C. scalpelliformis;* (6) *C. cactoides.*

Forms with looser and forked ramenta have been separated by some authors as *C. furcifolia* Harv. Other forms are much smaller and slenderer than the type.

Albany (W.A.); Great Australian Bight, Investigator Strait, Encounter Bay (S.A.); whole coast of Victoria; Tasmania; New Zealand.

The surculi often form tangled masses. Grows near low water.

Section ARAUCARIOIDEÆ.

Fronds with stout cylindrical trunks, bearing slender pinnate branches, stem and branches densely clothed with filiform ramenta.

9. *C. hypnoides* (R.Br.) Ag. and 10, *C. Muelleri* Sond. are very closely related indeed, and whether Sonder was justified in separating his species seems to me open to question.

They have the following characters in common:—Surculus stout tomentose; trunk of frond mostly simple, less often with a branch; branches slenderer than trunk pinnately arranged; ramenta clothing trunk and branches on all sides, shortly subulate, once-forked with bi-mucronulate tips. Fronds 8 to 12 inches long, pinnæ 3 or 4 inches.

Harvey says:—"I have seen them both growing abundantly on their native rocks, and can, at a glance, distinguish the present (*C. Muelleri*) by its much darker colour, more robust growth, more erect ramenta, and the less densely set and less finely divided scales of the creeping stems. A more definite character may be found in the ramenta, which, in *C. hypnoides*, are not merely connate at the base in pairs, but united for some distance above the base so as to be as distinctly forked as in *C. furcifolia*. The magnified figures in Turner's plate of *C. hypnoides* are not correct."

J. G. Agardh says:—"Harvey believed that he had found a chief distinction in the more basal forking of the ramenta in *C. Muelleri*. To me this difference seems less conspicuous."

Of *C. Muelleri*, Agardh writes:—"It more often appears to be a larger and stouter plant. The tomentum of the surculus is looser and longer than in *C. hypnoides*. The greater fronds, which in *C. hypnoides* are tomentose with stellate scales for a short distance above the base, are in *C. Muelleri* almost to the very base scaly with simple scales more like those higher up the stem. The fronds themselves are marked by more erecto-patent ramenta. The ramenta are forked; the branches of the fork are less divergent, almost parallel like the fingers of a hand. In the specimens examined by me the rachides of the branches are more evidently angular than appeared in *C. hypnoides*, but truly a difference less conspicuous, and, unless I am mistaken, disappearing in age. If I judge correctly from moistened specimens, there is further difference in that the branches are distichously arranged in *C. Muelleri* they issue more quaquaversally in *C. hypnoides*, but Turner and

Harvey, the latter observing the living plant, described the branches of *C. hypnoides* also being as distichous." (Translated from the Latin.)

The points of distinction seem to be trivial, nor can I find after examining numbers of specimens, that they are constantly associated. With complete plants we may perhaps be able to separate as *C. Muelleri* those in which the surculus is more loosely shaggy, and the fronds stouter and of a darker green, and the ramenta from the base long and simply forked with the lobes of the forks less diverging.

C. hypnoides has been recorded from W.A., the southern coasts of Australia, Tasmania, and New Zealand. I have specimens obtained in Twofold Bay and the Sydney district.

C. Muelleri has been recorded from the same regions with the exception of New Zealand. My plants are from Victoria and Tasmania.

11. *C. Abies* Areschong.

No authentic specimens in Australian Herbaria. I can do nothing but quote the description.

Surculus, creeping, squamous, bearing erect fronds. Fronds elongate, 6 to 9 inches high, in outline sub-conical, densely clothed with spirally arranged ramenta (*sic*). Ramenta (? rami) oblong, an inch long, pinnate, pinnæ sub-opposite, simple, 2 mm. long.

Port Phillip (V.).

Section SEDOIDEÆ.

Fronds with globose ramenta.

12. *C. sedoides* (R.Br.) Ag.

Surculus slender, smooth, branched. Fronds erect, simple or sparingly branched, 1 to 4 inches high, bearing sessile ramenta. Ramenta loosely distichous below, leaving the rachis nude in places, denser above, rising from all sides of the rachis, spherical or obovate. Growing like little green bunches of currants along the crannies and cracks of the rocks from just below low water mark downwards, the shore forms more stunted. All round the coasts of Australia, Tasmania, New Zealand; Islands of the Pacific.

13. *C. vesiculifera* Harv.

Surculus stout, glabrous, with strong rhizoids. Fronds erect, simple, or sparingly branched, to 8 inches long, densely clothed with imbricate ramenta disposed in about eight longitudinal series. Stem and branches long cylindrical, rather obtuse at the apex. Ramenta globose or obovate, smaller than in *C. sedoides*, collapsing when dried.

Guichen Bay (S.A.); coasts of Victoria; Tasmania. Has much the habit of *C. Brownii*, but is easily distinguished by its vesicular ramenta.

14. *C. simpliciuscula* Ag.

Surculus smooth, rather stout. Fronds erect, elongate, cylindrical, corymbosely branched, to 6 inches high, with blunt tips, bearing small obovate imbricate ramenta in 12 to 16 vertical series. The ramenta not more than half the size of those of *C. vesiculifera*; collapsing when dried. Intermediate forms occur between 13 and 14.

West and South Australia and Victoria; Tasmania.

15. *C. papillosa* J.Ag.

Surculus glabrous. Fronds erect, narrow, cylindrical, sparingly branched or quite simple, with long tapering apex, bearing minute imbricated globose ramenta, disposed in 16 or more vertical series. The ramenta do not collapse on drying. Fronds to 5 inches high. The slenderest and most compact of the three species.

Port Phillip Heads (V.).

Section OPUNTIOIDEÆ.

16. *C. cactoides* (Turn.) Ag.

Surculus stout, cylindrical, continuous, smooth, with long, distant rhizoids. Fronds erect to a foot or more high, simple or sparingly branched, constricted into rings and bearing large, opposite, clavo-obovate ramenta. The rachis, naked below, is above regularly set with opposite pinnæ (ramenta). It is sometimes divided by the constrictions into regular narrower nodes and broader internodes, which last bear the paired obovoid-oblong ramenta. The ramenta to $\frac{3}{4}$ inch long and $\frac{1}{4}$ inch in diameter, much larger than in any other species. Growing from near low water mark to several fathoms.

Coasts of Australia, from Rottnest I. to Twofold Bay; Tasmania.

These species are figured in colour in Harvey's *Phycologia Australica*: *C. cactoides, C. Harveyi, C. hypnoides, C. Muelleri, C. scalpelliformis, C. sedoides, C. simpliciuscula, C. Sonderi, C. trifaria, and C. vesiculifera*. This work may be inspected at the Public Library, Melbourne.

A NEW SILURIAN CORAL FROM LILYDALE.

BY FREDK. CHAPMAN, A.L.S., F.G.S.

During the Club's visit to Lilydale on March 7 of this year Mr. A. S. Chalk was so fortunate as to find a slab of limestone of great scientific interest. It was subsequently polished by Mr. Chalk, and on inspecting it I recognised a species of compound coral of the genus *Acervularia*, related to *A. ananas* (Linné), a Wenlock species in Europe.

Associated with the above coral is a coral of a simple rugose type, which may be referred to *Lindstræmia* sp. There is also on the same slab a Stromatoporoid (hydroid reef-coral), which may be referred to the genus *Stromatoporella*, of an unnamed species. This organism shows the finely vermiculate pillars and rounded monticular prominences of that genus, while the coenosteum is penetrated, at right angles to the growing surface, by "Caunopora" tubes, of an unknown organism, probably living commensally, or side by side with the Stromatoporoid.

DESCRIPTION OF *ACERVULARIA CHALKII* sp. nov.

Corallum compound, consisting of closely-adjacent corallites of somewhat varying size, circular to sub-elliptical in transverse section. Septa about 30, alternately long and slightly shorter, which penetrate almost to the centre of the calice (inner wall), becoming thickened in the median zone and thinning again near the boundary of the cup, where they are slightly angulate, but not nearly so far pronounced as in *Phillipsastrea*. Where the cut is oblique, dissepimental tissue is seen filling the interspaces between the corallites. The occurrence of smaller corallites inserted between the mature ones shows intercalicular gemmation.

Dimensions.—Diameter of largest calice, 11 mm.; diameter of inner cup, 5 mm.

Observations.—The nearest species to the above is *Acervularia ananas* (Linné), perhaps better known by its synonym, *A. luxurians* M. Edwards. That species has been recorded from the Upper Silurian of Wenlock Edge, England, and also from beds of similar age in Finland and Gothland. *A. Chalkii* sp. nov. differs from *A. ananas* in having fewer septa and excessively thin epitheca.

Acervularia chalkii.

Locality.—Silurian (Yeringian) Limestone Quarries, Lilydale, Victoria.

THE POLLINATION OF *CORYSANTHES BICALCARATA* (R.Br.)

By EDITH COLEMAN.

There are no more beautiful nor more complicated forms of plant-life than are to be found in the orchid-flora of our own country. He would be greatly daring who would offer an explanation of all the extraordinary pollinary mechanisms one finds in this order, though hundreds are patent to those who will spare a little time to meditate on such wonders.

In the orchids, from the humblest forest flower to the queen of the hot-house, one finds some of the most highly specialised devices in the whole of the vegetable kingdom. In most of them one petal (the labellum) has become changed almost out of recognition. All the forces of the plant would seem to have been marshalled in the shaping and adorning, often in extravagant fashion, of this one segment, serving, doubtless, to make it an object of interest to the special insect concerned with the pollination of the flower.

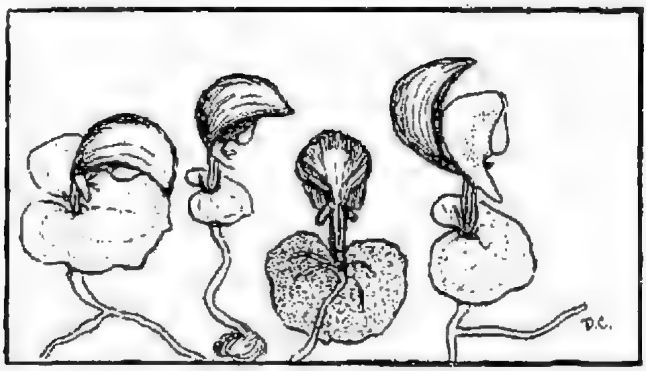


Fig. 1.

Corysanthes bicalcarata (natural size).

Having attracted, with this startling signal, its insect-agent, other segments of the flower are brought into action and play their several parts in delaying him until he has fulfilled the mission for which he was invited. On the labellum (his landing stage) he may find gay lines or ridges, so arranged, one supposes, that they lead him to the true flower—the reproductive parts, where his services are required. Frequently sepals and petals close him in, making his escape no easy matter. In his effort to find an exit he is practically certain to remove part, if not all, of the pollen masses. These he may deposit on a receptive stigma in the next orchid flower he visits

In almost all orchids one finds the sexes (stamens and stigmas) welded together in one structure—the column. Usually the stigma lies below, the pollen housed directly above it, with only a kind of shelf or platform separating them. In many orchids this "roof" does not effectively protect the stigma from the pollen so near at hand, and these are habitually self-fertilised. Even in orchids so planned one may find clever contrivances to secure an occasional cross, for, as Darwin believed, Nature would seem to abhor perpetual self-fertilisation. Darwin held that all orchids were once cross-pollinated, and that those species which are now self-fertile, may one day revert to their pristine habit. Since his day it has been fully demonstrated, in Europe, America, and Australia, that plants once thought to be self-fertile, are more or less frequently pollinated by the intervention of insects.

In many orchids, where the sexes are produced in juxtaposition they may mature at different periods, and a number of Australian orchids are so planned. In Darwin's work on this fascinating subject he describes the remarkable pollinary mechanism in two species of large-flowered Helmet-orchids. (*Corysanthes*). In these orchids the labellum takes the shape of a bucket, which is filled by drops of liquid, secreted by two strange appendages above. Bees, fighting for places on the smooth surface of the bucket fall into the liquid. In crawling through the only exit, a narrow overflow spout, they cannot fail to brush against the reproductive organs, thus effectively pollinating the flowers.

We have in Australia seven species of *Corysanthes*, lowly members of this famous genus. Five of them are well distributed throughout Victoria. A sixth has been doubtfully recorded. From early April to November, one or other of the interesting Helmet-orchids may be found. (The word *Corysanthes* means helmet-flower.) So small they are that until one has learned something of their habitat preferences, one is apt to pass them by. The whole plant would little more than cover a half-crown piece, yet the flowers rank among the highest developments in the plant world. One must seek them under cover of decaying leaves and twigs, or other rotting vegetation, on fallen logs or the trunks of tree-ferns, in dark gullies, half-hidden, perhaps, in moss. The small reddish, or prune-coloured flowers, each with a single, flat, roundish leaf, somewhat resemble slugs or snails. Except for the green leaves, they might be mistaken for colonies of small fungi.

In many orchids there is, relatively, not a great difference in the size of the segments, but in the Helmet-orchids the top sepal and the labellum have been developed out of all proportion to the rest of the diminutive flower, the former taking the shape of a protecting hood (or helmet), while the labellum broadens out into an extraordinary trumpet-shaped segment, completely enveloping the

reproductive parts. The rest of the petals and sepals are almost rudimentary, often barely visible. One can hardly credit that, in bygone ages, the ancestors of this remarkable orchid were flowers of simple structure. In *Corysanthes* the whole work of attracting and entertaining insect-visitors is thrown on the labellum, so marvellously adapted for the purpose. It has become advertising-agent and traffic-director in one. Humble as is the small flower, it receives, as I hope to show, its share of insect attention. There is the same wise precaution for the protection of the pollen that one notes in all flowers in which only a small quantity is produced.

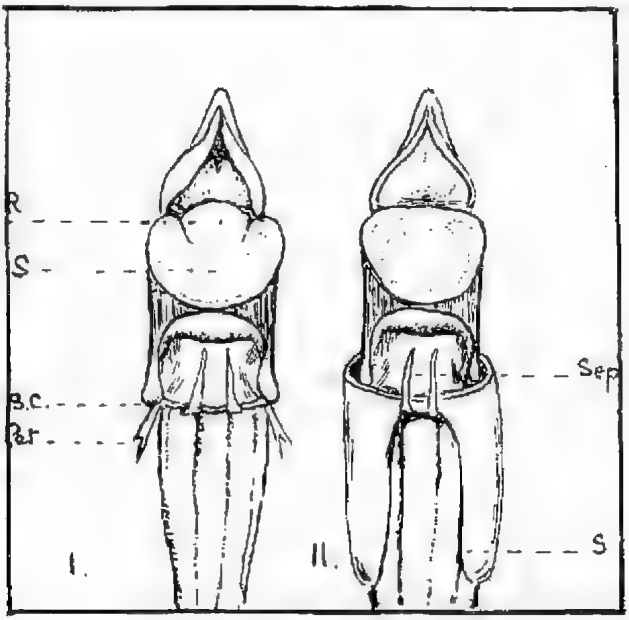


Fig. 2.
Corysanthes bicalcarata R.Br. (greatly enlarged).

Housed within the strange labellum is the usual orchid-column with the male and female parts fused into one structure. Above is the anther, a translucent, pearly arch through which can be seen the pale-golden pollen. Below is the glistening cup-shaped stigma, its upper part projecting into a sloping roof (the rostellum), supporting the pollen-masses, yet averting an undesired self-pollination by preventing their falling into the sticky cup. And thus, without the aid of an insect, would the sexes remain, almost in union, yet poles asunder, the flower to wither unfertilised. But, very occasionally, at the propitious moment, an insect-visitor

arrives and bears away the precious masses to the sticky cup of another orchid-flower, leaving here a portion of the pollen he purloined from his last host.

I say very occasionally, for, having, this season, spent two weeks within easy access to large colonies of *Corysanthes bicalcarata*, I have had an exceptional opportunity of making observations on this species. I was able to ascertain that in 50% of the flowers the pollen-masses had been removed cleanly and entirely, but in less than one per cent. was pollen found on a stigma. In other words, the species continues to flourish with the fertilisation of less than one flower in a hundred to ensure a supply of seed in case there should be a temporary failure of vegetative growth, or to secure the benefit of an occasional cross.

Fitzgerald believed *Corysanthes* to be self fertilised with the aid of insects; but, as I found its own pollinia intact in almost every fertilised flower I noted, I think a definite, though very occasional cross, is obvious. Moreover, cross-pollination is suggested by the large numbers of intermediate forms in the various species, notably those in which we find a very great similarity in the reproductive-parts, *i.e.*, *C. fimbriata, C. diemenica, C. dilatata, and C. pruinosa*. One notes also a general infertility which one does not usually associate with self-fertilised flowers.

The pollinia, attached to a large gland, rest on the posterior surface of the flat, semi-circular, translucent rostellum. In very young flowers the apex of the dorsal-sepal lies flat against the tube, effectively blocking the opening. Even in slightly older flowers, from which pollinia had been neatly withdrawn, the narrow opening would preclude the insertion of pollen en masse. I have seen but one insect associated with the flowers. This has not yet been identified. The attraction to insects appears to lie in the column of the orchid which, just below the stigma, swells out into a fleshy protuberance. A transverse section shows this to be full of liquid, which oozes out at a needle puncture.

Few capsules are formed, but precaution is taken to ensure the dispersal of the seeds to the best advantage. In gullies where large colonies are sometimes found on tree-ferns and other trees, the scape frequently elongates up to 12 inches or more. Thus, sway it ever so gently, as the capsule dehisces, the seeds, fine as dust, are cast forth, some to fall to the ground, others to float like powder in the air until wafted in the direction of another moist tree-trunk, there to adhere, a small percentage to germinate and form the nucleus of a new colony.

The more closely one studies the orchids, the more convinced one becomes that a life-time would not exhaust the wonders of the various mechanisms by which their pollination is effected. Some are so perfect in their action that, even though one may not go so far as to claim a deliberate purposefulness in the evolution

of the complicated adaptations, there are times when one asks oneself whether the assumption that plants have no volition may be altogether warranted. It is a fascinating subject and should appeal to every nature-lover who takes delight in quiet moments spent among the flowers.

In the illustration (Fig. 1) are typical specimens of *C. bicalcarata*, showing (left to right) variability in size of leaf, a posterior view of a flower (and spurs) and a side view, with the dorsal sepal moved back to show the tubular labellum and one spur.

Enlarged drawings of the column (Fig. 2) show:—

1. Pollinia intact. Rostellum, petals and sepals, spurs of the column and fleshy excrescence below the stigma.
2. Pollinia withdrawn. Spurs of labellum not removed. Sepals only shown—petals not visible.

A NEW SPECIES OF THE FORAMINIFERA.

Cassidulinoides chapmani.

By WALTER J. PARR, F.R.M.S.

During an excursion of the Field Naturalists' Club to Torquay, in January, 1923, the writer collected a number of samples of marl from the cliffs between Bird Rock and Point Addis. One of these, from Rocky Point, has proved to be rich in a new species of foraminifera, belonging to the genus *Cassidulinoides*. The same form has since occurred in the recent condition in shore sand from Point Lonsdale, Vic., and in a dredging made by Sir Douglas Mawson off the coast of Tasmania, in 1320 fms., but as it is rare at both these localities, the description of it here given is based on the abundant material from Rocky Point.

Test elongate, compressed, the early portion closely coiled, the later chambers usually forming a slightly curved, sometimes straight, biserial series, which, in adult specimens, may occupy three-quarters of the length of the shell; early chambers indistinct, those in the rectilinear portion broad and high, not inflated; sutures fairly distinct, but not depressed; wall calcareous, smooth and finely perforate; aperture sub-circular, situated in the depressed centre of the oblique apertural face.

Length up to 0.32 mm.

Holotype (Parr Coll.) from Miocene, soapy clay bed below echinoid band, Rocky Point, Torquay, Vic.

C. chapmani occurs sparingly in other tertiary deposits in Victoria, and was recorded by Heron-Allen and Earland (*Journ. Roy. Micr. Soc.*, 1924, p. 146), from the Miocene of Batesford, under the name of *Cassidulina parkeriana* Brady. It differs from that species, as Heron-Allen and Earland observed, in its smooth and regular outline, the flush and hardly-discernible sutures, and the absence of inflation in the individual chambers. Another related

form is *C. bradyi*, var. *attenuata* (Chapman), described (*Journ. Linn. Soc.*, London, Zool., Vol. XXX, 1910, p. 406, pl. liv., fig. 4) from off Funafuti, 2400 fms. This is proportionately longer,

Cassidulinoides chapmani, sp. nov. Holotype from Miocene, Rocky Point, Torquay, Vic. *a*, front view; *b*, back view; *c*, side view. X 74.

and has oblique sutures. The specific name of the new species is given in honour of the leader of the excursion, Mr. Frederick Chapman, A.L.S., under whose guidance the type material was collected.

THE LATE MR. A. E. RODDA.

A heavy blow has fallen upon the Field Naturalists' Club of Victoria by the almost sudden death on August 16 of its esteemed honorary secretary, Mr. Arnold E. Rodda. Mr. Rodda, as mentioned elsewhere, filled the breach when the late Mr. L. L. Hodgson was taken ill, and continued most successfully until he himself was compelled to take a rest from his office-work, in the Mines Department, at the beginning of August. He was well versed in Natural History matters, and, from his departmental duties, had a good general knowledge of the features and characteristics of the State. He was, perhaps, too unassuming in his manner, and thus was not so well known to members of the Club as he deserved to be.

After acting as substitute for the late Mr. Hodgson during the latter part of his term of office, Mr. Rodda was elected hon. secretary in June, 1929, and had been re-elected yearly since. He acted as leader of many excursions, even so late as the visit to the Daylesford district at Easter. He had also done good work at the various exhibitions held during his term of office, and especially at the jubilee functions last year. He was elected a member of the Club in November, 1921, and had contributed three useful articles to *The Naturalist*, viz., "A Naturalist at Bethanga," vol. 42, p. 164; "Around Yan Yean," vol. 43, p. 184; and "Walhalla Revisited," vol. 47, p. 87.

The Victorian Naturalist

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THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary monthly meeting of the Club was held in the Royal Society's Hall on Monday, 14th September, 1931. The President, Mr. J. A. Kershaw, C.M.Z.S., occupied the chair, and about 110 members and visitors were present.

DEATHS OF MEMBERS.

The President expressed the great sorrow of the committee in the untimely death of the late Secretary, Mr. A. E. Rodda. The Club had also lost, during the month, two old and respected members, Mr. J. M. Templeton of Melbourne, and Mr. Joseph Hill, of Stawell.

CORRESPONDENCE.

Mrs. L. L. Hodgson, expressed her wish to obtain from some member a photograph of her late husband for enlarging.

The Boy Scouts' Association declined to confine their planting to Australian vegetation. They would welcome the assistance of naturalists in preparing boys for efficiency badges.

EXCURSION REPORTS.

The following excursions were reported: August 22—Mitcham—Mr. Barnard; August 29—Sandringham—Mr. Hyam; September 5—Heidelberg—Mr J Strickland.

GENERAL BUSINESS.

To fill the vacant office of Secretary, Mr. Coghill and Mr. Miller nominated Mr. A. J. Swaby There being only one nomination for Secretary, Mr. Swaby and Mr. Miller nominated Mr. F. S. Colliver as Assistant Hon. Secretary and Librarian, in place of Mr. Swaby.

The President, Mr. Pescott (Director) and Mr. Miller announced details for the Wild Nature Show. Mr. Barrett called for information on special exhibits for publicity purposes.

Mr. Gabriel asked for special attention to be given to a display of protected plants, so that the public might know them.

An announcement was made of two special meetings in September of the Royal Australasian Ornithologists Union, to which members were cordially invited.

The President reminded members of Mr. C. French Senr.'s 92nd birthday and moved that congratulations be extended. This was carried with enthusiasm.

LECTURE.

The "paper" for the evening was given by Dr. C. S. Sutton—a lecturette on "The Flora of Cradle Mountain, Tasmania". The lecturer dealt with the general physiography and the characteristic vegetation. Excellent lantern slides were used in illustration.

EXHIBITS.

Miss Bolton.—*Tecoma australis* (Wonga vine), garden-grown.

Miss F. Smith.—*Clathrina repitora* (Coral lichen); *Grevillea alpina* (Mountain Grevillia) and *Conospermum Mitchellii* (Mountain conosperm); all from Grampians.

Mr. F. G. A. Barnard.—Galls on *Acacia Baileyana*.

Mrs. C. Barrett. Orchids grown under glass at her home in Elsternwick—*Dendrobium tetragonum* (two forms), *D. gracilicaule* and *D. acmulum*.

Mr. F. S. Colliver.—A series of Cypraea from tertiary localities, viz.:—Balcombe Bay—*Cypraea platyrhyncha, C. contusa, C. murrayana;* Muddy Creek—*C. gigas, C. eximia, C. platypyga, C. brachypyga, C. subpyritilata, Trivia avellanoides;* Table Cape—*Cypraea* sp.; Waurn Ponds—*C. platypyga;* Beaumaris—*Trivia* sp. (Balcombian), *Cypraea* sp.; Royal Park—*Cypraea* sp.

Mr. Chas. Daley.—Home-grown specimens of *Calytrix Sullivani, C. tetragona, Chorizema cordata, Brachysema lanceolata, Grevillea rosmarinifolia, Tetratheca ciliata, Thryptomene calycina, Micromyrtus ciliatus, Prostanthera rotundifolia, Lhotzkya alpestris*.

Mr. T. S. Hart.—The two Victorian species of *Isopogon* for comparison—*I. ceratophyllus* (Sandringham), and *I. anemonifolius* (Fernbank, sandy country, west of Bairnsdale).

Mr. W. H. Nicholls.—*Peterostylis curta*, pot-grown, under glass—nine plants from the original two, four years old.

Mr. L. R. Williams.—Large fossil bivalve, species unknown, from Little Swanport, east coast, Tasmania; photograph of shells in a kitchen midden—same locality.

The late Mr. A. E. Rodda's bound copies of *The Naturalist* are for sale. Mr. V. H. Miller, of 10 Lambeth Place, St. Kilda, S.2, has charge of them, for the Rev. C. T. Rodda.

Plate II.

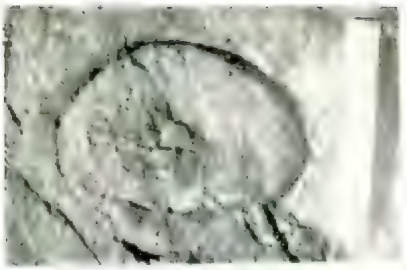


Fig 3.

Fig 2.

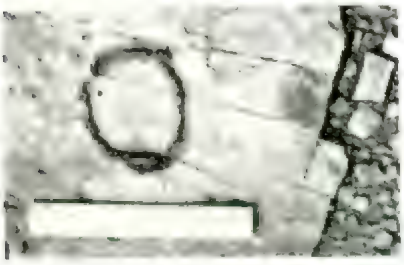


Fig 1

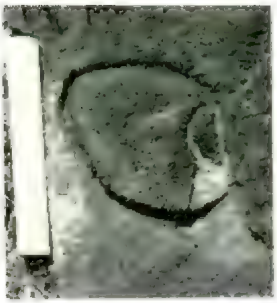


Fig 6

Fig 5.

Rock Carvings at Mersey Bluff, Tasmania

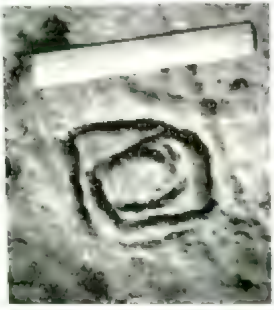


Fig 4

ROCK CARVINGS IN TASMANIA.

By A. L. MESTON, M.A.

Many descriptions have been given of aboriginal art in various parts of Australia, but accounts of paintings and carvings by primitive peoples in Tasmania are meagre. Peron, who visited this island in 1802, described some crudely-marked characters on bark; Bonwick gives some rude drawings, as seen by Mr. Commissary Browne; and Calder describes a few charcoal drawings; but they make no mention of rock carvings. Some fifteen years ago, however, the late Mr. Foster Leek discovered in the vicinity of Devonport a few rock carvings which he showed to Mr. H. Stuart Dove, who, in a brief note to *The Australasian* in 1923, drew attention to their existence. But no exhaustive search was made, and it was only within past few years that the majority of the figures described in this article were discovered.

Where the Mersey runs into Bass Strait, the western shore is prolonged into a rocky headland known as the Bluff. This promontory, very low where it joins the mainland, extends seawards for upwards of 600 yards, and runs up to a height of 74 feet at the northern end. The remains of an extensive midden in the south-west corner give ample evidence of aboriginal occupation.

Until quite recent years the place remained very much as it was when the natives frequented it. A sandbank covered with booby-allas afforded shelter from all winds: behind it lay a fresh-water lagoon, fringed with tea-trees, and in front a bank of shingle provided suitable material for stone implements. The abundance of water, the warmth of the situation, and an abundant food supply marked this spot as a favourite resort of the aborigines.

The rock forming the Bluff is diabase, and it is in this hard material that the carvings are made. All are cut on horizontal faces of rock, and are distributed over the whole area of the promontory. But although I have made a careful search of the north coast, from West Head to Cape Grim, I have found none elsewhere. The individual carvings are not of uniform depth, and they would seem to have been made, not by rubbing, but by a pointed piece of quartzite, breccia, or similar hard material driven by a stone hammer. A remarkable feature of the carvings is that the artists have not made use of the natural cracks in the rock. An examination of the plates will show how, in all the carvings, the cracks run transverse to the designs.

That there should be so many carvings in so small an area is not at all surprising when we learn of primitive carvings elsewhere. At Salt Creek, in South Australia, for example, in a valley about two and a half miles long, there are thousands of designs, and the late Clarence Bicknell examined and took rubbings of 15,000

on Monte Bego, in the Italian Alps. It would be idle to conjecture the age of the designs, but the extent to which weathering has spoiled some and made others dim points to a great age. Many on the seaward face of the headland, deluged with spray every storm, are rapidly weathering, and since I first saw them, in February, 1929, five have, by the flaking of the rock surface, completely disappeared. The manner in which weathering is destroying them may be seen from figures 1 and 6. In the former the crumbling of the rock from the edge is plainly seen, and in the latter flaking is destroying the outline of the carving. Both these carvings are deep, the circle shown in figure 1 varying from 16 to 21 millimetres. Figure 6, depicting a large oval with a smaller one set within it, and in part resting on the circumference of the larger, is a common form.

While it is impossible to say definitely what the carvings represent, that shown as figure 2 seems to represent a haliotis shell, the haliotis being an important article of food for the natives, and plentiful in this locality. The size of the design may be judged from the pocket-knife lying near the top margin; the six-inch rule provides a comparison for the others. This is the largest and deepest of the carvings, being 22 inches wide, 23 inches long, and reaching a maximum depth of just over two inches. Figure 4 is a very fair representation of a coiled snake. Figure 3 is the only carving of the familiar cup and ring type, which Mr. C. P. Mountford records as being found carved in quartzite, a harder material than diabase, on the bank of the Rocky River, South Australia. Figure 5 is a deep carving, reaching in its deepest part a depth of over an inch. Figure 7 depicts well-executed concentric circles. Figure 8 seems to be a conventionalised fish and, if so, would no doubt have some reference to a totem, for the Tasmanian aboriginal ate no fish but shellfish. Figure 9 contains markings similar to the lines tatooed on the bodies of the male aboriginal, and figure 12 has a salient which is characteristic of many of the carvings.

In getting photographs, the chief difficulty was to prevent distortion. This was eventually overcome by using an optipod, which enabled the camera to be focussed directly above the figures. Several when first seen were deeply encrusted with lichens, the haliotis shell was almost entirely covered with soil, while others stood stark to the elements.

That the carvings exist at the Bluff, and, to the best of our knowledge, nowhere else, is remarkable; but a possible explanation is that either this area was sacred or was a place of assembly and consultation. J. E. Calder describes a meeting-place and a ceremonial tree west of the Tamar, only some thirty miles away, and it seems that the Bluff was in some such way of grave importance to the aborigines.

Fig 7.

Fig 8.

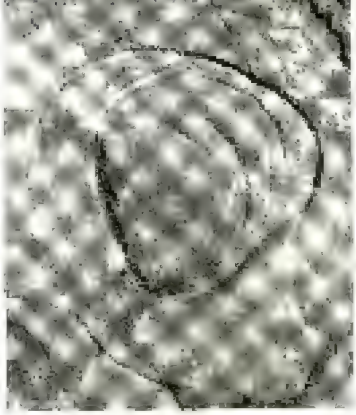


Fig 9.

Fig 10

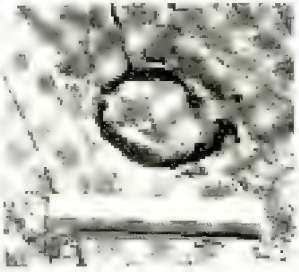


Fig 11.

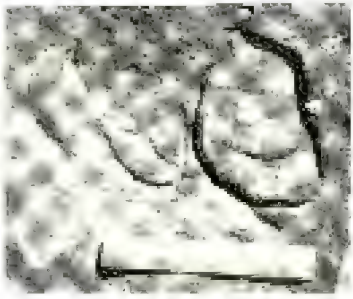


Fig 12.

Rock Carvings at Mersey Bluff, Tasmania

A REVISION OF CERTAIN SPECIES OF THE GENUS *PRASOPHYLLUM* R. Br.

(Including the Description of a New Species.)

By W. H. NICHOLLS.

This review, restricted to a few forms only, has been undertaken in the knowledge that the determination of certain species of this interesting genus is uncertain. This state of affairs has existed since the time of Bentham, as, in *Flora Australiensis* (Vol. VI), he records J. Hooker's *Pr. Archeri* and C. Stuart's *Pr. intricatum* as distinct species. Moreover, he incorrectly interprets Hooker's plant, and this error is repeated in every publication up to the present time (1931), with but one exception (in part), concerned with the botany of Southern Australia. The exception is Ferdernand von Mueller's *Key to the System of Victorian Plants* (1887-8). Herein the Baron, though interpreting Hooker's plant correctly, includes, like other authors, *Pr. intricatum* also.

With the exception of Dr. R. S. Rogers' very informative contributions in the *Proc. Roy. Soc. of South Australia* (1909-20), no important addition to our knowledge of these small plants has been published. I hope that the present paper, concerned for the most part with the differentiating of a few of the tiny Prasophylls, may increase the interest taken in a puzzling and, therefore, fascinating family. In all the plants under review the column has bifid appendages, and the outer lobes are more or less ciliate.

Curiously enough, Hooker's description has been almost completely ignored by all subsequent workers (as stated above). It is as follows:—"*Pr. Archeri* (Hooker fil.). Scapo gracillimo apicem versus bractea longe acuminata instructo; spica brevi pauciflora; floribus horizontalibus flavo-rubris, sepalis lateralibus basi connatis dorsali late ovato acuminato longioribus; petalis ovato-lanceolatis acuminatis; labello unguiculato marginibus fimbriato-laceris; lamella adnata simplici crassa definita, staminodiis bilobis, lobo anteriore subulato fimbriato carnosulo posteriore breviore truncato membranaceo; anthera rostro elongato."

The description of *Pr. intricatum* was published in Bentham's *Flora Australiensis*, Vol. VI, p. 346 (1873). It is evidently from a manuscript. From this description a few particulars only are quoted:—"*Pr. intricatum* (C. Stuart in Herb. F. Muell.): plant slender. . . habit, etc., of *Pr. fimbriatum*. . . Flowers brown or pale yellow . . . labellum purple . . . broadly-obovate, convex, recurved, fringed with shorter cilia than in *Pr. fimbriatum*."

The above description does not differ in any important particular from that given by Hooker for his *Pr. Archeri*. The plant described as *Pr. intricatum* by Stuart is well known throughout

Victoria, South Australia, and New South Wales. It is widely distributed, and like all such plants, varies considerably; but it is interesting to record that even its extreme limits in form and colour have been found in specimens from the same district. Both Hooker and Stuart might, perhaps, have been a little more generous with details. Hooker, in his description of *Pr. Archeri*, does not indicate the shape of the labellum; his reference to the labellum margins as *"marginibus fimbriato-laceris"* does not agree with his drawing—a misrepresentation due probably to the artist. Stuart gives a wrong impression when he describes his plant (*Pr. intricatum*) as "with the habit of *Pr. fimbriatum*" The orchid he describes invariably has an abbreviated (squat) spike of flowers, whereas R. Brown's *Pr. fimbriatum* has a long and comparatively loose spike of blooms.

It may always be interesting to speculate why Bentham (in his description of *Pr. Archeri*) came to describe the dorsal sepal and lateral petals as having cilia on the margins. The localities he quotes are: Cheshunt, *Archer;* Oyster Cove, *Milligan.* (No other data given.) But even if his specimens did hail from the island State, it does not alter the fact that his plant is distinct from the one described and figured by Hooker.

In a typical specimen of the form which Bentham calls *Pr. Archeri*, we have a comparatively long spike of deep purplish-black, or prune coloured, much fimbriated flowers, *i.e.*, the margins of the labella; the dorsal sepals and lateral petals are clothed with long fimbriæ. This plant is well known to Victorian collectors. It is also interesting to note that Hooker's reference to the colour of the flowers of *Pr. Archeri* corresponds with that given in Stuart's description of *Pr. intricatum.*

Mr. L. Rodway, the veteran botanist of Tasmania, in his *Tasmanian Flora,* 1903 (p. 194), also records both *Pr. Archeri* and *Pr. intricatum.* His descriptions agree (the localities also) with those given by Bentham. At the foot of the description of *Pr. intricatum* Bentham remarks: "The analytical details given as those of *Pr. nudum*[1] (see Hooker's *Fl. Tasm.*, II, t 113) appear to me to have been drawn from a flower of the present *Pr. intricatum;* but I have not met with any specimen from which it can have been taken."

The details referred to by Bentham are, roughly, in keeping with the stout form of the plant described as *Pr. intricatum;* but the labellum seems to be relatively smaller and broader. The figure of the loose spike of flowers (description gives it as from 11 to 30) is not in keeping with Stuart's plant.

Mr. Rodway, in answer to my enquiry regarding the whereabouts of the type specimens of *Pr. Archeri* and *Pr. intricatum,*

(1) Hooker considers his *Pr. nudum* a near relation of his *Pr. Archeri*—yet distinct.

wrote: "The Tasmanian collection (that is Gunn's collection) is now in the National Herbarium of New South Wales." Mr. Edwin Cheel, curator of the Herbarium (through the courtesy of Dr. Darnell Smith, Director of the Sydney Botanic Gardens), writes as follows:—"I find that we have in our collection three specimens collected in Tasmania (without specific locality being stated) by W. H. Archer. Hooker (*Fl. Tas.*, II, 14) gives Cheshunt as the locality, and I have no doubt that the three specimens are those examined and described by Hooker. We have also a solitary specimen from Tasmania (without specific locality), collected by Mr. L. Rodway in 1897."

The above-mentioned specimens (in perfect condition) were subjected to a most careful and minute examination. I find all identical, and agreeing in *every* particular with Hooker's description of *Pr. Archeri*. This definitely proves my contention that Hooker's *Prasophyllum Archeri* and Stuart's *Prasophyllum intricatum* are one and the same species, and that what we Victorians have been calling *Archeri* has to be renamed. A specimen (well preserved) labelled "*Pr. Archeri, W. H. Archer Coll.*" appears to be the identical one figured by Hooker, at least, it agrees perfectly.

The *Prasophyllum*, which Victorian botanists have been calling *Pr. Archeri* for so long, and which was described as such by Bentham, is described by J. H. Maiden and E. Betche as a variety of R. Brown's *Pr. fimbriatum* (see *Proc. Linn. Soc., N.S.W.*, Vol. XXXIV, 1909). It was collected at Charley's Forest, near Braidwood (N.S.W.), by L. Boorman, in March, 1909. Concerning this plant (which was not named), the following remarks appear:—"We drew up the above description from fresh specimens, under the impression that we were describing a new species; but we found out later that we cannot point out any essential difference from Bentham's description of *Pr. fimbriatum*...the description agrees fairly well for both forms...the two plants cannot be identical."

Bentham, in his description of *Pr. fimbriatum*, does not credit this species with having cilia on the margins of the lateral petals. Maiden and Betche, in their description of the Braidwood plant, also omit this important detail. (Mr. Cheel also forwarded this specimen.) I find marginal cilia present on the petals. Fitzgerald's drawings of *Pr. fimbriatum*, in his *Australian Orchids*, can be taken as a faithful representation of R. Brown's plant. The type specimens of *Pr. fimbriatum* were collected at Port Jackson (N.S.W.). W. Woolls, in his *Flora of Australia* (1867), records 45 species of orchids (including *Pr. fimbriatum*) from the Parramatta district (adjacent to Port Jackson), all of which, with but one exception, are described by R. Brown in his *Prodromus*.

Braidwood, the only locality in New South Wales from which the "dark-flowered form" has been recorded, is a considerable distance south from Sydney, and within the vicinity of 40 miles east of what is now Federal Capital Territory. It seems certain that, as Fitzgerald's drawings represent a form fairly common in New South Wales, more especially close to Sydney, this form must have come under R. Brown's observation; furthermore, this botanist describes the labellum as "longissime," a term not strictly adapted to that segment in the form herein described as a new species. In my work of sifting the abundant evidence connected with this tangle, I have received great help from Mr. P. F. Morris, of the National Herbarium, whose name I have bestowed upon this dainty little species.

Pr. Morrisii n. sp. *Plant gracillima, circa 9-36 cm. alta; supra medium caulis bractea subulata; inflorescentia spicata, laxiuscula, circa 5 mm.-5·5 cm. longa; flores circa 3-24, parvis, purpureis vel subviridis; sepalum-dorsale ovatum, cucullatum, acuminatum, circa 4-5 mm. longum, 3-4 mm. latum; marginibus fimbriatis; sepalis-lateralibus patentis, oblongo-lanceolatis, concavis, 4·5 mm.-5·5 mm. longus; petalis triangularibus acuminatis, patentis, 4 mm.-4·5 mm. longus; marginibus fimbriatis; labellum unguiculatum, oblongo-ovatum ad basin angustius, apice acutum, recurvum, 4·5 mm.-5 mm. longum, 2 mm.-2·5 mm. latum; marginibus multi-fimriatis; lamina callis duobus carnosis, parallelis, papillosis vel glabris, elevatis; columna brevis, circa 1·5 mm. 2 mm longa; anthera longe, mucronata, lacinae laterales bifidae; marginibus anterioribus ciliatis; stigma anguste ovatum.*

Plant slender, but usually more robust than in *Pr. fimbriatum* R. Br.; 9-36 cm. high; leafless, except for a small subulate bract below the spike; flowers 3-24 (in my specimens), almost wholly very dark purple or prune, or green with purple markings (rarely green with pale rufous markings); spike not very crowded, from 5 mm. to 5·5 cm. long; ovary oblong, recurved, on short pedicels, a minute bract below; lateral sepals united at the base only, oblong-lanceolate, falcate, concave, narrowing to a minute acuminate apex, wide spread, about 4·5-5·5 mm. long; dark purplish, lighter on the concave side, or greenish; dorsal sepal about 4-5 mm. long, 3-4 mm. wide, broadly ovate, cucullate, with a long acuminate point, margins deeply coloured, and beset with purple or purplish-brown hairs; lateral petals triangular, acuminate, deeply hued, except towards the base, fringed as dorsal sepal, about 4 mm.-4·5 mm. long; labellum about 4 5 mm.-5 mm long, by 2mm.-2·5 mm. wide, articulate on a small claw, oblong-ovate, conspicuously narrowing towards the base (in occasional specimens[2] the reverse is the case, and the fore part has a peculiar undulate twist (see Fig. J); apex abruptly acute, recurved, the margins densely fringed

(2) Sometimes every flower to a few flowers only.

with long undulate or bristly purple or purplish brown hairs, those, towards the fore part, sometimes very long (up to 3 mm.); lamina surface towards the tip, entirely smooth (almost black), and raised above the margins in some specimens received from Airey's Inlet (April, 1931); two raised pubescent bands extending to the base; column 1-2 mm. high; appendages acutely bifid, the anterior one longest, acute or acuminate, somewhat densely clothed with minute cilia or a few marginal cilia only; posterior lobe smooth, pale-coloured, obtuse or acuminate; anther with a long point; pollen masses granular, about 1 mm. long; caudicle about half as long; stigma narrowly-ovate, sometimes with a basal development of variable length.

Fl. December to May.

Victorian localities of specimens so far examined:—Springvale-Clayton, Mt. Waverley, Ringwood-Bayswater, Lockwood, Oakleigh-Cheltenham, Cravensville (*A. B. Braine*); Pyrete Ranges (*G. Lyell, Miss E. Bond*); Monbulk (*D. Matthews*); Ballarat North (*W.H.N.*); Airey's Inlet (*Miss M. Sutherland*); Wonderland Range, Grampians (*C. W. D'Alton*).

This species grows in abundance on open grassy flats (very wet in winter), also in lightly-timbered country or dense forest. The finest specimens, however, are seen in mountainous country, often at comparatively high altitudes (up to 3000 feet), where, on sloping rock faces, unsheltered from the sun, and generally with a seepage down the slopes, they attain their maximum development. On the Pyrete Ranges, near Gisborne, the plants grow on dry, rocky ridges; an occasional fruiting plant attains a height of 2 feet 6 inches. The tubers of the largest of several specimens from the Wonderland Range measured 1½ inches in diameter. Often they are much misshapen, owing to contact with rough rock surfaces and the dense network of rootlets of trees and shrubs. The stems of these exceptional plants are wholly dark olive-green, as opposed to the dark-purplish hue of the specimens gathered elsewhere.

[Bentham in *Fl. Aust'nsis.*, Vol. VI; Rodway in *Tasm. Fl.* (1903); E. E. Pescott in *Orch. of Vic.* (1928); Ewart in *Fl. of Vic.* (1931), *Pr. Archeri.*]

Prasophyllum Archeri Hooker fil. The following is a supplemented description of this species, based on the specimens collected from Victorian and other localities, now in my herbarium:

Pr. ciliatum Ewart and Rees (*Proc. Roy. Soc. Vic.*, 1912). Two specimens (labelled Type No. 2000) under the above name in the National Herbarium, Melbourne, were carefully examined. They were collected by "F. M. Reader, 19/6/1910. Loc., Green Valley, County of Talbot (Vic.). Herb., C. W. Sutton." One specimen is marked "acuminate labella," the other "broad labella."

These specimens were softened in the usual way. I cannot point out any character differing from the features of Hooker's *Pr. Archeri*, the slender form of which is not altogether uncommon in inland Victoria (Ararat, Stawell, Everton, Newstead, etc.).

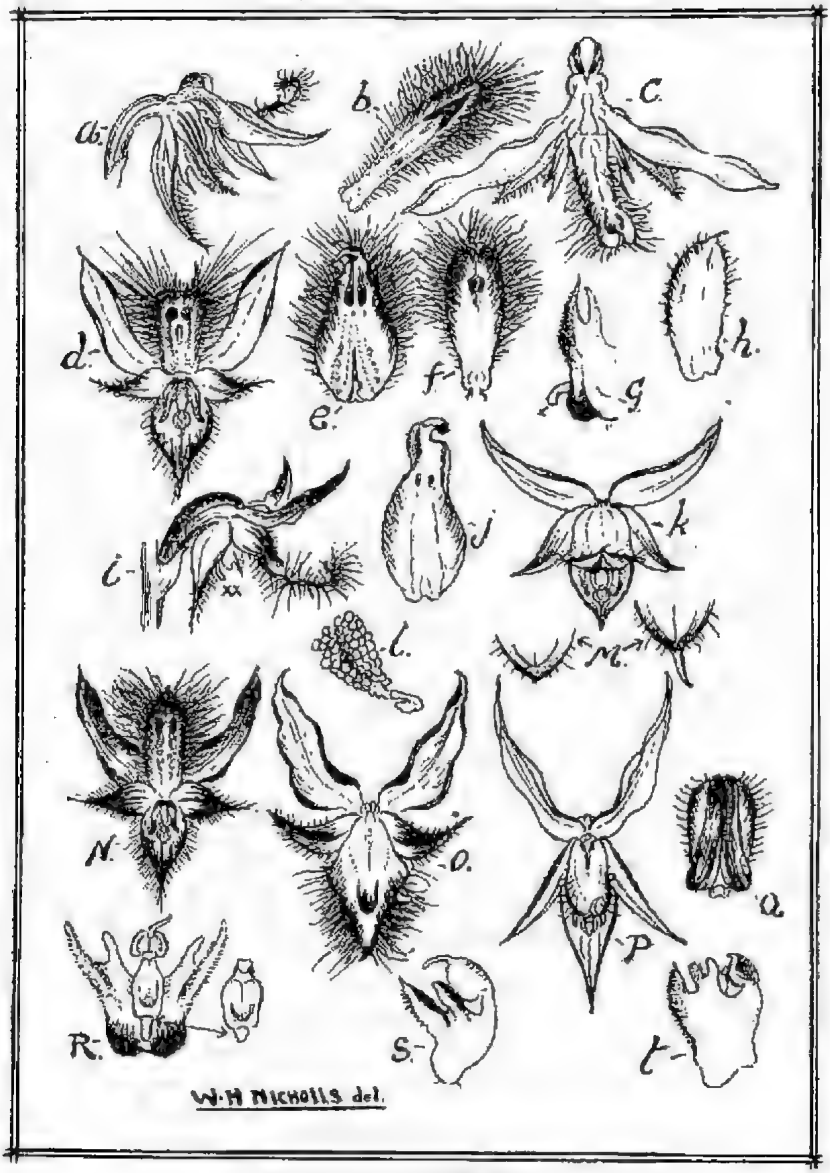
Pr. Archeri Hk. fil (synonyms: *Pr. intricatum* C. Stuart: *Pr. ciliatum* Ewart and Rees). A slender plant from 5-13 cm. high, leafless except for a long subulate bract below the short squat spike of from 2 to 14 flowers; flowers pale yellow or green, with pale brown, red or purplish markings or wholly deep purplish; ovary oblong or ovate, recurved slightly; pedicels very short, with a small very acute bract at base; lateral sepals connate at extreme base (sometimes free), oblong-lanceolate, falcate, somewhat undulate, narrowing to an acute tip; concave towards the front, widely divergent, about 4-7·5 mm. long; petals narrowly-ovate, falcate, wide spread, acuminate, about 4-5·5 mm. long; dorsal sepal broadly-ovate or oblong, deeply cucullate, tip acute or acuminate, about 4-6·5 mm. long; labellum articulate on a short, broad claw, as long as the dorsal sepal; broadly-obovate or oblong, sometimes convex and contracted towards the base; tip acute, or finely acuminate, recurved, often much so, deep purplish or brownish, margins entire or minutely crenulate, anterior margins sparsely and somewhat irregularly fringed with short cilia; the raised callus part and outer margins usually dark-coloured, triangularly divided at base, gradually narrowing upwards to extreme tip, or almost so; anther point very variable, often very long; column appendages bifid; anterior margins of outer lobe fringed with —usually pink—cilia, tip acute; inner lobe glabrous, obtuse, but sometimes divided and marked with cilia; stigma oblong; pollen masses easily detached, granular, very friable, caudicle rather short; base of plant, including tubers, enclosed in a fibrous sheath, remains of old tubers adhering.

Fl. December to June.

Tasmania, Victoria, South Australia, New South Wales. Victorian localities from which specimens have been received.—Ringwood-Bayswater, St. Hallam, Cravensville, Everton, Springvale-Oakleigh-Cheltenham-Black Rock (*A. B. Braine*); Ararat-Stawell (*W. Foster*); Newstead (*H. B. Williamson*); Airey's Inlet (*Miss M. Sutherland*); Foster (*F. Barton, junr.*); Pyrete Ranges (*G. Lyell, W.H.N.*); Frankston (*W.H.N.*); Cobungra (*H. B. Williamson*).[3]

ACKNOWLEDGMENTS.—Besides those already mentioned, thanks are due to the following for material or advice.—Mr. A. B. Braine, of Murrumbeena (Vic.); Dr. R. S. Rogers, of Adelaide (S.A.); the Ven. Archdeacon Atkinson, of Hagley (Tas.); Mr. Charles Barrett (Melb.); the Rev. H. M. R. Rupp, Weston (N.S.W.); D. Matthews (Vic.).

(3) See Note, *Victorian Naturalist*, Vol. XLV, March, 1929, p. 276.



KEY TO FIGURES.

(*Three Species of Prasophyllum* R. Brown.)

a. *Pr. fimbriatum* R. Br.—A flower from side (Port Jackson, N.S.W.).

b. *Pr. fimbriatum* R. Br.—A Labellum (Port Jackson, N.S.W.).

c. *Pr. fimbriatum* R. Br.—A flower from above (Port Jackson, N.S.W.).
d. *Pr. Morrisii* n. sp.—A flower with bristly cilia (Grampians, Vic.—labellum raised).
e. *Pr. Morrisii* n. sp.—A Labellum from front—anterior margins revolute and constricted apex (Pyrete Range, Vic.).
f. *Pr. Morrisii* n. sp.—Labellum from typical specimen, Springvale, Vic.).
g. *Pr. Morrisii* n. sp.—Appendage of column showing protruding appendage at base of stigma (×).
h. *Pr. Archeri* Hk.—Labellum from above (Newstead, Vic.).
i. *Pr. Morrisii* n. sp.—A flower from side, showing appendage of stigma (at ××).
j. *Pr. Morrisii* n. sp.—Labellum (from above); cilia removed to show peculiar anterior twist and revolute margins (Pyrete Range, Vic.). (*Sometimes the labella are quite typical in shape, etc.*)
k. *Pr. Archeri* Hk. (Cheltenham, Vic.).—A flower from front (stout form).
l. Pollinia of *Pr. Morrisii* n. sp.
m. Variations (extreme) in apex of labella, *Pr. Archeri* Hk.
n. *Pr. Morrisii* n. sp.—A flower from front (labellum raised); typical form from Springvale (Vic.).
o. *Pr. Morrisii* n. sp.—A flower from front, showing undulate character of lateral sepals. Labellum somewhat as Fig. *e* (Pyrete Range, Vic.).
p. *Pr. Archeri* Hk. (Ararat, Vic.).—A flower from front (slender form).
q. *Pr. Archeri* Hk.—Labellum from below.
r. *Pr. Morrisii* n. sp.—Column (wings outspread) showing variations in appendage at stigma base.
s. *Pr. Morrisii* n. sp.—Column from side from flower, as Fig. *o*.
t. *Pr. Archeri* Hk.—Column from side, showing abnormal appendage (Cheltenham, Vic.).

Note.—Dr. Rogers, about the year 1910, was doubtful as to the correctness of Bentham's determination of *Pr. Archeri*, for, regarding a specimen (No. 1418, marked *Pr. Archeri*) in the Herb. of Dr. C. S. Sutton, he has made the following remarks:—"Bentham says the petals and dorsal sepal also are fringed in *Pr. Archeri*. Hooker does not show them so. Hooker, in describing the labellum of *Pr. Archeri*, uses the words *marginibus fimbriata-laceris*, which most accurately describes 1418 labellum, though singularly his drawing CXIII does not show it, nor does Bentham refer to it. Both Müeller and Bentham rely for their diagnosis on this (which Hooker calls *a very distinct species*) on such comparatively unimportant matters as a *narrow tip* and *a broad tip*. *I doubt whether they have had Hooker's species before them.*"

IN THE INDO-PACIFIC.

By ROBERT HALL.

There is one richly concentrated area, of which the fish fauna is drawn from both the Indian and Pacific Oceans, and so it has been called the Indo-Pacific. The same nucleus gets from the west its Indo-Malayan land mammals and from the east its Austro-Malayan birds. It stands in the blazing sun, enveloped by no less than nine seas, embedded in this one rich centre between two oceans, and partly land-locked by two continents.

One of these seas has a greater depth than any ocean or any other stretch of water, and over it the China-Australian shipping regularly passes. Thus we have the fascinating groups of islands that Alfred Russell Wallace first so well described to us: the Malay Archipelago. Into it there are four trade gates: one each from the north, west, east and south, and if we wake up our friendly cast of international brains, all nations entering those gates will greatly benefit.

In passing through three of these four gates I got some very interesting, though perhaps superficial, impressions. From a fisheries point of view they were worth while. Starting from India, and arriving in Malayia, the comparisons of the fishes made me feel as if I had not altogether left northern New South Wales, and yet the conditions, *e.g.*, of Ceylon and the Malay Peninsula, were strangely different, without their fish being different. I gathered from the reports of Dr. Pierson and Mr. Malpas that the trawlers in Cingalese and Malay waters get quite different economic results with the same species. In the east they do not mass, they lay their eggs through all the year, while they do mass on the same latitude in the west. Because of the monsoons in southern India, the fish migrate or are nomadic. These fish are mostly the same as we have in southern Queensland, and their northern distribution is up in China as far as Ning Po, which is the divisional line between the southern and northern Chinese fish fauna. At this point there are nearly 6000 fishing boats, upon which the whole families live.

I visited the adjacent fish market in Shanghai one early morning, and saw immense numbers of the Whiptail (*Trichiurus*). This fish in Ceylon waters comes up from the deep to spawn in the shallows, and it is the poor man's food, mixed with rice at that time. Later it goes to the ocean bottom, and looks like one of those weird forms that need big eyes to see its way, assisted by a generator of phosphorescent light. Whether or not it is one of those species that can turn it off and on I do not know.

All up the western coast of India, at the close of the S.W. monsoon, thousands of machiawallas coast for the vast shoals.

Fishing along this coast is still rather primitive, and inferior to the Chinese and Japanese, who fish largely in Malayia. Some day the steam-drifter of 90 feet in winter, and oil-motor of 50 feet in summer, will make their advent with drift nets for the herring and mackerel shoals. At present most of the fishing is done down to 10 fathoms, and in particular good results would show at 20 fathoms along the long line of Bombay Presidency coast. They would catch the ray and the conger, both of which we get as far south as Tasmania, neither of whose people fully appreciate the food value. What the Moslem calls the Indian salmon the Queenslanders call Cooktown salmon, both being wrong. Certainly the flesh is pink, but the dorsal fin is not in the proper place to please the salmonidæ. This fish is mostly blind, and has many sensitive finger threads to guide it, the name being Polynemus.

The most popular fish on the western side of India is the Pomfret (*Stromateus*), as it is numerous in season (post monsoon) and is fine food. Both the black and white species are also known in Queensland. The fish as a whole are well called Indo-Pacific, because most of the edible sea fish of India are also found in Queensland waters, and as far out as the Hawaiian group. The human race extending over this broad area is known as the Malay-Polynesian family, of which the largest pure Malay town in the world is at Brunei, Borneo.

The Moonfish (*Drepane*) is common as far north as Bombay, and is also found as far south in eastern Australia as the dividing geographical line at Great Sandy Island. The largest-sized good edible fish is the genus *Sciena*, which is recorded as far north as Bombay, where I saw plenty. It is the Kingfish of Tasmania and Jewfish of eastern Australia.

The Schnapper (*Pagrus*) was plentiful in Shanghai, but not in Bombay, while it is patchy off Australian reefs and absent in Southern Tasmania. Southern Tasmania is inclined to draw its fish fauna from the Antarctic direction, while north-eastern Tasmania draws its genera from the temperate waters of South-east Australia. The land bridge that was once across Bass Strait, though it has been away some 30,000 years, has left its impression on the ways of animals, both land and water.

Sharks, apparently, are everywhere, but one might safely say in no greater abundance than on the western coast islands of Malay Peninsula and Southern Burma. It is a congestion, and we could there safely conduct a farm or business in leather, oil, glue, canned fish and patent medicines, all from the shark. I saw plenty of our northern Whiting under at least four languages. About Ceylon I saw northward a long-bodied Herring species, that would be the "Bombay Duck," or Harpodon. I gather from Heffer's report that it is so soft-bodied as to be no good when taken from the trawl. It is not an Australian genus, and probably not Malayan,

but as dried and salted it is the favourite staple food of the Bombay coastal people during the three months following the S.W. monsoon.

Ceylon, in its comparison with Malayia, has a fresh-water Sardine (*Ehirava*) and several species of air-breathers. In its estuaries are numberless young of at least four species of the Herring family, all the genera of which we know in Australia.

The Government of Ceylon now controls whale fishing in its own waters, whatever that may mean; and it is said by Norwegians that the prospects of a whaling industry are promising. This was said before the present year.

I found the pearl-oyster rather puzzling in Ceylon and Japan. The first matures in four years at latest and the second about eight years, according to the owner of the pearl-oyster farm. The climates may be the reason, and while the tropics may give low-value pearls the temperate waters do supply pearls up to £11,000 in value. In Ceylon water there is at least one bed of 19,000,000 oysters, which cannot be fished. It will be a good "game reserve" or sanctuary or ocean-forest conservation. Each 3¼ years, according to Mr. Malpus, the greater part, 63 per cent., will die out. The spat will serve the purpose of the submarine parks.*

With regard to fisheries in our Malay-Javanese-Australian waters, both Bleeker and Day long ago recorded a large list of species, but of their economy in spawning, grouping, distribution, feeding and migration there appears little recorded. The Straits Settlements or Southern Siam, as well as the Java Sea (by arrangement), with a large junk costing £1500, a drift net £250, and a crew of seventeen, offer fine opportunities, just as well as Eastern Australia and Tasmania. Mr. Birtwistle, the controlling officer of the Singapore Fisheries Department, tells me the bacteria destroy the nets in two years. Drift nets are largely used with sardines and mackerel, but the why of bacteria and their action on muddy bottoms in Bombay, Ceylon, and scantily in Malayia, is rather a puzzle.

The Chinese in Malayia cannot get nearly enough sardines for export to China. The demand is great. The deep-water Prionurus is common in Ceylon and Queensland, but apparently absent in Malayia. Fishery research in tropic seas is in its infancy.

Twenty miles south of Hong Kong there is a fleet of over 4000 fishing boats, and Hong Kong has its teeming, slithering market, with a veritable crush of man and fish in every part of it. Manila and Batavia each has an interesting aquarium.

Along the Great Barrier Reef, for 1200 miles, the wind was quiet, early January, and the sea most interesting. Some day it will be a system of water-farms. The cheap power will be got

*At Thursday Island an experiment is being made with the pearl oyster in beds. Oysters are said to freeze well, and to can well, if heated to a certain degree.

from its own shelf some 30 miles off shore by using its top heat, 26 degrees C., with its bottom cold —6 degrees C. It is a thermal treasure "to give 50 h.p. at thirty times less cost than solar energy." The fringe of this reef is the edge of an immense ocean of untapped energy, and will mean the creation of huge industries. Turtle farms are growing, and laws to protect, *e.g.*, the trochus and the sea cow, would be advisable, so I gathered.

This great fringing reef encloses 80,000 square miles of what is mostly an unruffled inland sea, the northern third of which is very rarely disturbed by hurricanes. It is where we may breed as equally good products as dry-land cattle, land vegetables and small delicacies. The abundant red mangrove will preserve the foods and tan the nets to catch it. The waste of food at present to get the by-products is a bad example of how to begin to do things, and should be discouraged.

Australia, and in particular Queensland, has a great prospective water-farming asset in this area, and it is high time that our people elected economic and scientific Parliaments, who would study the floating meadows of the sea in relation to our own economy.

EXCURSION TO SHERBROOKE.

A party of 34 Club members and friends visited Sherbrooke on August 8. Travelling via Belgrave and the steep track to the Falls, the party had lunch at the Kiosk. From this centre we divided into three parties to search for birds in different directions. All succeeded in both hearing and seeing some Lyrebirds. One party watched one singing and playing at a dancing mound for 15 minutes; while others heard a particularly fine recital of the magpie's sunrise warbling from a mimic they were observing. During our ramble a wallaby was sighted; it sat on a log for five minutes, under observation by the whole party.

In general the Lyrebirds were quiet, not calling so much as they frequently do. They seem to be growing tamer, as larger numbers of people follow and observe them, and are not deserting their feeding grounds of the last decade, although these are so well trodden now in many places by human intruders.

While there are no concrete indications of interference, one cannot help thinking that there are fewer Lyrebirds in the vicinity of the Falls than there were five years ago, and that there are many fewer in the whole Sherbrooke Forest. The food quest does not seem sufficient cause of a possible wider dispersal, nor does observation of the last year or two indicate that this has taken place. It would appear, then, that either the natural increase has fallen below the death rate (for which no explanation can be offered) or that live birds, or eggs, have been taken in recent years from this sanctuary.

A.G.H.

THE COLOUR OF GUM FLOWERS.

By W. RUSSELL GRIMWADE.

The colour of the stamens of the flowers of the various species of *Eucalyptus*, while being one of the most conspicuous features from the layman's point of view, receives but little attention from the scientific investigator. It has been accepted generally by botanists that the colour of the flower of any plant is one of its most changeable and variable features, and this impression is confirmed by a study of the genus *Eucalyptus*. Horticulturalists especially prize the coloured blooms, and, taken in conjunction with a prominence of inflorescence, it is to be expected that for garden purposes such species as *E. ficifolia* would be given first choice.

The great majority of the species show flowers of a white or cream colour in the filaments, and white is probably accepted as the prevailing colour in the genus. In many cases the cream becomes of greenish hue, and passes to undeniable green as a fixed feature in such species as *E. cornuta, platypus, Lehmanni*. In a few cases the green gives place to yellow hues, which find by far their highest expression in *E. Preissiana*, which is always undeniably yellow, and sometimes, especially in young plants, as yellow as a dandelion.

Red tints are exhibited by quite a large number of the species, but it is noteworthy that the better reds come from the more westerly and southerly areas of the Commonwealth. It is difficult to find data for the formulation of a law governing the appearance of red or reddish flowers, and almost impossible to definitely assert that the red is a fixed and inherent property of the species.

The reddest of all species is unquestionably *E. ficifolia*, and the cases of a change of colour from red in the progeny of a positively identified parent are rare. On the other hand, *E. calophylla*, which is a definite affinity of *E. ficifolia*, is most variable, and thousands of cases of disappointment to growers have occurred with this species. *E. leucoxylon* var. *macrocarpa* is another species that constantly provides disappointment in the uncertainty with which it will flower either white or red. Originally the pink or red-flowered *calophylla* was discovered in a line of these trees planted in the Melbourne Domain from seed provided from Western Australia. To the amazement and excitement of Baron von Mueller, one of these trees flowered for the first time with a definitely pink bloom. In due course seed was collected from this tree and distributed all over the world, and hundreds of the pink-flowered trees of this species in Melbourne can trace their ancestry to the original tree in the Domain, which has long since disappeared.

It is recorded by Maiden that a pink-flowered variety was

found growing naturally within the habitat of the tree at Bridgetown, Western Australia. The writer has observed many cases of seed from a definitely-established pink tree that have flowered as pink as the parent, and as many cases that have flowered white, and also many instances of trees that in their first season flowered definitely pink, and then in successive seasons gradually lessened their colour until they became an indefinite or muddy pink, and finally white. One tree, on the other hand, flowered its first season with only a tinge of pink at the base of the filaments, and then from season to season definitely acquired more colour, until now it has flowered for six or seven years of a uniform and definite rose pink colour.

Observation extending over many years leads to the impression that the "standard" or natural colour of the Eucalyptus flower is white or cream, and that the pink or red flowers are due to some influence of soil, climate or insect working, the manner of which is not yet understood. Such a well-established red species as *macrocarpa* seems easily able to depart from its red, and produce yellowish blooms, and a tree of this species in cultivation in Melbourne has more than once shown definitely rose pink and definitely pale yellow blooms at the same time. A similar observation has been recorded for *E. pyriformis*, and it is a comparatively frequent occurrence in *E. platypus*.

Mr. P. R. H. St. John records that some years ago he found a tree of *E. melliodora*, naturally growing near Eltham, that had white and red flowers on it at the same time. This note is primarily to record that the writer has seen specimens from a tree of *E. viminalis*, naturally growing near Seymour, on which white and red flowers occurred on the same branchlets, and quite recently a specimen of *E. Behriana* was brought in from Inglewood, Victoria, on which many white and many red flowers were conspicuously open on the same branchlets. The red can best be described as a crimson lake colour, and the flower upon macroscopic inspection, and also under low magnifying power, suggests in its shape and development insect or gall impregnation.

Those flowers with the red stamens—and some flowers even show deep red stamens on one side of the rim and pale pink stamens on the opposite side—appear to have a calyx that in comparison with the normal white flower is swollen and slightly distorted. Further, the pistil is highly coloured and is slightly turgid. No puncture nor trace of insect working is apparent, despite the suggestions of its presence, and the phenomena suggest most pertinently that the reason for the red colour in the filaments of these flowers is of entomological origin. The specimen of *E. Behriana*, recently discovered and inspected, was highly reminiscent in colour of the lithograph given by Brown, in his *Flora of South Australia*, of *E. Lansdowniana*.

SANDRINGHAM FORESHORE PLANTING DAY.

The first planting day at the area allotted to the Club by the Sandringham City Council was held on August 29. The area is situated in a delightfully sheltered dell or coombe surrounded by natural bush in a very fair state of preservation.

In laying out the plots, the Advisory Committee appointed by the Club had in view the ultimate formation of a "Wild Garden" effect, embracing the naturally-grown shrubs already there and the introduction of any native species and varieties likely to stand coastal conditions, planted in such a manner so as to give a "bush" rather than park or garden effect. The method adopted will also provide some self-protection from wind and other weather conditions. This year's planting is to form the framework of the scheme and is, in some respects, experimental as regards some of the varieties, but every plant was selected as having a fair chance of survival.

About fifteen Club members attended, but there was a total attendance of about 100, including representatives of the Council, the official representatives of fourteen societies interested in the preservation of the coastal flora and the general public.

Cr. Steele, representing the Mayor, in opening the proceedings, eulogised the work of the Club and strongly appealed to the citizens and the public generally to care for the plantation, to protect the foreshore flora from vandalism and to realise the asset they possessed in the natural beauties of the foreshore reserve generally.

After other official representatives had briefly addressed the gathering, Cr. Steele planted the first tree (*Melaleuca styphelioides*), and Mr. V. H. Miller, on behalf of the Club, the second (*Acacia pravissima*). The official representatives each planted on behalf of their respective societies. Club members and local representatives followed, until 100 trees and shrubs, comprising about 70 varieties, had been placed in their allotted positions.

A gratifying feature was the large attendance of school children, most of whom planted. It was announced that a Junior Foreshore League, organised by Mr. Swaby, already had a membership of 500 boys and girls, pledged to interest themselves in and conserve the flora and fauna of the foreshore.

The Club members and friends were entertained to afternoon tea by Miss Brown, of The Lodge, which adjoins the plantation. The suggestion that the site be named Correa Gully or Dell, as a compliment to the Club, was enthusiastically endorsed by the local councillors and residents present. The Club is indebted to the Council for its co-operation and to the Director of the Botanical Gardens (Mr. F. J. Rae) for making available a selection of plants, most of which could not have been obtained elsewhere.

ROCK WALLABY IN VICTORIA.

At one time the Little Rock Wallaby was very plentiful in the Snowy River Valley, especially around Gelantipy. I have been making inquiries recently to try and see whether any of this species still remain in the district, and have now ascertained that there is a small colony of these wallabies at the Pyramids, on the Murrindal River, about seven miles from Buchan.

The Dwarf Wallaby, commonly known as the Paddymelon, was very plentiful once along the coast between Lake Wellington and Metung, but I was afraid that these had been exterminated. I have ascertained, however, that there are still some of them in this district.

It is interesting to know that these two species of Wallabies are still in existence, and I hope we may be able to retain them. I propose to put them both on the whole year protected list as soon as I can get some further information, which I am now endeavouring to obtain.

F. LEWIS.
(Chief Inspector of Fisheries and Game).

GUIDE TO THE GRAMPIANS.

For more than thirty years Mr. Charles Daley has been a lover of the Grampians. He has studied the geology of the range and become familiar with its flora and animal life. His wide knowledge is summarised for others in "The Grampians, Victoria", an illustrated booklet of 48 pages, published last month. It is not merely a guide for tourists, but a very pleasantly-written description of wild Nature in our western mountains, of peaks and forest paths and waterfalls. Discovery and exploration, the overlanders, and early conditions of settlement are dealt with, too. The author is essayist as well as naturalist, and the charm of his literary style makes "The Grampians" a companionable book.

In preparing notes for my paper on the pollination of *Corysanthes* I misread Darwin's *Coryanthes*. Will members kindly delete from their copy of September issue of *The Naturalist* all reference to Darwin's work, in the second paragraph on page 96, beginning "In Darwin's work, . . . pollinating the flowers". In the succeeding paragraph place the stop after "species of *Corysanthes*", and delete the rest of that sentence. I have no excuse for my mistake. It was sheer carelessness.—EDITH COLEMAN.

At the Thomas Baker, Alice Baker and Eleanor Shaw Medical Research Institute, Alfred Hospital, a survey is being made of pollens of grasses and other plants which are of importance to sufferers from hay fever and asthma in Victoria. Botanical members of the Club can help by collecting pollen from grasses—a gram or more of each sample. Directions, tubes and varnished papers will be supplied by the Institute.

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THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary monthly meeting of the Club was held in the Royal Society's Hall on Monday, October 12, 1931. The President, Mr. J. A. Kershaw, C.M.Z.S., occupied the chair, and about 105 members and visitors were present.

CORRESPONDENCE.

Mr. C. French, senr., returned thanks for birthday greetings.

Professor Laver regretted that absence in Tasmania would prevent him from meeting members at Kinglake.

Dr. C. Sutherland asked for assistance in collecting pollen for research work in connection with hay fever and asthma. Members were requested to help.

REPORTS OF EXCURSIONS.

The following excursions were reported:—You Yangs, Mr. V. H. Miller; Austin Hospital, Dr. R. H. Flecker; Beaconsfield, Mr. A. E. Proudfoot.

ELECTION OF MEMBER.

Miss G. Scott was duly elected as an ordinary member.

GENERAL BUSINESS.

Mr. A. J. Swaby was declared duly elected as Hon. Secretary, and Mr. F. S. Colliver as Hon. Assistant Secretary.

Mr Swaby gave notice that, at a special general meeting, he would move:—

That Rule II be altered by striking out the word "and" before "Assistant," and inserting the word "Assistant" before "Librarian" in the line immediately succeeding.

This would separate the offices of Assistant Secretary and Assistant Librarian, and give the Assistant Librarian a seat in Committee.

Mr. G. N. Hyam seconded the motion.

Mr. A. D. Hardy drew attention to the position of the valuable Sperm Whale Head Reservation, and the difficulty of adequately guarding it. Messrs. Barton had given much of their time to it; but funds were urgently needed. He suggested that the matter be referred to the Committee for consideration. This was done.

The President welcomed Miss Jean Galbraith, a country member, who had rendered notable service in the Classification and Protected Plants Sections at the Wild Nature Show.

Highly satisfactory interim reports on the Show were given by several leaders. The President congratulated the Club and thanked all who contributed to the success of the Show.

Mr. A. S. Kenyon stated that the human agency in the rock carvings described by Mr. A. L. Meston, M.A. (October *Naturalist*) was open to question. The Hon. Editor (Mr. C. Barrett) said opinions of authorities on such subjects often differed. The article was very interesting.

The President announced that the lantern slides which the late Mr. L. L. Hodgson had collected had been presented to the Club, and would serve as a permanent reminder of his association with the Club.

The excursion to Loch was cancelled on account of expense.

EXHIBITS.

Mr. A. S. Kenyon.—*Grevillea rosmarinifolia, G. trinervis, G. ilicifolia, Callitris verrucosa, Eucalyptus uncinata, E. gracilis, E. tumasa.* All garden-grown.

Mr. F. S. Colliver. -Fossil bivalve mollusca. Section Asiphonida: *Aviculopectin* sp., Carboper, Tas.; *Pectin yallensis* Bal., Muddy Ck.; *P. murrayensis* same; *Avicula linguiata* Jan., Wauro Ponds, *Placunanomia ione* Kal., Beaumaris; *Spondylus pseudoradula* Bal., Muddy Ck.; *Limea bassi*, Jan., Table Cape; *Limea transenna*, Bal., Muddy Ck.; *Mytilus hamiltonensis* Jan. (?), Grange Burn; *Ostrea mamubriata* Kal., Beaumaris; *Lxmopsis morningtonensis* Bal., Muddy Ck.; *Barbatia cellaporacea* same. *Macrodon cainozoica* same; *Cucullaea corioensis* same; *Limatula jeffreysiana*, Bal., Royal Park; *Leda crassa*, Kal., McDonald's *Trigonia howitti* same; living specimen of *Unio novæ hollandiæ*.

Mr. Leo Stach.—Common large bivalve mollusca, from Spring Ck., Torquay:—*Pseudomussium yahlensis, Spondylus gaederopoides, Trigonia semimudulata, Glycimeris grunthoptera, Cucullaea corioensis, Cardium pseudomagnum, Venericardia scabrosa, Chione etheridgei, Chamalamellifera;* also well-preserved specimens of *Trigonia acuticostata* from Beaumaris, above nodule bed.

Mr. Whitmore.—Stone axe, unearthed at Camberwell.

Mr. A. H. Mattingley.—Photographs of *Eurostopodus guttatus* (Spotted Night-jar), brooding on young; *Billardiera cymosa* (Sweet Apple-berry), from Wyperfeld; fruit of *Eucarya Murrayana* (Bitter Quandong).

Miss J. W. Raff.—Gall-like growths on acacia, produced by fungus (*Urocladium*)—You Yangs.

Mr. F. A. Singleton. Relief models of portions of the Yarra River Basin, to illustrate the lecture.

Master P. Flecker.—Death's-head Spider, with eggs.

Mr. W. Hauks.—Basalt from flows at Coburg, separated by soil containing quartz.

Miss F. Smith.—*Ajuga australis* (Bugle), from Wyperfeld.

Dr. C. Sutherland.—Illustrations of pollen collecting methods.

SIGNIFICANCE OF THE WESTERLY TREND OF THE YARRA AND ITS TRIBUTARIES.

By A. R. KEBLE, F.G.S.

The Yarra downstream from Fairfield as far as Burnley is essentially young. It flows in a channel with a grade so steep, and a current so fast, that no silt or sediment has accumulated along it as river flats. It has deeply cut its channel in Silurian sediments at the edge of the Newer Basaltic lavas, for erosion takes the line of least resistance, and the Silurian sediments are much more readily eroded than basaltic lava. We know that these lavas occupied the valleys of the pre-existing river system, and forced the drainage into the course it now occupies at the fringe of the encroaching lava, thus initiating the young cycle we have already noted, and which we will refer to as the existing cycle.

At Collingwood and Burnley this sub-basaltic river bed has been encountered in excavations, and appears to have been representative of a fairly mature system. The cycle which it represents is the modified and concluding stage of one that started after and levelled the ferruginous sands and sandstones comprising what the late Dr. T. S. Hall termed the Red Beds.

The physiographical history of the Yarra then may be considered in three well-defined cycles:—

A.—The existing cycle.
B.—Pre-Basalt cycle.
C.—Red Bed cycle.

We find that during the Red Bed cycle the Yarra or its equivalent stream had a south-easterly trend, and that during the Basalt cycle, for some reason, its course was directed to the west-north-west, in quite the opposite direction, in fact, in a direction opposed to the general slope of the surface. Similarly, its tributary, Gardiner's Creek, which had a south-westerly trend, was diverted to the north-west.

It is proposed to discuss the development of these streams in terms of these cycles and suggest the factors that were responsible for their changes in direction.

RED BED CYCLE.

It is evident that the Red Beds, so well developed in the triangle formed by a line from Melbourne to Dandenong on the north-east, the Carrum Swamp on the south-east, and Port Phillip Bay on the south-west, originally extended much farther northwards, for we find inliers at Clifton Hill, Kew, Camberwell, Burwood, Surrey Hills, Notting Hill, Glen Waverley, and as far north as Doncaster. They consist of ferruginous sands and sandstones of moderately fine, even grained, usually well-rounded quartz, on the

whole, in thick and flat beds. They are of Lower Pliocene or Middle Pliocene age, since we find Lower Pliocene marine sediments at Beaumaris merging up into them. Nevertheless, the Red Beds, wherever they are exposed, are terrigenous, and organic remains in them are rare. They were probably deposited by fluvatile action, which reached such a stage of maturity that they were sorted and re-sorted and broadly distributed by lateral erosion.

The Red Bed surface had all the attributes of a peneplain, and the gently undulating surface east of Moorabbin is probably a remnant of it. From this peneplain protruded in a few places the tops of the ridges of the watersheds of the cycle that existed before the Red Beds were laid down, ridges that were composed of Silurian sediments or Lower Tertiary Basalts. The surface on which the Red Beds rests was dissected by a stream system, and the watersheds of the stream system on the Red Beds are essentially those of the underlying stream system, in other words, the Red Beds have been deposited mainly in the pre-existing valleys, although, in places, they thinly cover the watersheds, too. It has been stated that erosion takes the line of least resistance. The Red Beds were much less resistant than the Silurian sediments or the Lower Tertiary Basalt, and those streams that developed along the line of greatest thickness of Red Beds cut their valleys more rapidly and deeply than those which started in or encountered the Silurian sediments or Lower Tertiary Basalt at a shallow depth. These quickly developing streams became the main streams and, as the greatest thickness of Red Beds was always over the old valleys, the newer valleys were developed along the same lines.

Thus the exposure of the Silurian sediments or Lower Tertiary Basalts gives us the trend of the old watersheds; and old valleys can be readily defined between these.

JOLIMONT RIDGE.

The watershed or ridge that we are most concerned with trends south-easterly through Brunswick, Royal Park, Jolimont, Richmond, Heyington, and Malvern, and may, for convenience, be called the Jolimont Ridge. It is now discontinuous, having been breached by the Yarra between Richmond and Heyington, but at the beginning of the Red Bed cycle it was continuous and formed the western watershed of the main stream that drained the country east of Melbourne. If the Yarra of the Red Bed cycle is plotted on a map, it will be noticed that it has a south-easterly trend parallel to the Jolimont Ridge and always on the easterly side of it, and since the Jolimont Ridge is known to extend as far as Malvern, we can be sure that the Yarra of the Red Bed cycle extended to a point opposite Malvern. At Tooronga, which approximately occupies this position, the Red Beds are thickest, so

that we would expect to find a valley of the Red Bed cycle developed here.

Southwards of Tooronga, between Malvern and Caulfield, and extending south-easterly through Glenhuntly, Carnegie, and Ormond, is a chain of swamps or low-lying ground which has been reclaimed, and on which is now the Caulfield and Carnegie Parks. This is directly in the line of this Red Bed valley, and is the outlet of the Red Bed Yarra on the peneplain to the southwards. Its bed is here slightly below the 150 feet contour, so that farther south its fall must have brought it to a lower level. Its course south of Ormond is, however, difficult to follow owing to the encroachment of a newer drainage cycle from the north-west, but some well-defined bathymetrical contours of Port Phillip Bay opposite Beaumaris suggest that a fairly large stream debouched there, and in all probability this was the Red Bed stream system we have described.

It is significant that the late Mr. F. G. Spry mentioned, when discussing the sewerage excavations in the vicinity of Glenhuntly, that in a swamp near the Caulfield racecourse the tunnels passed through a bed of bouldery wash or fluvatile boulders of some stream that he was at a loss to account for. This was probably the bed of the Red Bed Yarra we have just indicated.

As far as Tooronga, however, the Jolimont Ridge is on the right of this stream, and the direction of the ridge is practically that of the stream.

NORTH-WESTERLY TREND OF GARDINER'S CREEK.

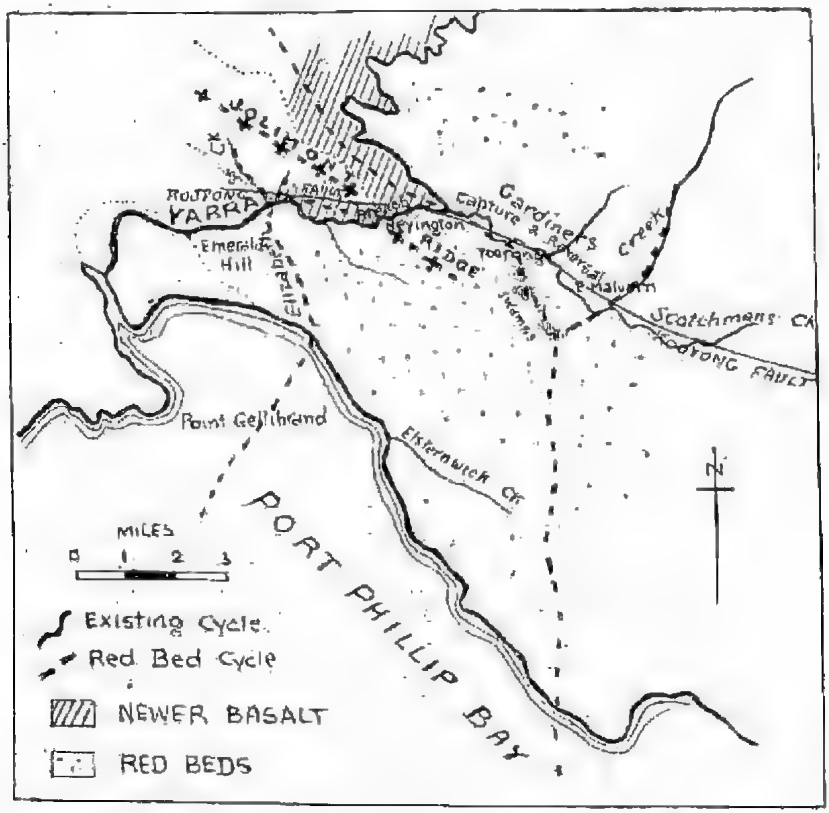
Gardiner's Creek rises near Blackburn, flows south-westerly as far as East Malvern Railway Station, and then changes its course to the north-west and continues in that direction until it joins the Yarra at Heyington. East Malvern station is immediately north of Murrumbeena, and between Oakleigh and Murrumbeena is low-lying ground that is partly due to the cutting back of the Murrumbeena Creek from Gardiner's Creek, the line selected for cutting back being the greatest thickness for Red Beds, and therefore the position of a pre-Red Bed valley. Now if we project Gardiner's Creek on its south-westerly trend, say, at a level of 150 feet, it would pass over this low-lying area and join the Red Bed Yarra in the Carnegie Swamp. What, then, was responsible for Gardiner's Creek changing its direction to the north-west, a direction that is against the general slope of the Red Beds?

KOOYONG FAULT.

It seems then that the Red Bed Yarra flowed south-easterly along what is now the Gardiner's Creek valley and was joined by the south-westerly flowing Gardiner's Creek in the vicinity of Car-

negie. For some reason the Yarra was diverted to the west-north-west through a breach in the Jolimont Ridge, and that part of it between Heyington and Tooronga has been reversed and now flows in a north-westerly direction. The lower reaches of Gardiner's Creek have also been captured and diverted into this north-westerly flowing stream.

It is significant that the portion of the Yarra diverted through the breach in the Jolimont Ridge and from there to its outlet, the reversed portion of the Red Bed Yarra between the breach and Tooronga, the capturing portion of Gardiner's Creek between Tooronga and East Malvern, and Scotchman's Creek, which joins Gardiner's Creek at East Malvern, conform approximately to the same line.



This line has every appearance of a fault or warp, and we have designated it the Kooyong Fault. If it is such, its relative upthrow side must be on its south side since the reversed and capturing streams conform to the direction of its scarp or shatter belt. Its scarp formed a barrier which prevented the drainage

taking its normal outlet to the south, south-east, or south-west. The fact that this line suggests a fault line, and the trend of the physiography supports it, is significant, but one looks for more concrete proof, and there is more convincing evidence up Scotchman's Creek.

On the north bank of Scotchman's Creek, opposite Amstel Park, there is the bed of an old southerly flowing stream a few feet above the present level of the creek. The extension of this stream, which belongs to the Red Bed cycle, cannot be found on the south bank, nor could it be found there since the south bank, for a considerable height above the level of the creek, consists of Silurian sediments. The southern extension of this Red Bed stream appears to have been raised with the relative upthrow side of the fault, and were it possible to definitely identify its uplifted portion on the south side of Scotchman's Creek, one would have a means of estimating the displacement of the fault.

EFFECT OF KOOYONG FAULT.

Previous to the Kooyong Fault the streams of the Red Bed cycle flowed southwards, south-eastwards or south-westwards. Those streams directly to the east of the Jolimont Ridge flowed southward and eastward and those on the west southward and westward. The Kooyong Fault was responsible for a general encroachment of the western system into the eastern system, and incidentally the reversals and captures evident in the latter. The Elizabeth Street Creek was part of the western system, and had its source near the Haymarket, flowed down where Elizabeth Street now is, between Government House and Emerald Hill (South Melbourne), through the Albert Park Lagoon, which is part of the old system, on the north side of the St. Kilda hill, and joined the trunk stream, which flowed down what is now the floor of the Bay south of Point Gellibrand. A small tributary heading in the Fitzroy Gardens joined it near Princes Bridge, and there was another heading back towards Heyington.

The Kooyong Fault was in a west-north-westerly direction across this drainage, and the scarp of its relative upthrow side on the south presented a barrier to the drainage seeking its natural outlet to the south and west. It drained to the scarp of the fault and flowed along the scarp until it sought an outlet farther to the west. This stream formed along the scarp was quickly strengthened by the formation of new tributaries of which the Hawksburn Creek was probably one, and eventually cut back until it breached the Jolimont Ridge. Once that was breached, the capture of the streams flowing on the east side of the Jolimont Ridge was only a matter of time.

The Newer Basalt Yarra, north of Heyington, was first of all diverted through the breach, and as its level was lowered that portion of it south of Heyington was gradually reversed. This re-

versal accomplished, a stream was pushed back along the fault scarp from Tooronga to East Malvern, and the head waters of Gardiner's Creek were captured and that portion of Gardiner's Creek between East Malvern and Murrumbeena was reversed. This fault scarp creek was pushed still farther south-eastwards until Scotchman's Creek was cut back. Thus by a system of capture and reversals the river system near Melbourne assumed its north-westerly trend and that doubling on itself that gives it the appearance of flowing against the general slope of the surface.

If the Kooyong Fault was responsible for any flooding of the truncated river system, evidence of it has for the most part been removed by subsequent erosion. There is, however, in the valley of Gardiner's Creek, near Boundary Road, between Burwood and Oakleigh, a clay deposit that may have been lacustrine and due to the draining of the Gardiner's Creek by the Kooyong Fault.

It is not proposed to go into the pre-Basalt cycle in any detail. It will suffice to say that it reached a fairly mature stage of erosion before the Newer Basaltic lavas obliterated it, a fact that is patent from the wide lava flows occupying its valleys.

CONCLUSIONS.

It is suggested that the trunk stream (Yarra) of the Red Bed cycle flowed south-easterly through Clifton Hill, Burnley, Tooronga, Caulfield, Ormond, and by a problematical course south-south-easterly past Beaumaris. It was joined by the south-westerly flowing Gardiner's Creek near Glenhuntly.

The Kooyong Fault was responsible for the reversal of some portions and the piracy of others, so that we find the streams still preserving their south-easterly or south-westerly trend in their upstream portions, but turning to the north-west or west-north-west directly they encounter the scarp of the Kooyong Fault. The proof of this, however, is to be had by establishing beyond doubt their south-easterly and south-westerly trend on the south side of the Kooyong Fault, particularly south of Ormond, where the encroachment of a newer and reversed system of drainage has largely obliterated the evidence

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Our entomologists are displaying interest in some of the "neglected" groups of insects. The order *Dermaptera* is the latest to receive attention. Earwigs, until recent years, were accorded only family rank. Comparatively little is known, Dr. R. J. Tillyard states, of the Dermapterous fauna of Australia and New Zealand. The Dominion has only three species, while about 45 have been described from Australia, many of them being very rare in collections. The specialist has a rich field, and undescribed forms exist in museum and private collections. The species so common in Melbourne gardens, *Labidura truncata*, was introduced long ago from Europe.

HABITS AND LIFE HISTORIES OF SOME VICTORIAN LYCAENID BUTTERFLIES.

By A. N. BURNS, F.E.S.

Genus *Ogyris* Westwood.

This genus, which consists of no fewer than eleven species in Australia and two in New Guinea, represents some of the largest and most beautiful Australian Lycænids. Five of the eleven species are taken in Victoria, and three of the five are rare, and restricted to the north-western portions of the State.

The larvæ of those species whose life histories are known are *Loranthus* (Mistletoe) feeders; are of very exclusive habits, feeding by night only, and sheltering by day in crevices, under bark, and in ants' nests. As *Ogyris* larvæ possess secretory glands on the posterior body segments, from which they exude a sweet substance, they are sought after and protected by ants, which continually attend them in order to obtain this sweet exudation. One species, *Ogyris olane* (Hew.), apparently does not possess these secretory glands, because it is not attended by ants. Each of the other species whose larva is known is attended by its own particular kind of ant.

Pupæ are found in similar situations to the larvæ, *i.e.*, under bark, in ants' nests, etc.

Ogyris zozine araxes nov.

This is the largest species of the genus, and in Victoria has been recorded by the writer from Horsham (November, 1930). Other recorded Victorian localities are Dimboola and Hattah (Waterhouse and Lyell). The male butterfly is a uniform shining purple on the upper surface and dark grey with darker markings on the under side. The female has the upper surface of the wings black, with a discal patch on the forewing, cream. Basal and central areas of forewings and hindwings, metallic green. Underside black-brown, suffused with richer and darker markings, cream patch of forewing upper-side visible, slightly more suffused.

The eggs are laid on the twigs of the food plant (*Loranthus pendulus*), and occasionally on the bark near the base of the tree and the attending ants' nest.

It is thought that the young larvæ, upon hatching, are carried to and from their hiding place in the ants' nest to the *Loranthus* to feed, for it must be remembered that the food may be many feet away from the base of the tree, and the ants' nest may be under stones near the base, or in a dead portion of the basal portion of the trunk. When the larvæ grow bigger, they are able to migrate backwards and forwards to and from their food, although the ants are in attendance with them on their journeys.

No doubt the continual presence of the ants must tend to guide them to a certain extent. When fully fed, the larvæ retire to within the shelter of the ants' nest, and there undergo the transformation into pupæ.

In colour the full-grown larvæ are pinkish brown, with darker, obscure markings. The lateral margins are clothed with fine, pale-coloured hairs. The secretory tubercles are very conspicuous in this species, and can be thrust out or withdrawn at will.

Pupæ are smoky black in colour, and are attached to some object within the ants' nest. Attachment is made by the tail, and round the body, about the centre, a silken girdle passes.

When ready to emerge, the adult butterfly crawls out of the exit used by the ants, being guided, no doubt, by the light from outside. The ants attending this *Ogyris* are a large species of sugar ant (*Camponotus perthiana*).

The life cycle may be set out as follows:—Eggs laid during November and December, young larvæ in January and February; full-grown larvæ in October and November, pupæ in November and December, and butterflies again during those two months. Thus it can be seen that the complete life cycle occupies one whole year. In Queensland this species has a spring and autumn brood.

Ogyris amaryllis meridionalis (Beth. Baker).

A very beautiful species, smaller than the foregoing one. It was taken at Horsham by the writer in November, 1930. Other recorded Victorian localities are Dimboola, Sea Lake, Kewell, Birchip (Waterhouse and Lyell), Stawell and Hattah (J. Hill) and the western Mallee generally.

The male butterfly on the upper side is a brilliant shining metallic blue; the under side is dark brown with darker markings, those in the cell of the forewing being edged metallic blue. The female on the upper side is metallic blue, tinged purple, with the outer margins broadly black. The under side is as the male under side, only that the cell bars are scarlet-orange.

The eggs are laid, singly or in pairs, on the twigs of the food-plant (*Loranthus linophyllus*). The young larvæ on emergence probably remain on the mistletoe plant until they grow a little, during that time hiding under mistletoe bark and in crevices. They are constantly attended by a small black species of ant, and it is useless looking for larvæ upon trees on which these ants are not present, no matter how heavily infested with *L. linophyllus* they may be.

Larvæ, from half-grown size and upwards, may be sought for near the base of the tree; they seem to prefer loose bark, under which they hide singly, and bark that lies in the path or "run" of the attending ants. Another curious fact is that more than 90

per cent. of the larvæ taken by the writer last year were found either on the northern or eastern sides of the trees.

The full-grown larva is dark brownish-black in colour, the whole body surface is rugged, and the larva in general presents a slug-like appearance. This flattened (dorsally) appearance and seclusive slug-like habit is characteristic of almost all Lycænid larvæ. The pupa is dark brown-black, and is attached by the tail and a central girdle. It is found in holes, under bark, or in crevices on the trunk (usually near the base) of the *Loranthus* host tree.

The life cycle may be set out as follows:—Eggs laid during October and November; larval existence from November until January; pupæ in January and February; adult butterflies from the latter part of February until the end of March. Eggs laid again during February and March; larvæ from April until August; pupæ from August until October; adult butterflies again in November. Thus there are two broods during the year, one in early summer, the other in autumn or late summer.

Ogyris idmo waterhouseri (Beth. Baker).

This very rare and apparently local species has so far been recorded only from Dimboola and the Grampians—near Hall's Gap (J. Kershaw). Its life history has so far not yet been worked out, so it is not definitely known whether it is a *Loranthus* feeder or not. In Western Australia, where the typical species, *O. idmo idmo*, is not uncommon, it has been recorded as flying near the ground, and always round a certain kind of creeper, which grows on and near the ground (J. Clark). It is likely that this creeper may later prove to be the food plant.

The male butterfly on the upper side is coloured as follows:—Forewing dull purplish-brown, apex and margin brown-black. Hindwing dull purplish-brown, margin narrowly brown-black. Female above, forewing brown, basal half bluish purple, a discal patch cream; hindwing brown, central area bluish purple. Male beneath, brown-black suffused greyish, with darker typical markings. Female beneath, as in male, but hindwing with a central brown suffusion.

The life cycle of this interesting species is almost certain to occupy one year, and thus it is single-brooded, because all the examples so far captured have been taken in November. During November, 1930, a careful search for this species was undertaken, and the following localities were visited:—Dimboola, Horsham, Hall's Gap and Mount Victory (Grampians) and Pomonal. But no signs of it were seen. This would seem to indicate that it is very local, and confined to certain spots which it frequents and where it breeds every year. This local habit occurs with a good many species of Lycænidæ and, although their food trees may

be abundant and spread over a very large area, yet a particular species may be confined to two or three trees, here and there, in that area.

Ogyris abrota (Westw.).

This member of the genus is perhaps commoner and more widely spread than any of the foregoing species. It is, however, rapidly becoming scarce, owing to the fact that so many of the trees bearing its food plant (*Loranthus celastroides*) are being cut down. The writer has bred it from Broadmeadows, Spring Vale, Mordialloc, and Vermont; other recorded localities are Gisborne (G. Lyell), Castlemaine, Stawell, Oakleigh, and Wandin (Waterhouse and Lyell), and Frankston (A. Brown). There are no doubt many other recorded localities also.

The male butterfly on the upper side is a rich dark purple, with the outer margins narrowly black. On the under side the forewing is black with the cell bars edged whitish. The hindwing is brown with faint whitish splashes and richer brown central markings (typical). The female above is brown-black, with a large pale lemon-coloured patch just from the outer end of the cell in the forewing. Under side as in male, except that the pale lemon-coloured patch of the forewing is visible as above, though slightly more obscurely.

The eggs are laid on the twigs of the food plant (*L. celastroides*). The young larvæ are pinkish brown in colour, and hide by day under the loose bark of the food plant. Right throughout their larval existence they do not seem to wander very far from the mistletoe, not to the same extent as larvæ of *O. zosine araxes* or *O. amaryllis meridionalis*. Occasionally one will get a fully-grown larva under bark near the base of the host tree, but it is usual to get them when fully grown under bark only a few feet away from the mistletoe itself. They are always attended by a species of small black ant. In colour the full-grown larva is pale pinkish-brown, with faintly-darker markings dorsally. Excretory tubercles are present, but are not nearly so conspicuous as in *O. zosine araxes*.

Pupæ are found in situations similar to those frequented by the larvæ; they are attached by the tail and a central girdle. In colour they are pale ochreous, with small, irregular, darker markings and striations.

The life cycle may be set out as follows:—Eggs laid during October and November; larvæ from November until January; pupæ during January and February; butterflies in February and March. Eggs laid again in March and April; larvæ from April till July and August; pupæ August to October; butterflies in October. This species then is double-brooded, the first brood appearing in spring, the second in late summer.

Larvæ of *O. abrota* appear to be much attacked by Dipterous parasites, particularly in the summer brood; the extent of parasitism sometimes is as high as 50 per cent. During prolonged wet weather (especially if hot, thus creating high humidity), they are also sometimes attacked by a fungoid disease, which takes heavy toll of their number.

The *Loranthus celastroides* appears to favour for its host tree the red gum (*Eucalyptus rostrata*); this tree formerly was plentiful around Melbourne, and heavily parasitised—a fact that no doubt accounts for the moderate abundance of *O. abrota* until about 10 or 15 years ago. *O. abrota* is now becoming restricted to a few favoured localities, where its food plant still remains.

Ogyris olane (Hew.).

This is perhaps the most abundant and widely-spread species of the genus in Victoria; in fact, it is rarer, if anything, in New South Wales than in this State, and quite rare in southern Queensland. The writer has taken it at Ferntree Gully, Vermont, Stawell, Ringwood, Eltham, Broadmeadows, Bacchus Marsh, and Blackburn. Waterhouse and Lyell record it from many other localities in Victoria.

In size it is about the same as the preceding species, *i.e.*, about 1¼ inches across the expanded wings. The male butterfly on the upper side of the wings is dark brown-black, with central basal areas of dull purple. The apices of the forewings are faintly splashed white. Beneath the wings are dull black, with greyish suffused markings, and the typical markings outlined only in black. The female above has the wings brown-black, as in the male; the central basal areas are not quite so large, and are bluish-purple; the apices of the forewings are faintly splashed white. The under side is as in the male, but the markings are slightly more intense in colour.

The eggs are laid on the twigs of the food plant (*Loranthus pendulus*). The young larvæ are ochreous in colour; and for the first two instars do not travel far from the mistletoe itself to find suitable hiding places. As they grow, however, they develop a very wandering habit, and seem to like to get as far as possible from the mistletoe during the day time—this is the general rule—because right near the base of the host tree, under loose bark, etc., is the best place to look for them. Occasionally, however, one will find an odd larva some feet up from the base of the tree. This species is not attended by ants, and of the *Ogyris* whose life histories are known is the only one whose larvæ are not attended thus.

The full-grown larva is ochreous brown in colour; individuals vary considerably from dark to light ochreous; the dorsal surface is rugose, and on the second anterior and anal segments (dor-

sally) is a flattened depression, bearing a somewhat T-shaped mark.

The pupa of this species is very similar to that of *O. abrota*; it is, if anything, slightly smaller and darker brown in colour, and found in situations similar to those affected by the larvæ. It is attached by the tail and a central girdle.

The life cycle may be set out as follows:—Eggs laid during October and November; larvæ from November until January; pupæ in January and February; butterflies again in February and March. Eggs laid again in March and early April; larvæ from April until August; pupæ in August and September, and butterflies again in October. There are, therefore, two broods during the year, one in late spring or early summer, the other in late summer or early autumn.

In some years this butterfly occurs more plentifully than in others; in 1921 it seemed to be plentiful everywhere; in 1930, however, it was scarce in localities where it could normally always be found. Specimens are usually more numerous during the late summer brood than in the spring one.

Genus *Miletus* Hubner.

Miletus ignita ignita (Leach).

This very interesting species, which has a very wide range in Australia (Darwin to Victoria and W.A.), belongs to a genus the butterflies of which are not only brilliantly coloured above, but have a definite pattern of reddish and metallic-green markings on their under sides. In many species of the genus, which has 13 representatives (exclusive of sub-species) in Australia, the markings on the under sides of the wings are often more beautiful than those on the upper sides.

On account of its wide geographical range in this continent, *Miletus ignita* has developed no fewer than four races, which are all clearly defined. The typical race, *M. ignita ignita* (Leach), occurs throughout Victoria (it is very local in this State), as far north as Brisbane. The North Queensland race is known as *M. ignita chrysonotus* (Grose-Sm.), and ranges from about Stradbroke Is. to Cairns and Cape York. The Darwin race is *M. ignita erythrina* (Waterh. and Lyell), while the race which occurs around Albany, in Western Australia, is *M. ignita oliffi* (Miskin).

The writer has only taken *M. ignita* at Ocean Grove, in Victoria (larvæ during November, 1930, and again, in the same month, in 1931); but other records for this State by Waterhouse and Lyell are Redesdale and Dimboola.

This species appears to have a number of different food plants. At Ocean Grove, larvæ feed on Golden Wattle (*Acacia pycnantha*); around Sydney it has several food plants, and the writer has bred it in North Queensland from different plants again.

The eggs are laid on the bark near the base of the food plant, and are only laid on such plants as have nests of the necessary attending ant, *Iridomyrmex nitidus*, at or near their bases. Almost as soon as the eggs have been laid, the ants cover them in debris, etc., under which the insects extend their nest. When they are very young, the ants probably carry the larvæ to the young shoots of the food plant. Dr. G. A. Waterhouse, of Sydney, in the *Australian Museum Magazine* (July-September, 1931), gives a very interesting account of the life history of this species. He mentions that "the larvæ, when still young, are guided by the attending ants to and from their hiding place in the ants' nest to the leaves on which they feed. Should the caterpillars when going out to feed or when returning to their hiding place take a wrong turning, an ant will come and turn them in the direction in which they should go."

The present writer has observed that the larvæ, in going to and from their shelter in the ants nest at the base of the food tree always travel in the ant track, where the ants are continually bumping into them, and tending them with the utmost care. This particular ant has a very strong and not unpleasant odour, which can be smelt immediately a nest is opened or disturbed, and perhaps this odour helps to guide the larvæ on their journeys. These larvæ have secretory glands on the posterior segments of their bodies (this is a characteristic of most Lycaenid larvæ) and on account of this the ants "milk" them to secure this much prized fluid. Even when the larvæ are on the leaves feeding, the ants are in continual attendance.

These caterpillars have a peculiar manner of feeding; instead of eating portions out of the leaves, as do most larvæ, they skeletonize the leaves, *i.e.*, they eat off the epidermis from one or both surfaces of the leaves: this gives the leaves a scorched appearance, and is a useful guide when searching for the larvæ. It is interesting to note that larvæ are only found on very young trees, usually those about two feet in height.

The fully grown larvæ are blackish-brown in colour, with darker and irregular dorsal markings. The sides of the bodies are fringed with pale greyish hairs.

Pupæ are found in the ants' nests; they are usually attached to the trunk of the food tree around which the ants build their nest, excavating the earth away from it for a little distance. Like the larvæ, pupæ occur in numbers together: as many as 30 may be found at the base of one small food tree. In colour they are blackish-brown with minute dotted darker markings. They are attached by the tail and a central girdle.

The male butterfly has the wings above dull coppery purple with the margins brown. Beneath, the wings are dark grey brown with a series of orange-red spots edged metallic green. The female

above has the wings brown with a very faint coppery tinge, the central areas are purple, sometimes tinged blue. The underside is similar to the male, but the orange-red spots are larger if anything.

In New South Wales and Queensland the species is double brooded, but in Victoria there is only one brood, which emerges in December and January. The eggs are laid about January; young larvæ appear about a month later; they grow very slowly during the autumn and winter months, reaching the pre-adult instar in October. They grow fairly rapidly from then on and pupate in November. The pupal stage lasts for about a month and the adult butterflies emerge in December and January.

Although so brilliantly marked, *Miletus ignita* is very inconspicuous on the wing; it flies very rapidly, but can be easily approached when at rest on a twig or a leaf. It measures about one inch across the expanded wings, and, although not so large as butterflies of the genus *Ogyris*, is equally as interesting and as much a prize for the collector.

PIONEERS IN THE PLANT WORLD: NOTES ON LICHEN-STUDY.

By A. LORRAIN SMITH, F.L.S.
British Museum (Natural History).

There are many aspects of lichen study that should appeal to nature lovers; the unusual variety in form and colour of the plants is a great attraction, and also that they may be found in almost every kind of situation and locality—they are never far to seek. Another distinct advantage is the ease with which they may be preserved.

In form lichens vary from flat crusts that spread unobtrusively over the bark of trees, over rocks, etc., to the leafy, shrubby or filamentous forms of large dimension familiar to all botanists. The prevailing colours vary from a greenish or bluish dove-grey, white or yellow to the most brilliant red hues. The only harm charged against them is that the larger forms on trees, if unchecked, exercise a somewhat smothering effect.

As plants they are unique, not only in the outward form, but more especially in their constitution. An examination of their tissues under the microscope reveals the presence of two very distinct elements: groups of small green or blue-green, mostly rounded cells, along with long, colourless strands of cells—the hyphae—which form the medulla and the cortical elements of the plant body or thallus. That these are respectively algae and fungi is now a matter of common knowledge, but for long years presented a much-debated puzzle. The algae are aerial species belonging to a few genera of Chlorophyceae or Cyanophyceae; it is

of importance for the lichen student to recognise their characters. The fungus hyphae are less variable, being mostly allied to Ascomycetes, and, as the fungus forms the fructification—apothecia or perithecia—we consider the lichens as akin to fungi.

The combination of these two dissimilar elements to form the lichen plant is termed a "symbiosis." In the mutual metabolism the fungus supplies the nitrogenous compounds and builds the structural tissue systems; the alga contributes the carbohydrates, and therefore sunlight is a necessity; lichens are thus—unlike fungi—essential sun-plants, though, as exceptions prevail throughout nature, some lichens prefer to live in the shade.

Lichens are plants of slow growth and of marvellous longevity. They renew or extend the plant tissues very slowly, and so are unable to withstand the smoke-charged air of towns or of industrial areas. Owing to the interdependence—the mutualism—of the two "symbionts," little or no nourishment is required from the substratum, hence the boundless choice of habitat, from rock or tree to iron or old boots. They cover trees, soil, and rocks, etc., though most species or even genera may be restricted to a special substratum—they are corticolous, terricolous, or saxicolous plants, with specialised preferences as to the type of soil, tree, or rock. Again, while some genera and a few species are ubiquitous, some grow only in warm, others only in cold countries or localities. In the course of time many lichens have become adapted to special climate and habitat.

The value of lichens as members of the plant-kingdom has been somewhat slighted, but their service in the economy of nature ranks high. They are among the first, and—if not always the first—the most important in clothing the bare rocks. They settle on the inhospitable stone or slate, live there by virtue of their self-support, and, besides minutely attacking the rock, they gradually accumulate dust, and detritus and form a nidus for other plants—mosses and their phanerogams—till gradually a soil and vegetation is built up. Lichens are thus in every sense the pioneers in the plant-world, they attain the highest altitude reached by living organisms, and at the poles they advance until stopped by a covering of eternal snow. They are also the hunting ground of small insects, of snails, etc., and might well be regarded as the "plankton" of the land.

Lichens have served in the past as valuable dye-plants, providing rich and beautiful colours. These occur as "lichen-acids" in the plants, the result of the symbiotic association of the fungus and the living alga. Their place has now been taken by coal-tar dyes; in any case, the supply of lichens could not meet the tremendous demand of present-day manufacturers.

We would again emphasise their slow growth, and ask our field-botanists not entirely to root out these lovely and interesting plants. To preserve them for the herbarium and for examination, the

larger forms are easily pressed after being thoroughly moistened. Crustaceous species require no special attention except, perhaps, to destroy depredating insects. Notes should be added by collectors as to the substratum; the kind of tree, soil or rock are all items of importance in the determination of species.

[We are fortunate in having this contribution from one of the world's foremost authorities on a fascinating, though neglected, class of plants. Miss Lorrain Smith is the author of the volume on Lichens, in that notable series, *Cambridge Botanical Handbooks;* also of a handbook on Lichens, published by the British Museum (Natural History). In a letter, she remarks that someone is needed to gather up all the references to Australian species of Lichens, scattered through botanical literature, and publish the descriptions given. Collections of Lichens will be welcomed at the British Museum. Great advances, fortunately, are now being made by Lichens; owing chiefly to the fact that ecologists include them in their surveys. This has excited much new interest in the lowly plants. A large collection of Australian Lichens is preserved at the National Herbarium, Melbourne. The late Mr. R. A. Bastow, who was a member of the Field Naturalists' Club, bequeathed his fine Lichen collection to the Herbarium. He was an enthusiast, both in the field and in the study, and from him I received my earliest lessons in lichenology. I met Mr. Bastow, one November day, collecting in the Tea-tree near Beaumaris. Since his death, we have had no specialist student of Lichens in Victoria.—C.B.]

AMONG THE MARSH TERNS.

By CHARLES BARRETT.

Silvery-grey, black-headed birds, with blood-red bills, on the wing above some inland water, recall to the travelled naturalist scenes in many countries. For the Whiskered Tern, *Chlidonias leucoparcia*, occurs in Europe, Asia, and Africa, as well as in Australia, where it is widely distributed. In November, 1930, on the Muira Lakes, I spent a day among the Marsh Terns. They were nesting there in hundreds, and the sky was flaked with their graceful forms above islands and promontories of aquatic vegetation, chiefly *Limnanthemum*, starred with yellow flowers.

With shrill notes sounding above and around, while the flattie "nosed" a channel through the weed, I made the long flight on memory's wings, from a Victorian haunt of the Marsh Tern to the headquarters of bird life in Egypt, Lake Menzaleh, with its flamingoes, its herons and ducks, and wading birds. Menzaleh is frequented also by the Whiskered Tern, though I did not find the species nesting there. On the Nile, *C. leucoparcia* is not uncom-

Plate IV.

Nest and Eggs of Whiskered Tern

Photo by L. Barnett

mon, but the White-winged Black Tern, *Chlidonias leucoptera*, is rare. The latter occasionally visits our country's northern shores, and a notable occurrence near Perth, West Australia, has been recorded, also an "accidental" visit of the species to New Zealand.

Grebes often are neighbours of Marsh Terns, and it is hardly surprising that nests of the one should sometimes be used by the other species, as Canon Tristram observed in North Africa. Probably, however, the deserted homes were "reconditioned" or merely served as foundations for new structures. There is little architecture in any case. On Moira Lakes I examined scores of nests. All were constructed of stalks and leaves of aquatic plants, and had submerged foundations. Mostly, they were in the midst of large Marshworts, *Limnanthemum geminatum*, whose flowers made golden acres of the surface of the Marsh Terns' lake. Many nests, though, were anchored in the "Moira grass," which grows so thickly that it is toilsome to pole a flattie through these water-meadows that are due to overflowing of the Murray.

Once a nest had been located, to find others was easy enough. The rule was three or four close together, and other groups only a few boat's lengths away. Sometimes in avoiding one nest we collided with another. There were hundreds of Tern nurseries among the yellow flowers of every large "island." Clutches varied in size, as the eggs did in colouration and markings. Three eggs formed the clutch in most cases; many pairs were seen, and a few nests each contained four eggs. The ground colour was grey-green, "warm" olive, or light-green—a "cold" tint. I was glad that no collector was there to take toll, for he would have been sorely tempted. Beautiful clutches were numerous, and some collectors are greedy for series. We troubled the Terns for a while, cruising among their nests and taking photographs. Then they were left in peace, but continued to utter sharp cries—sounds that became fainter as we poled away until they were almost musical: shrill notes from a host of birds, softened and blended by distance into a pleasant murmur.

Looking backward, we saw the Terns darting and hovering above the marshwort 'islands," whose gold was misty now. They appeared no bigger than swallows, but some magic of the sunshine made of the high-flying ones silver forms against the blue.

A few miles from Meningie, on Lake Albert, South Australia, a large area of swampy land exists—unless it has been reclaimed in recent years. Many thousands of Marsh Terns have been reared in that desolate place. When I visited it, returning from a trip to the Coorong's bird islands, nests were scattered freely over the swamp. But the silence was broken only by the croaking of frogs. Nesting time was over for the sharp-voiced Terns, and we heard them only on the lake.

A NEW VICTORIAN CALADENIA.

By W. H. NICHOLLS.

Another name must be added to the Victorian list of *Caladenia* species by the finding at Yarram and Wonthaggi of R. D. Fitzgerald's *Caladenia tessellata*—a form previously recorded only from New South Wales. To Miss Evelyn Bond and Mr. E. H. Homann we owe the first definite records: these collectors discovered *Cal. tessellata* in October, 1930. But to Miss J. Anderson, also, credit is due. From her I have received a number of specimens in good condition, and no doubt now exists concerning their identity. *Cal. tessellata* appears to be fairly plentiful in both localities and has been previously confused with R. Tate's *Cal. cardiochila*—a shorter-segmented form.

The first-received Yarram specimens were few in number and lacked the lower portion, (leaf, etc.), still, they were identified with Fitzgerald's plant. On the other hand the 1930 Wonthaggi specimens showed slight, though definite departure from the typical form as figured by Fitzgerald in his *Australian Orchids*, Vol. I; but in New South Wales this species is regarded as a somewhat variable one. The Wonthaggi specimens certainly suggested hybridisation—as between *Cal. reticulata* Fitzg. and *Cal. cardiochila* Tate, two forms (among a number of others) which appear to hybridise with great frequency. The results, needless to say, are most embarrassing to the specialists. Miss Anderson's fine lot dispelled any existing doubt as quite a number of her flowers were typical, thus proving beyond all doubt (as already stated) that we have in Victoria Fitzgerald's *Caladenia*.

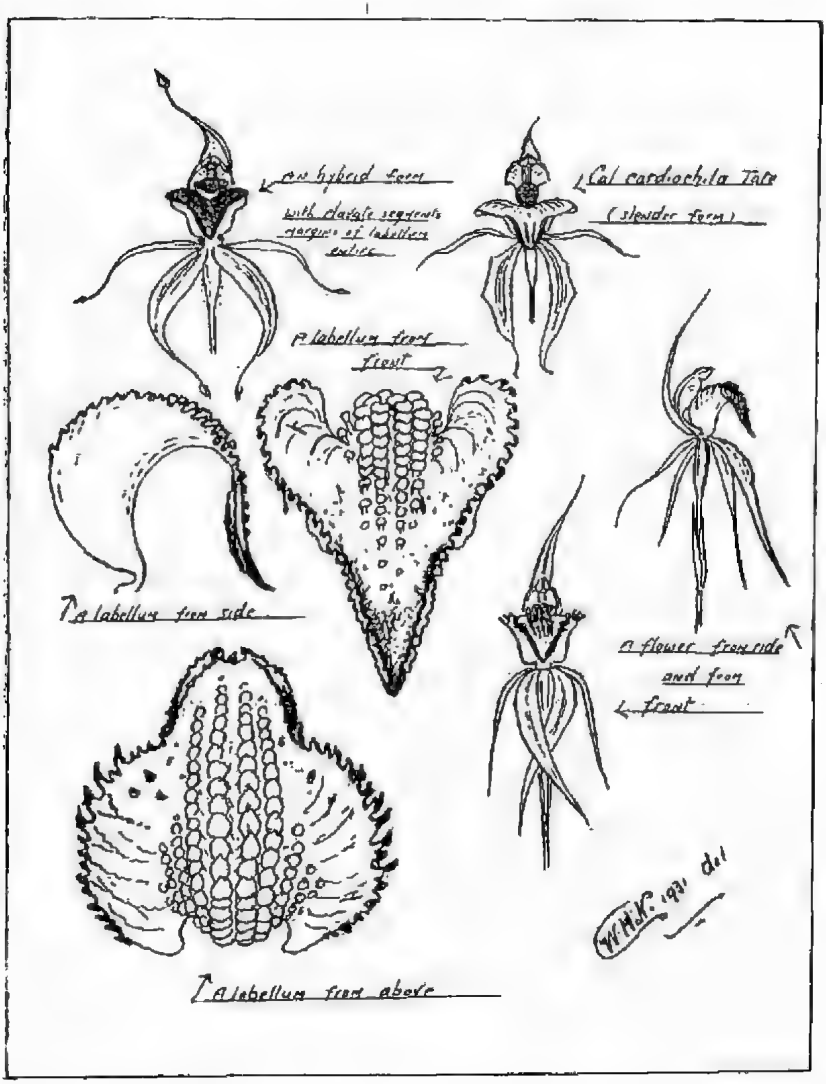
crotis orbiculares Rogers, a species not previously recorded from

The following is a description taken from Wonthaggi specimens received on October 22, 1931:—

Cal. tessellata Fitzgerald.

A slender plant with the leaf and habit of *Cal. leptochila* Fitzg., flowers usually 1, rarely 2; segments of the perianth biscuit coloured, with reddish-brown or dark brown markings, accuminate with glandular tips, occasionally minutely clavate; dorsal sepal erect, but slightly incurved, about 3·5 cm. long; lateral sepals usually pendant, occasionally crossed or somewhat spreading, about same length as dorsal one; petals about 3-3·2 cm. long; narrower than the other segments; labellum very broadly-ovate, 9-14 mm. wide x 1·3-1·5 cm. long; tip not incurved (or very rarely so), cuneate-acute; the erect margins of lamina entire then minutely and irregularly serrate, anterior margins also serrate or forming an entire thickened narrow marginal band to the end. Calli very darkly coloured, clavate; when viewed from above, having a flat tessellated appearance, and often with a tendency to imbrication; in 4-10 rows, the inner rows often extending to within a short

distance of the extreme apex; forward calli often sessile; tip of labellum either biscuit coloured or wholly reddish-brown; outer margins of lamina sometimes with short, indefinite reticulate veins;



column stout, 10-12 mm. high, broadly-winged above, red-blotched and spotted, two prominent oval yellow glands at base; anther with a short point.

Victoria.—Yarram, Wonthaggi. Fl., Sept.-Oct.

CENSUS OF THE PLANTS OF VICTORIA.

SUPPLEMENT 4.

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INTRODUCTION.

About fifteen years ago a Sub-Committee of the Club, known as the Plant Names Committee, was appointed to deal with the vernacular names of Victorian plants. The work of the Committee was published in the valuable work, *A Census of the Plants of Victoria*. As a matter of course, this Committee was dependent on the Government Botanist and his staff for a list of botanical names.

Scientific names cannot be made to order or changed by any committee of either a popular or scientific club, but depend on the systematic work of botanists throughout the world. The discussions and determinations are published in scientific journals and accepted by the ruling botanists, who are guided by the rules of International Conferences.

In August, 1930, the Imperial Botanical Conference was held at Cambridge, and many questions of vital importance to Australia were dealt with. In addition to a number of British botanists, there were present delegates from fourteen Dominions, overseas universities, and research institutes. It was decided that another Imperial Botanical Conference should take place in England in 1935, shortly before the Sixth International Botanical Congress, which is to be held in that year in Holland. Mr. J. M. Black, of Adelaide, represented Australia at the Cambridge Conference.

Members will realise that when any alterations are made full consideration is given before publication.

The present revision has been in progress for three years, and our work has been guided by the definite rules and changes accepted at the International and Imperial Congresses.

There are now about 2,250 species of flowering plants and vascular cryptogams in Victoria and some 550 naturalised aliens. The changes given here apply only to the native plants. These include new species; plants new for Victoria, plants removed to new genera, the result of botanists specialising in certain groups; alterations rendered necessary in the detection of errors in determination, spelling and changes of species names in conformation with Article 48 of the International Rules.

The authors trust that this contribution will be of value to students of the Victorian flora.

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1.—For "Dryopteris parasitica (L.) Mett.", read "D. dentata (Forsk) C. Chr. Toothed Shield Fern". N.W., S.W.
1.—For "Dryopteris punctata (Thunb) C. Chr.", read "Hypolepis punctata (Thunb), Mett., Ground Hypolepis". all but N.W.
2.—For "Davallia dubia R. Br.", read "Balantium dubium (R. Br.) Cop."
2.—Add "Asplenium scleroprium, Homb. and Jacq., Shore Spleenwort", delete "A. obtusatum". Wilson's Promontory.
3.—For "Polypodium gramitidis R. Br.", read "P. grammitidis R. Br."
3.—For "Gleichenia circinata Sw.", read "G. circinnata Sw."
3.—Delete "Gleichenia dicarpa R. Br."
3.—For "Cheilanthes tenuifolia", add "Rock Lip Fern", C. Sieberi, "Creeping Lip Fern".
3.—For "Azolla filiculoides L.", read "A. filiculoides Lam."
4.—Selaginella. For "Spring", add "Spreng".
5.—Add "Callitris tasmanica (Benth) Bak and Sm. Tasman Cypress-pine". N.W.
5.—"Sparganium ramosum", add "E."
7.—For "Zoysia", read "Zoisia".
7.—For "Themeda triandra Forst.", read "T. australis (R. Br.) Stapf."
7.—For "Panicum coenicolum F. v. M.", read "Digitaria coencicola (F. v. M.) Hughes."
7.—"Digitaria ammophila F. v. M. Hairy Umbrella-grass." N.W.
7.—For "Panicum crus-galli", read "Echinochloa crus-galli (L.) Beauv."
7.—For "Panicum divaricatissimum R. Br.", read "Digitaria divaricatissima (R. Br.) Hughes."
7. "Panicum jubiflorum Trin.", add "Paspalidium jubiflorum (Trin.) Hughes". N.W.
7.—For "Panicum leucophaeum Benth.", read "Paspalidium Brownei (R. & S.) Hughes".
7.—For "Panicum melananthum F. v. M.", read "Panicum acroanthum Steud."
7.—For "Panicum marginatum R. Br.", read "Entolasia marginata R. Br."
7.—For "Panicum repens L.", read "P. airoides R. Br."
7.—For "Panicum sanguinale L.", read "Digitaria sanguinale (L.) Scop."
7.—Delete "Setaria macrostachya" and transfer "S. verticillata" to page 82.
7.—For "Eriochloa punctata Ham", read "E. ramosa O. Kuntze".
8.—"Tetrarrhena distichophylla", add "E."
8.—For "Amphipogon strictus", delete "E.", add "All".
8.—Add "Stipa aphanoneura Hughes, Delicate Spear-grass". N.W.
8.—Add "Stipa Blackii C. E. Hubbard, Crested Spear-grass". N.W.
8.—Add "Stipa incurva Hughes, Curved Spear-grass". N.W.
8.—For "Stipa Luchmannii Reader", read "Stipa Drummondii Steud." N.W.
8.—For "Stipa Macalpinei Reader", read "S. MacAlpinei Reader."
8.—Add "Stipa mollis R. Br. Soft Spear-grass". S.
8.—Add "Stipa platychaeta R. Br. Flat-awned Spear-grass". N.W.
8.—Add "Stipa scelerata Behr., Ribbed Spear-grass". N.W.
8.—Add "Stipa variabilis. Variable Spear-grass". All.

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8.—Delete "Sporobolus indicus", read "S. Berteroanus (Trin) Hitch." and transfer to page 82.
9.—Add "Danthonia auriculata J. M. Bl., Lobed Wallaby-grass". N.E., N.W.
9.—Add "Danthonia geniculata J. M. Bl., Kneed Wallaby-grass". All
9.—Add "Danthonia setacea. Mulga Wallaby-grass". N.W., S., S.W.
9.—Add "Danthonia semiannularis (Lab) R. Br. Wallaby-grass". All,
10.—For "Eragrostis tenella L.", read "E. interrupta (Lam) Beauv."
10.—For "Agropyrum", read "Agropyron Gaertn."
11.—For "Cyperus pygmaeus Roth", read "Juncellus pygmaeus C. B. Cl."
12.—For "Cladium Mariscus R. Br.", read "C. jamnicense Crantz".
12.—For "Cladium glomeratum R. Br.", read "Cladium rubiginosum (Sol) Domin"
14.—Delete "Poir" from "Gymnoschoenus sphaerocephalus", add (R. Br.) Hook. f."
14.—For "Trithuria submersa Hk. f.", read "Juncella tasmanica F. v M."
16.—For "Arthropodium paniculatum R. Br.", read "A. milleflorum Redoute".
18.—"Prasophyllum Hartii Rog.", add "S."
18.—For "Prasophyllum odoratum", read "All".
18.—Add "Prasophyllum Morgani Nich. Dense Leek Orchid". N.E.
19.—Add "Calochilus saprophyticus Rog. Pale Beard Orchid".
19.—Add "Thelymitra D'Altonii Rog. Spiral Sun Orchid". S.
19.—Add "Thelymitra Merranae Nich. Purple Sun Orchid". S.W.
19.—For "Microtis porrifolia R. Br.", read "M. uniflora Reichb. f."
19.—"Microtis oblonga", add "S.W., N.E."
19.—"Microtis orbicularis Rog. Hooded Leek Orchid", add "S."
19.—For "Corysanthes unguiculata", add "E."
19.—For "Corysanthes bicalcarata R. Br. 1810", read "C. aconitifolius Salisb. 1805"
20.—Delete "Caladenia testacea".
20.—Add "Caladenia tutelata Rog. Sentinel Orchid". S.
20.—For "Caladenia angustata", delete "Fitz", add "Lindl".
21.—"Diuris longifolia", delete "Tall", read "Wallflower Diuris".
21.—"Diuris punctata", add "N.W."
21.—For Spiranthes australis Lindl.", read "S. sinensis (Pers) Ames".
22.—Add "Casuarina Muelleriana Miq. Slaty Sheoke". N.W.
22.—Add "Casuarina pusilla E. D. Mackl. Little Sheoke". S., N.W.
22.—Delete "Casuarina lepidophloia F. v. M.", add "C. cristata Miq."
23.—Add "Grevillea ilicifolia R. Br. var. lobata Benth. Sombre Grevillea". S., S.W.
25.—"Emex australis Steinh.", transfer to page 77.
25.—For "Rhagodia hastata", add "N.W."
25.—Delete "Chenopodium triandrum Forst."
25.—Add "Chenopodium microphyllum F. v. M. Small-leaf Goosefoot." all but E.
26.—Add "Bassia biflora (R. Br.). Twin-flower Saltbush". N.W.
26.—Add "Kochia excavata J. M. Black. Creeping Bluebush". N.W.
27.—For "Salicornia australis Soland", read "Banks and Soland".
27.—For "Amarantus", read "Amaranthus".
27.—For "Codonocarpus cotinifolius F. v. M.", read "Gyrostemon cotinifolius Desf."
27.—For "Glinus lotoides L.", read "Glinus lotoides Loefl.; Molluginaceae".
27.—For "Mesembrianthemum", read "Mesembryanthemum".

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28.—Delete "Calandrinia pusilla Lindl."
28.—Add "Spergularia diandra Heldr. and Sart. Lesser Sandspurrey". All.
28.—"Spergularia rubra", delete "Camb.", read "(L.) J. and C. Presl."
28.—"Polycarpon tetraphyllum", delete "L. F.", add "Loefl.", transfer to page 81.
28.—"Dysphania littoralis", change to "Chenopodiaceae".
28.—Delete "Colobanthus subulatus", add "C. Benthamianus Fenz."
28.—Change "Scleranthus" from "Caryophyllaceae" to "Illecebraceae".
29.—"Stephania hernandifolia", delete "Stephania", add "Corella-vine".
29.—For "Hedycaryia", read "Hedycaria".
29.—Delete "Anonaceae", read "Eupomatiaceae".
30.—For "Nasturtium palustre D. C.", read "Roripa Islandica Schiz. and Thell."
30.—Add "Cardamine tenuifolia Hk. Slender Bittercress". All.
30.—"Cardamine laciniata", add "N.E."
31.—"Cakile edentula maritima (Scop.)", delete "Scop.", add "Pursh."
31.—"Drosera Planchonii", delete "E.", add "All".
31.—"Crassula exserta", delete "Reader", add "Ostenf." N.W.
33.—Add "Acacia phlebophylla F. v. M. Buffalo Sally". N.E.
34.—"Acacia vestita", delete "Edwards", add "Ker; Gawl."
34.—"Acacia salicina", delete "Willd.", read "Lindley".
34.—Delete "Callistachys", read "Oxylobium". Delete "elliptica Vent", add "Oxylobium ellipticum Vent." Delete "O. trilobata", read "O. trilobatum F. v. M."
35.—Add "Daviesia buxifolia Benth. Box-leaf Bitter-pea". N.E.
35.—"Pultenaea procumbens A. Cunn. Curl-leaf Bush-pea". N.E.
36.—"Pultenaea Readeriana", add "E."
36.—"Pultenaea viscosa R. Br. Sticky Bush-pea". E.
36.—"Dillwynia hispida", add "S.W."
37.—Add "Goodia medicaginea F. v. M. Small Golden-tip". S., S.W., N.W.
37.—Add "Desmodium brachypodium A. Gray. Short-pod Tic-trefoil". E.
39.—Add "Boronia dentigera F. v. M. Toothed Boronia". All.
39.—Add "Boronia hispida Cheel. Bristly Boronia". N.W., S.W.
39.—Add "Boronia rigens Cheel. Stiff Boronia". E., S.W.
40.—"Acronychia laevis", delete "Vorst.", add "Forst."
40.—For "Polygala veronicea F. v. M. 1860", read "P. Sibirica L. 1753"
40.—For "Bredemeyera", read "scoparia, volubilis, retusa, ericina, defoliata".
42.—"Dodonaea attenuata", add "E."
43.—"Discaria australis", add "N.W."
43.—"Ruelingia prostrata", delete "S.", add "E."
43.—"Thomasia petalocalyx", add "E."
44.—"Hypericum japonicum", add "All".
44.—Delete "Elatine americana", add "E. gratioloides A. Cunn."
44.—Add "Bergia trimera Fisch. and Mey. Small Waterfire". N.W.
44.—Add "Frankenia angustipetala Summerhayes. Thyme Seaheath". N.W.
44.—Delete "Frankenia serpyllifolia Lindl., not Vict."
44.—Add "Frankenia foliosa J. M. Black. Pink Seaheath". N.W.
44.—Transfer "Frankenia pulverulenta L." to page 77, Introd.
44.—For "T. fruticulosa D. C.", read "F. sessilis Summerhayes. Small-leaf Seaheath".
45.—For "Hymenanthera dentata R. Br.", read "H. angustifolia R. Br."

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45.—For "Pimelea linifolia Sm.", read "P. involucrata Banks and Sol."
46.—Add "Eucalyptus bicostata. Victorian Blue Gum". All except N.W.
46.—"Eucalyptus Baxteri Benth. Brown Stringybark". S., S.W.
46.—Delete "Eucalyptus coriacea var. alpina", add "E. niphophila Maid. and Betch."
46.—Add "Eucalyptus Dawsonii R. T. B. Slaty Gum". N.E.
47.—Add "Eucalyptus glaucescens Maiden and Blak. Alpine Mallee". N.E.
47.—"Eucalyptus laevopinea R. T. B. Silver-top Stringybark". E., S., N.E.
47.—"Eucalyptus novae-anglica Maiden. New England Peppermint". S., E., N.E.
47.—"Eucalyptus oviformis, Maid. and Blak. Rare Red Gum".
47.—Add "Eucalyptus paradoxa Maid. and Blak. Puzzling Blue Gum". E. Metung
47.—"Eucalyptus phellandra", add "S.E."
47.—Add "Euc. pseudoglobulus (Hort.) Naudin. False Blue Gum". E. Metung.
47.—Add "Euc. Robertsonii Blake. Messmate Peppermint".
47.—Add "Euc. St. Johnii R. T. B. Minor Blue Gum". N.W., S., S.W.
47.—Add "Eucalyptus Wilkinsoniana R. T. B. Mallee Stringybark" N.W.
48.—"Eucalyptus uncinata Turcz.", delete "Labill."
50.—For "Thryptomene calycina J. M. Bl.", read "Stapf."
50.—For "Halorrhagis", read "Haloragis".
50.—For "Jussieua", read "Jussiaea".
51.—Add "Astrotricha linearis A. Cunn. Narrow-leaf Starhair". E.
51.—For "Didiscus pusillus", read "D. pilosus (Sm.) Domin."
51.—For "Didiscus pilosus Benth.", read "D. Benthami Domin."
52.—For "Azorella cuneifolia F. v. M.", read "Oschatzia cuneifolia F. v. M.
52.—Add "Eryngium tetracephalum Bunge. Small Blue Devil". N.W.
52.—"Daucus glochidiatus", delete "(Lab.) Fisch.", add "Fisch. and Mey."
52.—"Gaultheria hispida", add "E."
52.—"Wittsteinia vacciniacea", add "E."
52.—"Melichrus urceolatus R. Br.," add "N.W."
52.—For "Liliæopsis", read "Lilæopsis".
53.—For "Acrotriche ventricosa Luehm.", read "A. prostrata F. v. M.", add "E."
53.—Delete "Epacris longiflora".
54.—Delete "Rapanea variabilis", add "R. Howittiana (F. v. M.) Mez. Turnip-wood".
54.—For "Statice australis Spreng.", add "Limonium australe Ktz."
55.—Add "Marsdenia australis (R. Br.) Druce. Doubah". N.W.
55.—Delete "Erythraea australis R. Br.", add "Centaurium puchellum Hoch., var. Muelleri, Hochr."
56.—For "Borraginaceae", read "Boraginaceae".
56.—For "Eritrichum australasicum D. C.", read "Allocarya australasica (D. C.) Green".
56.—For "Lappula concava", read "Omphaloiappula concava (F. v. M.) Brand."
56.—For "Rochelia plurisepala F. v. M.", read "Allocarya plurisepalea (F. v. M.) Brand.
56.—For "Lycopus australis R. Br.", read "L. europaeus Linn."
56.—For "Mentha gracilis R. Br.", read "Mentha diemenica Spreng."
56.—For "Brunella", read "Prunella L."
56.—Delete "Chloanthes parviflora Walp."

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57.—"Prostanthera nivea," add "N.W."
57.—Add "Scutellaria mollis R. Br. Hairy Skullcap". E.
57.—"Prostanthera meliasifolia," add "N.E."
58.—Delete "Tecoma australis", add "Tecoma pandorana (Andr.) Skeels."
58.—"Veronica Derwentia," delete "Littej.", add "Andr."
59.—For "Orobanche australasica, F. v. M.", read "O. cernua Loefl."
59.—For "Myoporum Dampieri A. Cunn", read "M. montanum R. Br."
59.—Add "Myoporum parvifolium R. Br. Small-leaf Myoporum". N.W., S.W., S.
59.—For "Eremophila longifolia", read "Stenochilus longifolius R. Br."
59.—For "Eremophila polyclada", read "Pholidia polyclada (F. v. M.) Kranz."
59.—For "E. bignoniifolia", read "Pholidia bignoniiflora Kranz."
59.—Read "Stenochilus glaber R. Br." instead of "Eremophila glabra (R. Br.) Ostenf."
59.—Read "Stenochilus maculatus Ker." instead of "E. maculata F. v. M."
60.—Add "Coprosma nivalis Oliver. Snow Coprosma". N.E.
60.—Add "Coprosma Tadgelli Oliver. Mountain Coprosma". N.E.
60.—Delete "C. Billardieri", add "Coprosma quadrifida (Labill) Robinson".
60.—Delete "C. pumila Hk. f.", read "C. repens Hk. f."
60.—"Coprosma nitida," add "E."
60.—Add "Asperula subsimplex Hk. Water Woodruff". S.W.
61.—Place "Lobelia, Pratia, Isotoma" in "Lobeliaceae".
61.—For "Pratia erecta Gaud.", read "Pratia concolor (R. Br.) Druce".
61.—Add "Goodenia primulacea Schlecht. Primrose Goodenia". N.W.
62.—For "Scaevola suaveolens R. Br.", read "Scaevola calendulacea (Andr.) Druce".
63.—For "Stylidium perpusilla F. v. M.", read "S. perpusillum Hk. f."
—For "S. calcaratum F. v. M.", read "S. calcaratum R. Br."
—For "S. despectum F. v. M.", read "S. despectum R. Br."
62.—"Adenostemma viscosum," delete "N.W."
63.—"Olearia glutinosa," add "E."
63.—For "Vittadinia australis A. Rich.", read "Vittadinia triloba (Gaud.) D. C."
63.—Add "Vittadinia megacephala (F. v. M.) J. M. B. Large-headed Daisy". S., N.W.
63.—Add "Vittadinia pterochaeta (F. v. M.) J. M. B. Wing-seed Daisy". N.W., N.E.
63.—Add "Vittadinia tenuissima (Bth.) J. M. B. Slender Daisy". N.W.
64.—For "Calotis lappulacea", add "E."
64.—For "Lagenophora Billardieri", read "L. stipitata (Lab.) Druce"
64.—For "Lagenophora Emphysopus Hk. f.", read "Lagenophora Gunnii (Hk. f.) J. M. B."
64.—Delete "Brachycome chrysoglossa F. v. M.", read "B. marginata Bth."
64.—Delete "B. collina", add "Brachycome perpusilla (Steetz) J. M. B."
64.—Add "Brachycome lissocarpa J. M. Black. Creeping Daisy" S.W.
65.—"Brachycome Tadgellii," add "Alpine".
65.—For "Epaltes australis L.", read "Lessing".
65.—For "Centipeda orbicularis Lour", read C. minima (L.) A. Br. and Aschers".
66.—For "Craspedia Richea Cass.", read "Craspedia uniflora Forst."
66.—For "Quinetia Urvellei", read "Q. Urvillei".
67.—For "Rutidosis Pumila Benth.", read "Rutidosis multiflora (Nees) Robinson".

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67.—Delete "Ixiolaena tomentosa", not "Vict."
67.—Instead of "Podotheca Cass.", read "Podosperma Lab. 1806".
67.—For "Podolepis rhytidochlamys", read "Podolepis arachnoidea (Hk. f.) Druce".
67.—Delete "Leptorrhynchus", add "Leptorhynchus".
67.—Add "Leptorhynchus medius A. Cunn." S.W., N.W.
67.—Add "Leptorhynchus panaetioides Benth." N.W., S.
67.—For "Helichrysum lucidum", read "Helichrysum bracteatum (Vent.) Andr."
67.—Add "Helichrysum retusum Sond. and F. v. M. Blunt-leaf Everlasting". S., N.W.
67.—For "Helipterum incanum", read "H. albicans (A. Cunn.) D. C."
68.—For "Helipterum australis", read "Helipterum australe (Gray) Ostenf."
68.—For "H. hyalospermum", read "Helipterum variable (Sond.) Ostenf."
68.—For "Helipterum cotula", read "Cotula".
68.—For "Helipterum exiguum F. v. M.", read "H. demissum (A. Gray) Druce".
68.—Delete "Ewartia catipes (D. C.) Beauv."
68.—Add "Helipterum Sturtianum Sond. Flowery Sunray". N.W.
69.—Add Senecio hypoleucus F. v. M. Downy Groundsel". N.W.
69.—"Senecio lautus," delete "Forst." add "Sol."

STUDY OF THE GENUS *NICOTIANA*.

Professor T. H. Goodspeed, Professor of Botany and Curator of the Botanical Gardens, University of California, for over twenty years has been engaged in a study of the genus *Nicotiana*. In a letter to the Hon. Secretary, he asks for the co-operation of our Club.

"The problem of the distribution of *N. suaveolens* in Australia, and particularly the question of the extent to which distinct species occur," Professor Goodspeed writes, "is one which has not been adequately investigated. Some years ago, through the co-operation of Sir Arthur Hill, Director, Kew Gardens, I received a number of collections of seeds from various parts of Australia. The plants which we have grown from these collections prove exceedingly interesting and I am very desirous of obtaining still further collections. I know that *suaveolens* is likely to be quite restricted in its occurrence in any given area and there may be certain difficulties in obtaining seeds. I will, therefore, all the more appreciate such assistance as you may find it possible to give me. . . .

"Mr. Hubbard felt that a brief note in the Australian newspapers as to my desire for seed of the Australian Wild Tobacco might reach persons in isolated localities who have enough interest in the plants of the region to be able and willing to collect a little seed."

It was at the suggestion of Mr. Hubbard, whose acquaintance he made at Kew Herbarium, that Professor Goodspeed wrote to the Club.

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THE FIELD NATURALISTS' CLUB OF VICTORIA.

A special general meeting of the Club was held in the Royal Society's Hall on Monday, 9th November, 1931. The President, Mr. J. A. Kershaw, was in the chair, and 100 members were present.

Mr. A. J. Swaby, Hon. Secretary, moved that Rule 11 be altered by striking out the word "and" before "Assistant," and inserting the word "Assistant" before "Librarian" in the line immediately following. The motion was seconded by Mr. G. N. Hyam, Vice-President, and carried unanimously.

To fill the vacancy so created, Mr. H. V. Miller and Mr. C. Daley nominated Mr. W. H. Ingram.

The meeting then closed.

The ordinary monthly meeting was held immediately after the special meeting, with the President, Mr. J. A. Kershaw, in the chair, and about 110 members and visitors present.

CORRESPONDENCE.

Mr. F. J. Cardiff, Secretary of the Combined Progress Associations of the Shire of Fern Tree Gully, asked for Club representation on a deputation to the Minister for Forests, the object being to ask for the fencing and cleaning up of 100 acres of the Monbulk State Forest. The area would be used as a sanctuary for fauna and flora.

Mr. G. N. Hyam, who attended the deputation with Messrs. F. A. Pitcher, C. Daley, and G. Coghill, reported a favourable reception, and asked for delegates to a conference at Belgrave on 21st November, at which the development of the plans would be further considered. Messrs. Hyam, Pitcher, and Hooke were appointed.

The Hon. Secretary of the Women's Auxiliary, Melbourne Volunteer Bush Fire Brigade, invited women members of the Club to the annual meeting. The Chairman asked members who thought of attending to inform the Secretary.

EXCURSION REPORTS.

Reports were furnished by Mr. W. C. Tonge, Eltham, and Mr. A. J. Swaby, Seaford.

ELECTION OF NEW MEMBERS.

By a show of hands, the following members were elected:—As Ordinary Members: Mrs. E. M. Brunton, Misses A. L. Ewins, and N. McLean, Messrs. H. Jones, G. Russell, and E. R. Manks. As Associate Members: Masters K. A. Bailey and K. Gallagher.

GENERAL BUSINESS.

Mr W H. Ingram, Special Hon. Secretary for the Wild Nature Show, estimated the profit for the Show at over £200.

PAPERS.

Mr. F. E. Wilson, F.E.S., gave a lecture on "Aquatic Insects." Miss J. W. Raff, M.Sc., F.E.S., supplemented his remarks.

EXHIBITS.

Mr. A. D. Hardy.—Larvæ of *Chironomus* (sp.), from eggs exhibited at October meeting.

Miss J. W Raff.—Larvæ and nymphs of various aquatic insects.

Master P. Flecker.—Spine-tailed Lizard, and skin of Banded Anteater (W.A.).

Mr. A. S. Kenyon.—Garden-grown specimens of *Eucalyptus torquata, E. melliodora,* with lerps on the leaves, *E. dumosa, E. uncinata, Hakea laurina, H. elliptica, H. saligna, Agonis flexuosa,* and *Callistemon phœniceus.*

Mr. F. S. Colliver.—A series of Tertiary Echinoids, including —*Cidaris* (sp.). Port McDonnell and Balc., Royal Park; Cidaroid spines, Janj., Waurn Ponds; *Goniocidaris plumispinosa* Balc., Balcombe Bay; *G. pentaspinosa* Balc., Balcombe Bay; *Lovenia forbesi* Kal., Beaumaris; *Psammechinus woodsi* Balc., Royal Park; *Monostychia australis* Kal., Beaumaris; *Clypeaster gippslandicus* Balc., Muddy Creek; *Duncaniaster australis* Janj., Waurn Ponds. *Eupatagus rotundus* Janj., Table Cape; *Echinolampus* (sp.) Janj., Table Cape and Balc., Beaumaris; *Scutellina patella* Balc., Muddy Creek, also, to show appearance when living; *Maretia ovata,* Williamstown, and *Strongylocentrotus erythrogrammus,* Port McDonnell.

Mr. H. P. McColl.—Stick insect, Mt. Dandenong.

Miss G. E. Neighbour.—Hand paintings of moths and butterflies:—*Agarista agricola, Chaerocampa celerio, Delias aganippe, D. harpalyce, D. mysis, D. argenthona, Miletus narcissus, M. hecalius, Pseudalmenus chlorinda,* and *Papilio ægeus,* a rare gynandromorph specimen in the National Museum.

Mr. Leo W. Stach.—A series of rarer fossils from Kalimnan at Beaumaris, above the nodule bed:—*Aturia australis,* Voluta of *Ancilloides* (cast). *Clausinella allportii,* hitherto reported only from Table Cape beds (upper), and Rose Hill; *Crassatellites oblonga* (recorded by Mr. Chapman from Rose Hill), *Ancilla oryeta, Bullinella exigua, Corbula ephamilla, Dosinia* (sp.)

Mr. Jas. A. Kershaw.—Spiny Seahorse, *Solegnathus spinosissimus,* Gunth., Victorian coast; Sea Dragon, *Phyllopteryx foliatus* Shaw, Loc., Flinders, Victoria.

Note:—Miss Neighbour asks for the loan of butterflies or moths, particularly "freak" specimens, for painting. Address: Miss G. Neighbour, 34 Cochrane Street, Brighton, S.5.

NOTES FROM THE MALLEE.

By W. J. ZIMMER, Forest Officer, Mildura.

After several years of drought the North-Western Mallee has staged a good recovery. From 1925 the seasons have been dry; 1929 saw the country a moving mass of sand; but with the improved season of 1930 and the present good year the outlook has been altered completely. With the return of good seasons the native trees and shrubs have put forth new growth, and the flowering and seeding in most instances has been remarkably heavy.

Taking into consideration the natural covering, the north-west of Victoria can be divided into five distinct sections:—

1. Red Gum and Box Flat Belt.
2. Pine Belar and Buloke Belts.
3. Fair Land, Mallee Areas.
4. Desert Areas.
5. Treeless Plains.

River Red Gum (*E. rostrata*) and Black Box (*E. bicolor*) are always confined within close limits to the Murray River, with, perhaps, a few exceptions where Black Box extends to about nine miles from the actual river bed. In these cases, however, the land is subjected to periodical flooding by excess water from the Murray. It has often been stated that wherever *E. bicolor* is to be found the flood waters from high floods will find their ways This was proved during the flood of 1931. During October and November several fine flowering specimens of *E. bicolor*, carrying crimson flowers, were to be seen in the Kulkyne State Forest. The River Red Gum predominates along the banks of the Murray, its main creeks and billabongs, and fresh water lakes in the vicinity of Hattah. Black Box occupies the low flats between the creeks, bungs, and sandhills adjacent to the river. Scattered throughout the Euwong (*Acacia salicina*), Willow Wattle (*A. stenophylla*) and Myall (*A. homalophylla*) are the largest trees, and are common.

Native Pine (*Callitris*), Belar (*Casuarina lepidiphloia*) and Buloke (*A. Lehmanii*) are not so moisture-loving as Red Gum and Black Box, and are to be found well removed from the river. Usually *Callitris* and *Casuarina* do not form extensive mixed stands, but more or less group themselves together within the belt, appearing as a pronounced predominant stand of, say, Belar surrounded by Pine, or *vice versa*. Buloke also occurs in patches in the same manner. The most common and useful species of *Callitris* are *C. robusta* (Murray Pine) and *C. proprinqua* (Slender Pine). These occur, mixed, throughout the better classes of soil. *C. verrucosa* (Scrub Pine) is common in dry, sandy belts, as is also a type close to *C. calcarata*.

A large variety of small trees and shrubs form a lower canopy. Three species of Needlewood are quite numerous—*Hakea vittata*, *H. leucoptera* and *H. rostrata*. All of these have very sharp-pointed needles. Other plentiful species are the Cattle Bush, locally called Cabbage Bush (*Heterodendron oleifolium*), a splendid shade tree; the Bush Cherry (*Exocarpus aphylla*), and the Sugar wood or Sandalwood (*Myoporum platycarpum*), a wood which burns with an extremely black smoke. Several different Emu Bushes occur, the most common of which are *Eremophila longifolia*, *E. oppositifolia*, both small trees, smaller types being represented in *E. scoparia*, *E. gibbifolia*, *E. polyclada*, and *E. glabra*. The Native Pittosporum (*Pittosporum phillyreoides*), very pretty with its golden pods and red seeds, and numerous wattles, form small under-shrubs to trees.

The North-west is favoured with a very extensive range of Wattles, about 26 species being present. The genus is represented by the leafless type with spinescent branchlets (*Acacia spinescens*); by the sharply-pointed rigid phyllodes (*A. colletioides*); the prickly and spiny *A. vomeriformis*, the small phyllode section by *A. farinosa*, *A. montana* and *A. linearis*, and the rare *A. acanthoclada*, the soft needle-like *Acacia calamifolia*; numerous ordinary phyllode types, such as *A. hakeoides*; the broad short form of *A. obliqua* and the extremely long linear phyllode type of *A. stenophylla*.

The Quandong is met with occasionally, both the Sweet Quandong (*Fusanus acuminatus*) and the Bitter Quandong or Ming (*Fusanus persicarius*). These trees produced a heavy crop of fruit, presenting a vivid picture, the red fruits contrasting with the green of the foliage. The fruits were badly attacked by a minute grub, both in the Quandong and Ming.

Swampy localities, always of small area, carry Tea-Tree (*Leptospermum coriaceum*) and "Heath"—local name for *Melaleuca* (*Melaleuca pubescens*), and *M. squarrosa*. Large tracts of Mallee connect the Red Gum-Black Box areas and the Pine-Belar-Buloke areas.

The Mallee areas can be divided into two sections—that growing on average land, consisting of limestone and sandy areas, and the desert type of country, always extra dry and arid, and clothed with stunted Mallee mainly. The first section carries large Mallee of the following species:—*E. incrassata*, normal type, intermediate form and varieties *angulosa* and *dumosa*; *E. oleosa*, *E. gracilis*, *E. Behriana*, *E. calycogona*, *E. viridis* and *E. incrassata*. The second type carries the same species more or less, but in a very stunted form. Scrub Pine (*Callitris verrucosa*) is also present, and Ming. The Bell Fruit Tree (*Codonocarpus cotinifolius*) occurs, but is not common. *Acacia rigens*, *A. spinescens*, *A. vomeriformis*, and *A. acanthoclada* are scattered throughout. *Eco*

corpus spartea (Broom Ballart) is fairly common, and is confined to dry, arid situations. The following small shrubs have been observed from time to time:- *Grevillea Huegelii*, *G. aquifolium* and *G. pteridosperma*. These three species flowered during October.

Callistemon brachyandrus is rather rare. Two forms of *Cassia*, *C. eremophila* and *C. Sturtii*, both with bright yellow flowers, are a common sight near Mildura. The Native Cherry (*Exocarpus aphylla*) has brightened up after the good rains and is now thriving. Several species of Hop Bush (*Dodonaea*) occur. Smaller shrubs are represented in *Beyeria* (Turpentine Bush). *Baeckea*, *Westringia*, *Phebalium*, *Halgania* and *Dampiera*. *Jasminum lineare* was seen to advantage, flowering profusely and twined about Mallee (*E. incrassata*, var. *angulosa*), common in the Boulka Lake country. The Murray Lily (*Crinum flaccidum*) was at its best, forming garden-like beds of large scented flowers.

Large areas—the treeless plains—are very wind-swept, and apparently never carried timber. Saltbushes (*Bassia* and *Atriplex*) form the chief vegetation.

The Mistletoe pest is extremely common, perhaps more so near the Murray River. *Loranthus linophyllus* is plentiful on Buloke, as is also *L. exocarpi*. An interesting specimen was obtained of *L. exocarpi parasitic* on *L. linophyllus*, which was attached to a large Buloke. The form of *L. linophyllus*, which attacks *Acacia calletioides* in the north, is very different in appearance from the form growing on Buloke. The leaves are much shorter, thinner and softer to the touch. Black Box appears to be more prone to attack than Red Gum, but no tree or large shrub escapes, as some form or other is to be found on nearly every species, with the exception of *Callitris*, which is not attacked.

SILVER GULLS NESTING IN WESTERN DISTRICT.

In a letter to the editor, Mr. Wilfred F. Hill, of Bendigo, gives interesting notes on a lake islet in the Western District:—

"Near the township of Cressy is Lake Martin, and on a small mud island in it there used to be colonies of the Silver Gull and the black-headed (Marsh) Tern. They nested there every year. (I am speaking of 20 years ago.) The nests were often raided by boys, who sold the young gulls in Ballarat, as good slug and snail destroyers. I visited this rookery several times, and, so far as I know, it was the only one in the district, and was about 50 miles inland. It was quite unprotected, and the birds nested on the bare ground, using pig-face (*Mesembryanthemum*) and any drift vegetation as building material.

"The nests were placed so that each bird was just out of reach of her neighbour's beak. Close to the Silver Gulls' nesting ground, where several thousand birds were sitting, the Terns nested, under similar conditions, but in smaller numbers. The curious thing was that between each of these colonies was a well-defined "No Man's Land," where no nests were to be found, but where the remains of young gulls showed the fate of any wandering chick which strayed into the wrong camp."

THE BLACK SPLEENWORT IN VICTORIA.

By CHARLES BARRETT.

Common Spleenwort is the generally-accepted trivial name for *Asplenium Trichomanes*, but this charming little fern is rare in our State. There are only six Victorian specimens in the National Herbarium, and few of our botanists have collected the "Common" Spleenwort south of the Murray.

Localities for *A. Trichomanes* are the Upper Murray, Buffalo Mountains, Grampians, Dartmoor, and the Buchan district. Last month Mr. T. Green found this small, tufted Spleenwort growing at the entrance to the Federal Cave, at Buchan, and took the photograph here reproduced, which shows the kind of spot where the fern loves to grow. From rocky banks down Dartmoor way, some years ago, I collected specimens of the black Spleenwort—"black" is preferable to "common." In deep crevices the fern was growing, its black, rigid frond-stalks contrasting with pale-coloured rock and their own green pinnæ. High road banks near the river were tufted with plants of *A. Trichomanes*, smaller than those of the necklace fern (*A. flabellifolium*), for which it sometimes has been mistaken. The latter species is variable, and in one of its forms bears a resemblance to the Black Spleenwort. But it is easy to distinguish between the two. Remember that *A. Trichomanes*, besides being usually a smaller plant, is much more rigid than the necklace fern. The rare species seldom exceeds six inches in height. It grows upright mainly, but also has a tendency to creep. The slender stems are black and polished, lighter-hued below—more of a brownish tint. The pinnæ, ovate in typical specimens, are of a dark green colour; usually the edges are toothed or indented, but sometimes almost entire.

A. Trichomanes is a cosmopolitan plant, occurring on all the continents. It is found in New South Wales and Tasmania, also New Zealand (both the North Island and the South Island). It flourishes in both tropical and temperate regions.

English Maidenhair, Maidenhair Spleenwort, Wall Spleenwort and Common Spleenwort are among the popular names for *A. Trichomanes* in Great Britain, where the species is widely spread. Rich the folk lore of such a plant should be, and it has, in fact, a distinguished place in the old herbals. The specific name *Trichomanes*, meaning "a growth of hair," indicates that the Black Spleenwort was credited with a property which it does not possess. For centuries it enjoyed the reputation of being an excellent "hair restorer." Perhaps the black and hair-like stems had something to do with this belief. Gerard declares that an infusion of Spleenwort is "good to wash the head," while Parkinson, another of the famous old herbalists, says: "It both stayeth the shedding

Photo. by T. Green

Black Spleenwort growing at the Entrance to Federal Caves, Buchan.

of the haire, and causeth it to grow thicke." Has any modern botanist tested these opinions of pioneers of plant study? Hair restoring is but one of this Spleenwort's "vertues," according to Gerard and others. Even the illustrious John Ray refers to its value as a remedy for diseases of the chest!

English writers on ferns describe many varieties of *A. Trichomanes*, but none of them, I believe, has yet been recorded for Victoria. Most charming is the variety *incisum*, figured originally by Plukenet in his *Phytographia* (1691). The deeply-cut, narrow and acute pinnæ of this variety are more or less triangular in outline.

Asa Gray, the noted American botanist, and friend of Charles Darwin, has recorded a phenomenon which places *A. Trichomanes* among the wonder plants. He was not himself the observer. A Washington resident noted that one of the fronds of a tuft of the Common Spleenwort, growing in a glass dish in his house, "made quick movements alternately back and forth in the plane of the frond, through from 20 degrees to 40 degrees, whenever the vessel was brought from a shaded situation into sunlight or bright daylight." When it was younger the frond's movements were more rapid than those of the second hand of a watch, but there were occasional stops in the course of each half-vibration. The active frond was rather short and erect, and showing fructification. All the other fronds were sterile and reclining, and none made any movement.

The following notes are contributed by Mr. A. J Tadgell:—

The Common Spleenwort is found in N.E. Victoria, on the Kiewa River, near Mt. Bogong, and near Omeo, at the Cobboras Mounts; in the S.W. of Victoria it will be seen near Dartmoor, on the Glenelg River, also at the Grampians I have found it in the crevices of huge rocks—opened by frost—near the Yarrangobilly Caves, at Kiandra, N.S.W., which, for a long time, held the reputation of being the highest inhabited place in Australia. It is rather a difficult fern to grow in cultivation, as it needs little moisture in its sandy loamy soil, and its crown must not be watered. It is thus better to adopt its natural conditions, and grow it in a rocky or a gritty soil. The fern becomes untidy looking in age, as the leaves fall from the slender stems, which still persist, and their naked appearance gives them the look of coarse, long, black, glossy hairs. This, perhaps, is responsible for this Spleenwort's specific name *Trichomanes*.

A better vernacular name for *A. Trichomanes* would be "Maidenhair Spleenwort" for not only is it superficially like the *Adiantum* maiden-hair, but this Spleenwort perpetuates a pretty German legend. In the folk lore of the Fatherland it is recorded that a handsome lady, to evade another danger, was falling over

a precipice, when she was caught by the hair and held. Later a fern grew in the place of the maiden's accident, and ever since the Spleenwort has been known in Germany as Maiden-hair Fern, a name also by which it is known in New South Wales. The name "Spleenwort" has common application to several ferns of the same genus. They were used for diseases of the spleen by the old medicmers. The spleen was considered to be the source of anger and black bile or melancholy, and a common remedy was the seed, like dust, of the asplenium, mixed with the juice of the plantain. A tea-like preparation was made from the leaves, and still is used as a vermifuge or worm powder. There are still people who make a concoction from Spleenworts for pulmonary troubles.

EXCURSION TO ELTHAM.

About 30 members and friends of the club took part in the excursion to Eltham on October 17. Showers in the morning had made the paddocks damp, but the afternoon was more favourable for field work. A good number of birds was seen and heard, and several nests were inspected.

A nest of Tawny Frogmouths (*Podargus strigoides*) on the limb of a Box tree had just been vacated, misfortune having happened to the eggs. In the gully close by a Yellow Robin's nest was seen, and close to it a pair of Golden-breasted Whistlers (*Pachycephala pectoralis*) had a nest half-built in a Sweet Bussaria bush. The next nest visited was that of a White-throated Tree Creeper (*Climacteris scandens*), and the parent birds were observed visiting the nest in a hole about 10 feet up in the bole of a Red Box tree; it contained three newly-hatched nestlings. In a Stringy-bark not far away a pair of Brown Hawks (*Hieracidea orientalis*) had a nest about half-built on a limb about 35 feet above the ground. Several nests of White-winged Chough (*Corcorax melanoramphus*) were in the vicinity, and one parent bird was observed feeding its young. Some of the Choughs' nests were built fairly high in the Stringy-barks.

In our own paddock a Tawny Frogmouth was sitting on her two white eggs, in a frail nest on the fork of a Box tree close to the house, and the party was able to observe the lizard-like appearance of the bird at close range. Among other birds noted were Rufous-breasted Whistlers (*Pachycephala rufiventris*), Black-faced Cuckoo Shrikes (*Coracina novæ hollandiæ*), Scarlet Robin (*Petroica multicolour*), Painted Quail (*Turnix varia*), Grey Thrushes (*Colluricincla harmonica*), Mistletoe Bird (*Dicæum hirundinaceum*), Wattle Birds and several other Honeyeaters.

—W. C. TONGE.

QUEENSLAND SLUG IN VICTORIA.

At the November meeting of the Club Mr. J. A. Kershaw exhibited, for the National Museum, a living specimen of the Giant Slug, *Anadenus graeffei* Humbert, which was found on Staghorn Fern at Murrumbeena, Victoria, by Mr. A. Sunderland, on November 4, 1931. This species occurs in Queensland and northern New South Wales and was probably introduced into Victoria with a consignment of ferns. Previously taken in Victoria on bananas (November, 1908) and on Bird's Nest Fern (September, 1924).

SOME PORT PHILLIP FISHES.

By J. A. KERSHAW, C.M.Z.S. (Hon. Zoologist, National Museum, Melbourne).

Among the numerous fishes of Port Phillip there is quite a number which would form suitable and most attractive exhibits in the Melbourne Aquarium, and which could be obtained with little difficulty and at comparatively small cost.

Sharks particularly, because of the ferocious habits of a few of them, always arouse the keenest interest and comment. It would not be necessary to aim at the larger species; there are many of the smaller kinds available, which would probably adapt themselves to the confined space of a fair-sized tank much more readily than the ten-feet examples, and which would be quite as interesting and attractive.

Of these, the common "Port Jackson" or "Bull-Dog" Shark (*Heterodontus philippi*) is excellently suitable. It is plentiful, and is remarkable for its unusual shape and markings, its extraordinary crushing teeth, and the fact that it is a survival of a group of sharks showing very ancient structural characters. From its fossil remains it would appear that these sharks were at one time numerous, and greatly exceeded in size the existing species.

The School Shark (*Galeorhinus australis*) and the Gummy (*Mustelus antarcticus*), both of which produce their young alive, are numerous, and grow to a length of from three to five feet. The former produce up to fifty living young at a birth, each measuring a foot in length.

The Banded Carpet Shark (*Orectolobus devisi*) is not uncommon in rocky situations, though it does not frequent the shallow waters of Hobson's Bay. It obtains its name from the beautiful carpet-like arrangement of its body markings, which closely assimilate its immediate surroundings. Its broad head and large mouth, furnished with several rows of long, curved teeth, and the fringe of weed-like tentacles suspended from its lips, give it a hideous appearance. It is, however, the most beautifully marked of all our Sharks, and grows to a length of six feet. A second, though somewhat smaller, species (*O. maculatus*) also occurs in our waters.

The Cat Shark (*Parascyllium variolatum*), known also as the Collared Shark, is one of our smallest species, but a particularly attractive one. It does not exceed three feet in length, and is easily recognised by its broad, blackish collar, closely spotted with white, and the narrow, rounded body being ornamented with white spots and conspicuous black blotches.

The little Saw Sharks, the two known species of which occur in our waters, must not be confused with the larger Saw-fishes

(*Pristes*), which do not occur here. The common species (*Pristiophorus nudipennis*), about three feet in length, is occasionally washed up on our beaches, and always attract considerable attention. The front of the head is produced into a long, flattened snout, furnished with a series of long, sharp, so-called teeth along its margins, giving to it a dangerous appearance, and is, no doubt, an effective weapon among the schools of small fishes upon which it feeds. The young are born alive.

The ungainly-looking Angel Shark (*Squatina australis*), usually mistaken for one of the Rays, has a broad, flattened head and body and a tail similar to the Rays. It haunts the sea bottom, and feeds upon crabs and shell fish. The young are produced alive.

Among the Rays are several well suited for the Aquarium. The Fiddler Ray (*Trygonorrhina fasciata*), readily distinguished by the characteristic light blue cross bands on the back, is a well-known species, from three to four feet in length, frequenting shallow water. The Common Skate (*Raja australis*) has a very broad, flattened body, pointed snout, with rows of sharp prickles along the spine and near the sides of the head. The Thorn-back Ray is another fairly common form. Some of the Stingrays grow to a great size, one species exceeding five feet across the back.

The Elephant Shark (*Callorhynchus millii*) is not often captured, but is a remarkable-looking creature, growing to about three feet. Its name is derived from the peculiar prolonged appendage in front of the snout. The mouth is small, its teeth remarkable, and the colour of the body brilliantly silvery, with beautiful iridescent reflections.

Of the ordinary bony fishes, as distinguished from the cartilaginous Sharks and Rays, and among the most attractive for the Aquarium, are the beautifully-marked Box-fishes (*Aracana*), more commonly known as Cow-fishes. These are all small in size, usually from six to eight inches, and of the most brilliant colouration, disposed in lines or spots of pale blue and yellow. Their bodies are encased within a hard shell or armour of bony plates, except a small area around the mouth and at the bases of the fins. Being slow swimmers, they appear to float about in the water rather than swim. Three or four species occur in Port Phillip.

The well-known Toad-fish (*Spheroides richei*), so very numerous in the shallow waters all around the Bay, makes an excellent aquaria fish. This, and its allies, has a habit of inflating its body with air until the skin is distended to its fullest extent. Its flesh is considered to be poisonous.

Leather Jackets, of which over a dozen species are recorded in Victorian waters, and the Parrot Fishes, seven or eight species, are already represented in the tanks of the Melbourne Aquarium

by a few odd specimens. They are among the most beautifully coloured of our local fishes, are easily obtained, and if in sufficient numbers make a wonderful display.

Gurnards (*Triglidæ*), with their bright-red bodies and enormous fan-shaped pectoral fins of olive-green or red; ornamented in some species with a large black blotch, are strikingly handsome fishes. The head is devoid of scales, and is encased in bony armour, from the sides of which project long, sharp spines. The three lower rays of the pectoral fins are completely separated, and are used as feelers on the sea floor.

The group of fishes known as Star-gazers, is represented by the curious, heavy-bodied Stone-liter (*Kathetostoma laeve*). The head is of a bull-dog appearance, very broad and massive, and flattened on top. The gape of the mouth is directed upwards, the eyes very small, and the body devoid of scales. Its habit is to lie concealed in the sand or mud of the sea bottom, with only its eyes and mouth exposed, ready to snap up any unsuspecting fishes which may come along. It attains a length of over two feet.

Gobies, represented by half-a-dozen species, and Blennies by a dozen species, although rather small, are wonderfully attractive, both for their unusual form and their gorgeous colouration. Their homes are the shallow waters of the coast, where they live in the weedy rock-pools. The commonest, and at the same time most handsome, of the local Gobies is *Gobius bifrenatus*, known as the Bridled Goby, from the conspicuous dark streaks on the sides of the head. This species is plentiful on the muddy flats at Mordialloc, and will live in brackish water. Some of the Blennies bring forth their young alive.

Cling Fishes (*Diplocrepis*), so called from their habit of attaching themselves to rocks and weeds by means of an adhesive disc or sucker, situated between their pectoral fins, are represented by two small species.

Many other fishes, not difficult to obtain, might with advantage be introduced into the Aquarium tanks.

Flatheads of several kinds; the Cobbler (*Gymnapistes marmorata*), well known for the poisonous wounds it can inflict upon the unwary by means of the long, sharp spines on each side of the snout; the Red Gurnard Perch (*Helicolenus papillosus*), prettily coloured with reddish-orange and dark-coloured cross bands; the Spiny-sided Dragonet (*Callionymus calauropennus*), the prettily-marked Grub-fish (*Parapercis allporti*)—brown, with a series of dark-brown cross-bars o nthe back; the Herring Cale (*Olisthops cyanomelas*), the male of which is of a bluish-black colour, and the female brown, with bright orange and blue streaks on the head; the curiously-shaped Boar Fishes (*Histiopteridæ*); the Old Wife (*Enoplosus armatus*)—silvery, with black bands

across the body: Butterfly Perch (*Cassioperca lepidoptera*), Red Mullet (*Upeneichthys porosus*); Trevally (*Caranx georgianus*); and many others.

For small aquaria there is the extraordinary little Winged Sea Dragon (*Acanthopegasus lancifer*), measuring not more than two or three inches, the extremely flattened body of which is protected with bony rings. The snout is long, very narrow, and edged with small, backwardly-directed spines. The pectoral fins are large, and placed horizontally, giving the appearance of extended wings. It is common in sandy situations.

Pipe-fishes (*Syngnathus*) and Sea-horses (*Hippocampus*) are represented in our waters by several species, are easily obtained, and make most interesting exhibits in small tanks.

EXCURSION TO BEACONSFIELD.

On October 10 about 30 members and friends journeyed by rail and car to Beaconsfield, the object being birds and orchids. The weather was not at all favourable from a bird observer's standpoint, being dull and threatening for portion of the afternoon, with rain setting in about 4.30 o'clock, and continuing intermittently until dark.

These conditions had the usual effect of keeping birds more silent than we would have desired. Nevertheless, quite a number was either seen or heard, including the following:—Southern Yellow Robin, Gray Fantail, Pallid and Fantail Cuckoos, Yellow-faced and White-eared Honeyeaters, Eastern Spinebill, Blackbird, Blue Wren, Yellow-tailed and Striated Thornbills, Golden and Rufus Whistlers, Spotted Pardalote, Black-faced Cuckoo-shrike, Kookaburra, Gray Shrike-thrush, Australian Ground-thrush, Bell Miner, Red-browed Firetail, Magpie, Grallina (Mudlark), Noisy Miner and Eastern Whipbird. The following nests, some containing eggs, were located:—Yellow Robin, Gray Fantail, Blackbird, Red browed Firetail, Australian Ground-thrush, Golden Whistler, Blue Wren, Bell Miner, and Yellow-tailed Thornbill.

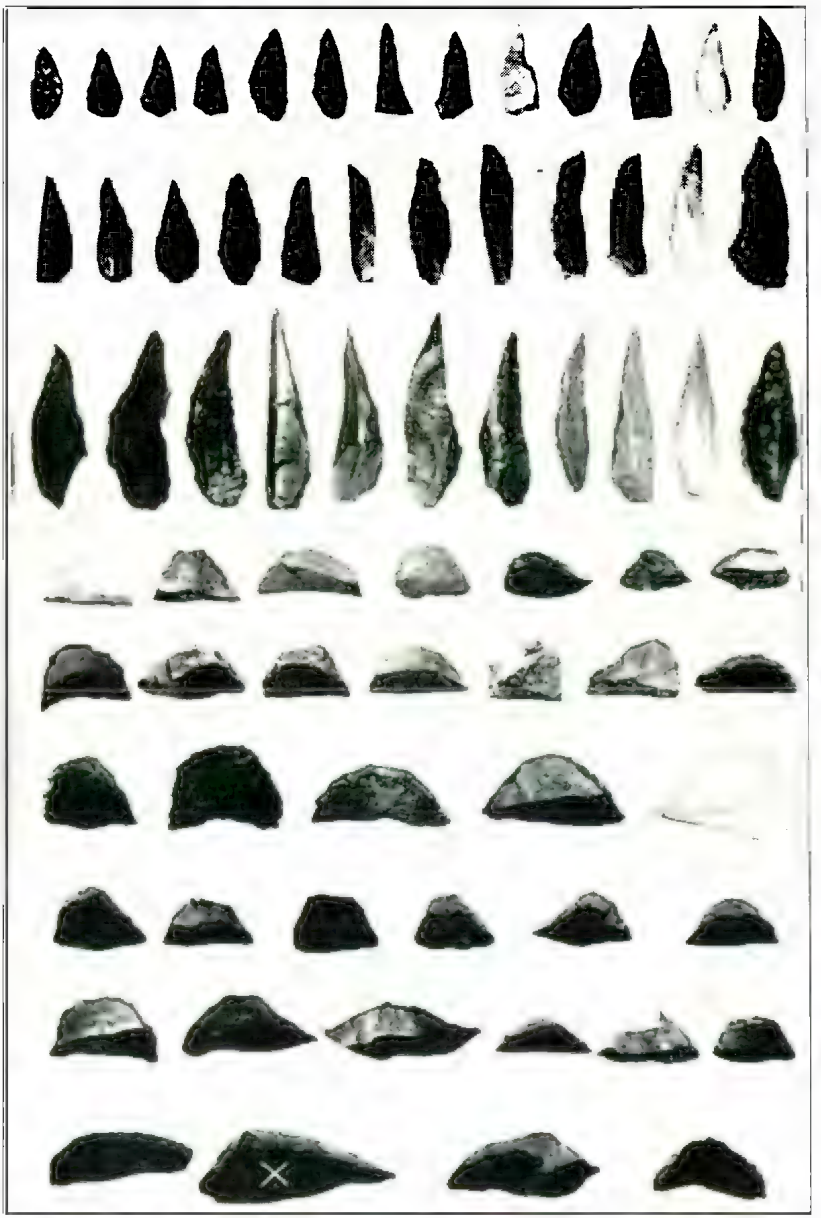
Of orchids, those found were mainly Waxlips (*Glossodia*). These were growing in profusion. The Snake orchid (*Diuris pedunculata*) was also plentiful, with an occasional "Spider." There is a wide range of orchids to be found in the district, but the time at our disposal was too limited to permit of a visit to the localities where Bird's tongues (*Chiloglottis*) and other kinds are known to exist.

A good many flowering shrubs were met with, the beautiful Woolly Tea-Tree (*Leptospermum lanigerum*) being in full bloom and in abundance. Several Ring-tailed Opossums were hustled from the serenity of their comfortable nests. Their display of "acrobatics," in an endeavour to avoid capture, provided entertainment.

—A.E.P.
A.S.C.

NATIVE WELLS.

Near Sydney, New South Wales, Mr. E. L. Hornshaw, of Drummoyne, recently found a remarkable aboriginal "conservation scheme." Many native wells exist in the vicinity, and the scheme was devised to lead water into them. Mr. Hornshaw also noted two series of charcoal drawings in rock shelters, and many grooves in the rock where the aborigines had sharpened stone axes. Photographs of all these relics of a lost tribe were taken.



Aboriginal Stone Implements from Lower Tarwin.
Points and Crescents. Stone marked with white X is 1½ inches in length.

AT LOWER TARWIN.

By S. R. MITCHELL.

The following notes have been prepared in anticipation of the forthcoming excursion by Club members interested in the study of the former camping grounds of the Australian aboriginal.

The district includes the coast that extends from Anderson's Inlet to Cape Liptrap, a distance of, roughly, twenty miles, as well as the country inland which is traversed by the lower reaches of the Tarwin River and several small creeks between this river and the Cape. Within comparatively recent geological times, this coastline was much farther north of its present position. An arm of the sea then occupied what is now Anderson's Inlet, portion of the country to the north of it, and the lower reaches of the Tarwin River. Its reclamation was brought about principally by sand washed up by the waves and currents, and by silt brought down by the river. As with many other inlets on the south coast of Victoria, gradual shoaling has taken place, with the formation of sand- and mud-bars on which sand could accumulate. The hummocks between Anderson's Inlet and the coast have been formed in this manner.

A sand-bar at the mouth of the Tarwin River has blocked its direct outlet to the sea and caused the diversion of its course at least ten miles to the west, so that its waters now enter the ocean through Anderson's Inlet. The enormous quantities of mud and silt from the denudation of the soft, jurassic mudstones and sandstones of the South Gippsland hills, brought down by the Tarwin River, have been important factors in the filling in of this area and the deposition of this alluvium has resulted in the formation of the very rich flats now known as the Tarwin Meadows. Siltation is still going on, being materially assisted by the sand blown in from the coastal dunes. Anderson's Inlet is slowly, but surely, being filled in in this manner.

The district consisted originally of swampy flats, sandy rises and sand dunes, covered with a scanty vegetation peculiar to these conditions; stunted *Eucalypts, Banksia, Melaleuca, Leptospermum* and *Acacia* on the higher ground and dunes, with reeds and water-loving plants in the swamps. It must have teemed with wildfowl, with an abundance of fish in the river and in the shallow inlet, and shellfish on the coast. The country inland, also, would carry much animal life, all combining to enable an aboriginal population to exist in comparative plenty.

This locality was probably one of the most important camping places of the Kurnai people, as it provided them with suitable living conditions; shelter, permanent water and a plentiful food supply. Evidence of their former presence is to be seen all along this coast in the numerous shell middens on the dunes. Where the seashore was sandy, these middens are composed mostly of the

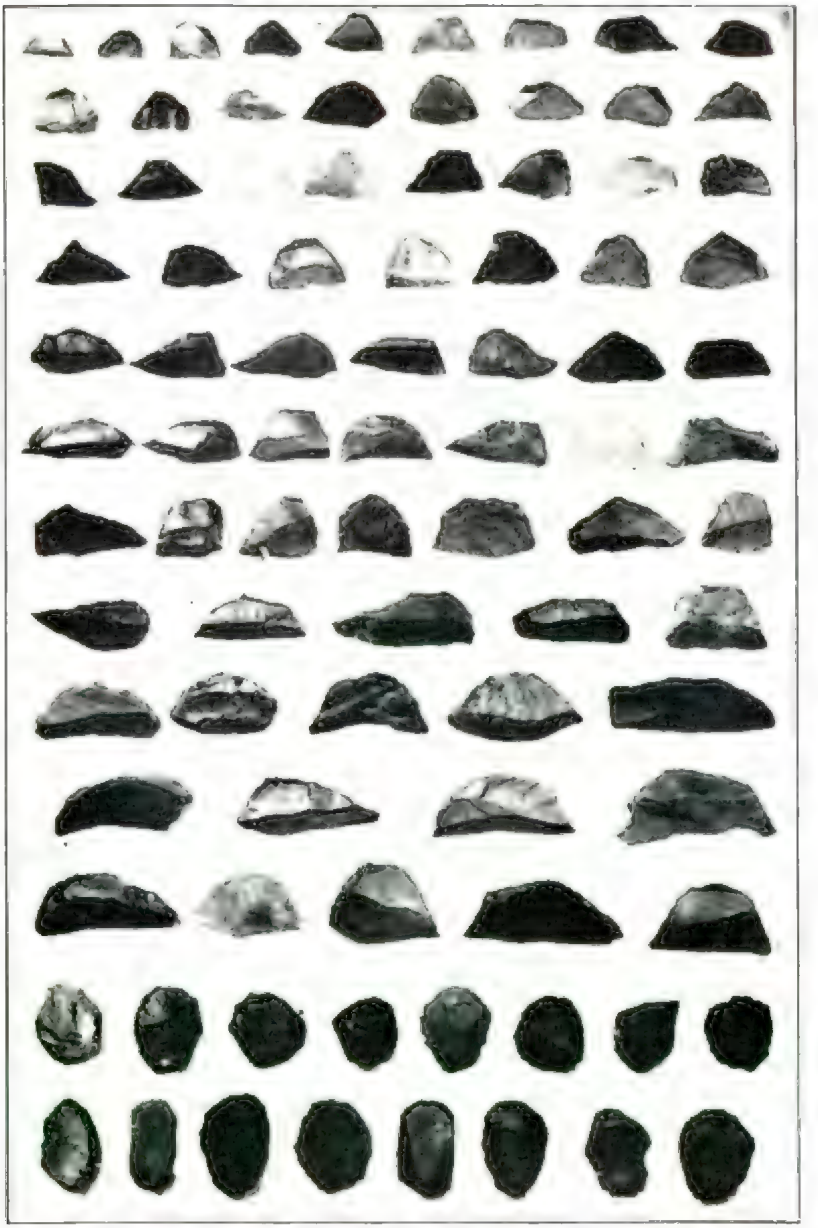
sand-loving bivalve, *Donax* sp., and when the Warriner, *Turbo undulatus* predominate, one can be sure the rocks were nearby. Some of these middens are quite a distance from the sea and the shellfish may have been collected when the shore line was further inland.

On the coast beyond the Ten Mile Creek, an impure limestone of Pleistocene age appears in the high cliffs. This limestone was originally sand made up largely of comminuted shell, and has been compacted into a fairly hard stone. Very little of ethnologic interest is to be collected on these cliffs, other than an occasional hammer-stone or fragment of flint. In the shingle at the foot of the cliffs, are numerous flat pieces of water-worn limestone, often disc-shaped or oval, and many of these are to be found on the middens, showing bruising on the periphery, through use by the natives in breaking open the shells to extract the contents. Similar limestone pebbles are found at Bream Creek, but instead of having been used as hammer-stones, they appear to have functioned as anvils. The bruising is usually on one or both of the flat faces of the pebble, and not on the edges, as if they had been struck with the univalve to break the shell behind the operculum.

From the lower Tarwin to the Ten Mile Creek, high dunes fringe the coast, sheltering a strip of low-lying country in which are numerous dried-up lakes or swamps, and it is here we find the permanent camp sites of the departed people. Fragments of stone of many varieties occur in abundance, together with many small, highly-specialised implements, and a nondescript accumulation of flakes, chips, etc., which are exposed by the wind. Their profusion indicates the importance of stone in the domestic economy of the users.

There are minor differences only between the stone remains found here and those found in other typical camp sites in Victoria; and these are mostly due to differences in the nature of the material used. A study of a representative collection of stone artefacts from Tarwin will show large preponderance of rough axes or choppers, water-worn pebbles of sandstone or quartzite, and occasionally basalt, that have been crudely flaked, either on the end or on one side of the stone. They appear to have been used in the hand only, not hafted, and would prove most effective tools for rough-shaping of aborigines' wooden implements.

Ground stone axes, made from material of a superior toughness and hardness, brought from some distant source, are occasionally found. Mills, hammer-stones and slipper-type planes are common. The small, highly-specialised implements found at Tarwin are of great interest. A large proportion of the crescents, points, and small scrapers, or gouges, were made from red jasper, and are quite characteristic of the locality. The jasper probably came from the same series to which the ancient igneous rocks of



Aboriginal Stone Implements from Lower Tarwin.
Crescents and Thumbnail Scrapers.

Waratah Bay belong, and was obtained as pebbles in the shingle on the foreshore.

The next mineral used freely is a clear transparent variety of quartz and many beautiful crescents and scrapers of this material have been found. This quartz has been used extensively, and sharp flakes and chips of it are found almost everywhere. Its source was probably veins in the Silurian rocks of Waratah Bay, or possibly the granite of Wilson's Promontory, as similar material is found in the vicinity of Welshpool on the eastern side of the Promontory. Flint is common on the middens and is found on the shore, as water-worn lumps washed out of the tertiary limestones. The flint is a siliceous replacement of portions of these limestones and contains minute fossils, mostly remains of Bryozoa, recognisable by means of a magnifying glass. It is found along most of the Victorian coast. Numbers of crescents, points and scrapers have been made of this material. Recently, more than 500 small implements were collected on the workshop close to the small lake nearest the Ten Mile Creek, 85 per cent. of which were crescents and points and 15 per cent. small thumbnail scrapers or gouges. A classification of them according to material showed that 53 per cent. were of quartzite, 37 per cent. jasper, 6 per cent. flint, and 3½ per cent. of quartz. The middens close to the outlet of the Five Mile Creek, the Ten Mile Creek and the Drummond Creek are always worth investigating.

The Tarwin District is of the greatest interest, especially to the ethnologist. As every wind tends to uncover relics, the student may at any time stumble on some find that may throw further light on these Stone Age people.

BRINE SHRIMP EIGHTY MILLION YEARS OLD.

One of the most wonderful discoveries of beautifully-preserved extremely ancient fossil remains was made by the late Dr. Chas. Doolittle Walcott, in 1910, in British Columbia.

These fossils are in a dark gray shale of Middle Cambrian age, and represent members of many groups of plant and animal life that were washed into a great shallow marine and finely silty basin, which Walcott has named the Wapta Pool. The collection at the National Museum, Washington, contains 35,000 of these wonderful specimens, and besides these there have been many hundreds distributed among museums and other collections all over the world, mainly by exchange.

Here, in this old-time backwater, drifted tress-like seaweeds, lace-like sponges, sea cucumbers or *bêche-de-mer*, worms of a fearsome sort, with bristles, brine shrimps and trilobites. Some of the crustacea, like *Marella* which was exhibited lately at the Club's meeting, have their minutest structure preserved in a thin film of carbon.

We are all familiar with the Australian "toe-biter" or *Apus*, and so can more fully appreciate Dr. Reaser's conclusions on his latest studies of *Marella* (June, 1931), that this 80 million-year-old brine-shrimp is actually more advanced in structure than the Australian crustacean above mentioned.

ORCHID NOTES AND NEW RECORDS.

By W. H. NICHOLLS.

The present season has been a most propitious one for Orchid collectors, and some interesting finds have been made.

Caladenia iridescens Rogers and *Pterostylis pusilla* Rogers (this an 8-fld. spm.) have been collected at Foster (F. Barton, junr.); *Thelymitra Merranæ* Nich. and *Caladenia iridescens* Rogers, at Wonthaggi (E. Homann); and a three-flowered specimen of *Caladenia carnea* R. Br. was interesting, *each* flower possessing two dorsal sepals (Airey's Inlet—Miss M. Sutherland); also a many-flowered specimen of *Prasophyllum Morganii* Nich., with nearly a third of the blooms likewise adorned (Cobungra—H. Morgan).

Thelymitra fusco-lutea R.Br. was collected at Wilson's Promontory by Miss E. Devonshire. This record is interesting, in that this rare species has not previously been found so far east. It is essentially a Western Australian form.

Pterostylis gracilis Nich. was collected at Olinda, etc. (A. J. Tadgell), also at Gorae, via Portland (Murray Holmes). Concerning this species (which is not listed in the *Flora of Vict.*, Ewart [1930]), the following notes may be of interest. Prior to my visit to the Tallangatta Valley (November, 1930), I had not observed this greenhood in a locality where other growth (tall grass, etc.) had not exercised a certain influence on the specimens, *i.e.*, all the Victorian and Tasmanian specimens collected previous to its description in the *Vict. Nat.* (Vol. XLIII, p. 324) were of slender habit. On the Tallangatta Creek, between Cravensville and Mt. Benambra, this species grew in more congenial surroundings under trees and on open grass-lands, where *Pt. nutans, curta, acuminata*, etc., were plentiful—and good. These specimens were more healthy looking, and the stem-leaves more strictly basal and of different shape—broadly ovate on very short petioles.

This Orchid is figured in *Proc. Linn. Soc., N.S.W.*, Vol. 1, 1925, p. 304, fig. 3, as an undescribed form (this figure typifies the Tallangatta Valley specimens). See also the *Flora Tasm.*, Vol. 1, plate cxiv, under *Pt. pedunculata* R. Br. The figure of the labellum in the *Vict. Nat.* shows the tip of the labellum much decurved. It is not *always* so pronounced, and the labellum itself is (in the more robust specimens) much broader.

An interesting addition to the Keilor Plains Flora is *Prasophyllum Frenchii* F.V.M. (Tottenham, Sunshine, W.H.N., Nov.); also collected seven years ago—*not appearing in the interval*. The very sturdy character of these specimens and the absence of the characteristic labella-constriction suggested a distinct species, but this season some of the specimens possessed, even on individual spikes, almost every conceivable variation.

TWELVE DAYS IN NORTH-EAST VICTORIA.

By C. W. BRAZENOR, (National Museum, Melbourne).

In November of the present year I had an opportunity to spend some twelve days collecting and observing in north-east Victoria, with headquarters near Mitta Mitta township. The primary object of the trip was to collect rodents for the National Museum collection, but considerable time was also spent in attempting to find that rarest of Victorian marsupials, Leadbeater's Opossum, *Gymnobelideus leadbeateri* McCoy.

Traps of two kinds were taken to capture the rats; the cage type for taking the specimens alive, and an all-steel variation of the breakback type for use in more confined space. The latter proved by far the most successful, though it must be admitted that the cage traps had the disadvantage of being new and shiny. A "snake-stick" was also taken to deal with live snakes, and tubes, etc., for small reptiles and insects. A strong "spotlight" electric torch gave the illumination for observing at night, and several sets of batteries were worn out during the trip.

The weather was excellent during the whole of the stay, though the lateness of summer, and consequent coolness, of this year, was a drawback. Much of the animal life was not so active as it is during a normal November; and this, of course, also applied to the reptiles.

After a preliminary scouting out of the surrounding country, to which it was my first visit, a trapping ground was selected at Scrubby Creek, in the hills about nine miles south of Mitta Mitta township. A small hut in the midst of the scrub formed a local headquarters, and was dining-room, bedroom, and workshop during the four days' stay. The scenery here is magnificent and the heavy rainfall during this year has made the scrub exceptionally thick and green. Several specimens of the Allied Bush Rat, *Rattus assimilis* Gould, were trapped; also one Swainson's Phascogale, *Phascogale swainsoni* Waterhouse, which, with unfortunate results for herself, developed a curiosity as to the taste of the cereal bait used for the rats.

During the daylight hours much observing was done among the birds and many species were noted. The scarlet heads of Gang Gang Cockatoos, *Callocephalon fimbriatum* Grant, made vivid splashes of colour among the green foliage and many of the birds were uttering their screeching cry. The beautiful whistle of the Rufous Thickhead, *Pachycephala rufiventris* Lath., sounded on all sides and appeared to dominate all other bush music. Orioles, *Oriolus sagittatus* Lath., Honeyeaters of various kinds, as *Meliphaga chrysops* Lath., *Zanthomyza phrygia* Shaw, and *Melithreptus lunatus* Vieill, Tree-creepers, *Climacteris leucophaea* Lath.,

and the Friar-Bird, *Philemon corniculatus* Lath., were among other birds noted. The most common bird in the bushland seemed to be the Grey Fantail, *Rhipidura flabellifera* Gmel., of which there were, literally, hundreds.

Two Slow-worms, *Typhlops australis* Gray, were discovered under a stone and added to the collection, as were several species of ants and some other insects.

Night observing with the spotlight was singularly disappointing. Owing to the intense thickness of the foliage, it was impossible to penetrate it with the light beam, and, except for an occasional glimpse of shining eyes, which may have belonged to anything from spiders to opossums (the eyes of all mammals and of many insects, reflect light), there was little to be seen.

Swampy country was chosen for the next trapping ground, and hopes were raised that it might be the home of the Swamp Rat, *Rattus lutreola* Gray. Three nights of trapping, however, failed to produce a single specimen; but two more Allied Rats were secured. Strangely enough, the Golden Bell Frog, *Hyla aurea* Lesson, was a great nuisance in setting off the traps laid for animals, and more than twenty perished in this way. A very fine specimen of the Water Rat, *Hydromys chrysogaster* Geoffroy, was captured here. Footprints and other signs were found in the mud, and traps were set, but it was not until small fish were used as bait that success was attained.

Only four snakes were seen during the whole of the stay, but an exceptionally fine Black Snake, *Pseudechis porphyriacus* Shaw, was caught with the snake-stick. A certain amount of argument took place before he would consent to go into a sugar bag, the only receptacle at hand.

Seven Spoonbills, *Platalea flavipes* Gould, were seen, and one Native Companion, *Megalornis rubicundus* Perry, Herons, *Notophoyx novae-hollandiae* Lath., were comparatively plentiful, and the Spur-winged Plover, *Lobibyx novae-hollandiae* Steph., was numerous.

The third and final trapping ground was selected far back in the hills where no traces of the all-invading rabbit were to be seen. The trapline was laid down in an almost dry gully in which an underground spring occasionally showed in small pools. Fallen logs and bush debris were plentiful and the spot seemed ideal, but it proved to be the least fruitful of any of sites chosen for trapping. Three nights brought only one Allied Rat.

Many Kangaroos and probably Wallabies were heard at night, but only one Wallaby was seen and that for an instant in the half light of dawn. The home of the Flying Phalanger *Petauroides volans* Kerr, was discovered in a big Blue Gum, and the animal afterwards was seen by the light of the torch; it was, however, impossible to take it alive, the tree being too big to fell. Many

trees showed small scratches, which were probably made by the Flying Squirrel, *Petaurus breviceps* Waterhouse, but the animal itself was not seen. Two small trees, which were felled, disclosed nothing more than old nests. Scratches of the Echidna, *Tachyglossus aculeata* Shaw, were very numerous, and a live animal was "collected", fed at a neighbouring ants' nest, and later released.

At the water pools several specimens of the Water Lizard, *Hinulia quoyi* Dum. and Bibr., were caught. The quickness of their darting movement made this no easy task and there were many misses to each success.

Birds noted in this locality were the Fantailed Cuckoo, *Caromantis flabelliformis* Lath., the Eastern Roller or Dollar Bird, *Eurystomus orientalis* Linn., and the Satin Bower Bird, *Ptilonorhynchus violaceus* Vieill. The latter was a solitary bird, and no trace of a bower was found, although a search was made for it. The fibrous-looking nest of the Friar-Bird was noticed hanging from the branch of a sapling.

Nothing was seen of Leadbeater's Opossum, but this does not necessarily mean that the animal is not there. It probably lives and feeds in the scrub, and is not equipped with hooked, clinging claws as are the larger Phalangers, having, instead, "grasping" hands, with spatulate finger-tips. It would, therefore, leave no scratches or other signs of its presence. Under these circumstances it must be largely a matter of luck to find it, for it is undoubtedly a rare animal.

Probably the end, rather than the beginning, of the summer would be the best time to search for Leadbeater's Opossum, for the scrub would not then be so thick. In spite of the failure to locate it during the present trip, it is still believed that the small creature will again be taken in the scrub of eastern Victoria, and all naturalists in, and visiting, that country should particularly look for it. This small animal is just like the Flying "Squirrel" in size, form, and colour, but without the lateral flying membrane, and with a bushy tail. Any news regarding it will be gratefully received by the writer, at the National Museum, Melbourne.

MOONWORT IN VICTORIA.

At Cobungra, Mr. H. Morgan collected recently several specimens of the Moonwort, *Botrychium lunaria* Sw., rarest of all the ferns occurring in Victoria. Three specimens forwarded to me by post are growing in the bushhouse. One has a "flowering" spike, which behaved rather strangely. In the early morning it was drooping, as if wilted; during the day it "recovered," and by evening was erect. This has happened several times, but the fern now seems to be so well established, its stem has given up the drooping habit! Possibly, though records are so few, the Moonwort is not very rare at Cobungra and in other north-eastern localities, where it was collected by Baron von Mueller so many years ago.

—C.B.

WILD NATURE EXHIBITION.

The Wild Nature Show at St. Kilda Town Hall on October 6 and 7, 1931, was, excepting that of last year at the Melbourne Town Hall, in aid of the Lord Mayor's Fund, the most successful from every point of view that the Club has yet held.

The Exhibition was opened by Mr. Theodore Fink, after an introduction by the President of the Club (Mr. J. A. Kershaw). Mr. Fink eulogised the work being done by the Club in advancing knowledge of Australian fauna and flora and popularising natural history.

A notable feature of the Exhibition was the fine display of Waratah blooms which came from private lands in New South Wales. It was probably the finest display of these flowers that has ever been made.

Some 4000 people paid for admission at the doors. In addition, about 1000 tickets were sold by members of the Club, making a total of 5000 visitors to the Exhibition during the two days.

As usual, the live exhibits attracted a great deal of attention. It would probably be advisable in future shows to allot a special room to these where a still more representative display could be staged with advantage to all sections.

An exceptionally fine series of paintings of Australian birds by Mr. Neville Cayley was shown with the National Museum exhibits.

The following sections were well represented:—Aquarium (Mr. H. W. Davey and Mr. de Norval), Anthropology (Messrs. A. S. Kenyon and S. R. Mitchell), Biological Exhibits from University, Entomology, Exhibits from Museum (Mr. J. A. Kershaw), Conchology (Mr. C. Gabriel), Geology (Mr. R. Keble), Live Animals (Dr. D. Fleay), Microscopical room (Miss Janet W. Raff, assisted by the members of the Microscopical Society), Orchids (Mrs. Edith Coleman), Protected Flowers (Miss Jean Galbraith), Pot Plants (Mr. G. N. Hyam), Publications (Mr. Chas. Daley), Broad classification of plants (Mr. A. J. Swaby), Flower Paintings (Miss Amy Fuller).

Also, a large collection of individual exhibits that space forbids mention of went far to add to the general interest.

A number of specimens of Western Australian plants from the Exhibition were sent to the National Herbarium. These were selected by Mr. Audas, who, with Mr. P. F. Morris, was kind enough to classify the exhibits.

The Club has again to acknowledge its indebtedness to the Shell Company, the Director of the National Museum, the Biology School, University, and the Geological Museum for kindly co-operation.

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THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary monthly meeting of the Club was held in the Royal Society's Hall on Monday, December 14, 1931. The President, Mr. J. A. Kershaw, occupied the chair, and more than 100 members and friends were present.

BUSINESS FROM MINUTES.

Mr. G. N. Hyam, Vice-President, reported the attendance of Messrs. Pitcher, McColl, Hooke, Swaby, and himself at Belgrave. They were shown the area proposed for the sanctuary for fauna. No progress was made with the matter, a reply not having been received from the Minister for Forests.

CORRESPONDENCE.

The Secretary for Forests, in reply to a letter from the Committee concerning the exploitation of *Boronia Muelleri*, stated that the Forest officers were exercising keen supervision over protected plants, and the co-operation of the police had been requested. There was no doubt concerning the validity of the Wild Flowers Protection Act.

The Secretary to the Premier of Victoria announced the allocation of a free copy of Professor Ewart's *Flora of Victoria* to the Club.

ELECTION OF MEMBERS.

On a show of hands, the following new members were unanimously elected:—Miss Elsie Hancock as ordinary member; Miss Lorna Banfield and Mr. Henry Brew, as country members; Mr. Rodney G. Matthews, as associate member.

GENERAL BUSINESS.

Mr. W. H. Ingram was unanimously elected to fill the new office of Hon. Assistant Librarian.

Excursion reports were given by Messrs. E. S. Hanks, J. W. Audas, R. A. Keble, and W. Hanks.

Mr. A. D. Hardy asked for a reconsideration of the Committee's decision not to make a grant for the maintenance of the Lake Park at Sperm Whale Head. The President explained that there were other similar claims on the interest of the Club. All could not be helped, so it was not wise to set a precedent.

LECTURE.

Dr. C. H. Kellaway, M.C., M.D., M.S., F.R.C.P. Lond., spoke on the Venomous Snakes of Australia. He dealt with the chief species and the relative danger from their venoms. In Victoria, the Tiger Snake, the Copperhead and the Brown were the only

species to be feared. The method of snake-bite treatment was stressed, and should be interesting to country members.

The ligature, Dr. Kellaway said, was all-important. It should be a *broad* elastic band and should be applied instantly about the limb *above* the knee or elbow. This application over a single bone was much more effective than over two where the vessels were protected against pressure. The surface of the flesh should be cleansed before incision. The venom was often discharged on the surface. In all cases the aid of a doctor should be obtained at the earliest possible moment. A sure antidote for Tiger Snake-bite was now available in the anti-venine, but this was of very little use against other venoms. Potassium permanganate might be useful; but was not to be relied on to destroy venom in the tissues. In any case, it should be used in solution.

The lecture aroused much interest, and Dr. Kellaway and his field assistant, Mr. Tom Eades, were called upon to answer many questions.

EXHIBITS.

Mr. F. S. Colliver.—Skulls of Wombat (*Phascolomys mitchelli*) and Fox, atlas bone of Whale: all from Kalimnan, Beaumaris.

Mr. R. S. Mitchell.—Aboriginal artefacts from Lower Tarwin.

Mr. A. S. Kenyon.—Various cultivated native plants.

Mrs. C. Barrett.—*Cymbidium suave*, cultivated.

Mr. C. Barrett.—*Botrychium lunaria* (Moonwort), collected by Mr. H. Morgan, at Cobungra.

Mr. C. Daley.—Lower millstone of sandstone from Riverina.

Mr. T. S. Hart.—Abnormal (double) flowers of *Glossodia*, *Anguillaria* and *Tetratheca*, from Eltham; winged galls on *Eucalyptus leucoxylon*; other galls on *Eucalyptus* sp. and *Acacia* sp., from Studley Park.

Mr. Leo Stach.—A series of graptolites from the lowest bed in the upper Ordivician, at the junction of Jackson's and Riddell's Creeks, collected by exhibitor and Mr. D. E. Thomas, on the Clarkefield excursion:—*Glossopteris hincksii*, *Climacograptus riddellensis*, *Didymograptus* spp., *Diplograptus euglyphus*, *Retiograptus* sp.

Mr. F. Chapman.—*Cypraea leptorhyncha* McCoy, a cowrie from Lower Miocene, and a tooth of the Indian shark, *Notidanus* sp., from the nodule bed of Upper Miocene—collected by Mr. A. S. Nelson, of Hamilton, at Clifton Bank and nodule bed, Muddy Creek.

Mr. W. Hanks.—Stone axe, found in Port Fairy township by Master Colin Artis.

Mr. J. A. Kershaw.—Young two-headed Blue-tongue Lizard (*Cyclodus nigrolutea*), from Yarra Junction; Black-and-White Ringed Snake, taken in the act of swallowing a blind snake (*Typhlops*), from the Mallee, Victoria.

THE FLYCATCHER OF THE REEDS.

By TARLTON RAYMENT.

Since all things in Nature seem to be more or less interdependent, the student of botany not infrequently finds it essential to trespass on the domain of the geologist, in order to explain some obscure phenomenon of the plant world. In a like manner, the specialist in bees has sometimes to depart from his beloved honey-gatherers to investigate a fly or a wasp, because of a certain incidence on the subject under review.

Just so; when I was delving into the life-history of the reed-dwelling bee, *Gnathoprosopis marianella* Raym., I found in two or three of the cells abandoned by the original occupant, a few minute, dark, "woolly" cocoons. There were several smaller cells, each of which was provisioned with dozens of exceedingly small midges—flies measuring only a millimetre or two in length. No regular storing of the provender is observable, for the prey is just cast into the cell in the utmost disorder.

Who gathered those tiny pests of the air; creatures so small that we humans know of their presence only when one dashes into the eye like a speck of dust? Indeed, when a good Samaritan removes it from our watering eye we cannot be blamed for continuing to regard the black trifle as an atom of debris. But the microscope reveals that which the human eye fails to perceive. The lenses show the marvellous compound organs of vision glowing like rubies; the two iridescent wings; the frail legs—yes, all the characters are there to prove their place in the Naturalists' Order, Diptera—let us call them midges for convenience.

The spring, 1931, was rendered intolerable by the innumerable hordes of midges that not only infested the countryside, but also descended on the city, so that the city-dweller, too, was forced to notice the miniature lives about him. For my own part, driving along a country road on a still evening, I passed through a huge stratum of winged life; a wall, seven miles long, twenty feet in width, and, say, thirty feet in height. I did not find the ends, which may have extended for many more miles. Think of the immensity of that moving mass, not one unit of which would measure over a millimetre or two in size.

The flies were dashed into ears, nose, eyes, mouth; thousands flew in among our clothing, and I had to cover my face with a scarf to ward off some of the threatening millions. Our horse progressed under protest; his continuous snorting testifying to the irritation of his nostrils. The dog, sneezing with unwonted energy, and passing both feet down over his nose in rapid succession, provided the comic element to lighten our most miserable moments. Never would I have believed the tale had it come from some friendly narrator.

Has Nature provided any check on such an unbelievable host? There are plenty to decimate these hordes of midges. Swifts, hawking through the atmosphere, devour them in untold numbers by the most primitive method of simply opening their beaks: the prey flow in. But the execution is devoid of all finesse; it is too much like the whale plunging through a sea of life while the food pours in an unending stream down the mammal's open gullet.

I like better the sudden swoop of the Kookaburra, diving at the haystack for the suspicious mouse, the majesty of the Wedge-tail Eagle cleaving the air to pick up deftly with its talons the timorous rabbit, but far more admirable is the exquisite hawking, the banking, the hovering, the side-slipping, the spirals, the sudden dash of the minute black wasp that nests in the reeds with the bee.

Let us pause for a moment to limn her portrait. Four millimetres—that is to say, two-twelfths of an inch—in length, jet-black and highly polished; only on the front and median pair of legs is any change in the prevailing tint, there a little amber relieves the sable hue. The compound eyes are huge, for is not the prey of infinitesimal size, and the clear wings are beautifully prismatic. But the chief character that enables me to classify her is the peculiar, slender, node-like segments of the abdomen. By these things I know her to be a member of the Family Crabronidae; the generic and specific titles I give in another place. Let us call her the Flycatcher of the Reeds.

Where do I find this accomplished aeronaut?

At Ferntree Gully, the searcher after such petty truths cannot fail to observe the clusters of the common reed, *Juncus communis*. This hardy member of the plant-world grows anywhere, everywhere; it is at home in almost all parts of the world, so let us dismiss its geographical distribution from our minds.

Near the top of the reed one may observe a tiny circular hatchway, cut by the reed-bee to enable her to reach the dry pith of the interior. When the honey-gatherer is away, other insects take advantage of the entrance so provided, and also take up their quarters in the interior of the reed. The parasites, greatly daring, take up their residence in the very cells of the bee; feeding their babies on the stores of the industrious mother, others are content to accept any unoccupied nook or angle to shelter their nursery.

Among the last is the Flycatcher, and ever and anon, I see her return to the hatchway clasping a fly as an Eagle clutches a rabbit. No time is wasted in the cell, nor is there any need, for the midges are merely thrown in, without any observable order, and cover the egg entirely. In a few days the wasp's egg will hatch, and the larva will devour the flies. When the food is exhausted, the Flycatcher's baby will spin for itself a rather dark, woolly-looking cocoon.

Critical examination of the cradle-gown shows that the blackish colour is entirely due to the incorporation of small particles of the hard chitinous "shells" of the victims. These indigestible portions of the exoskeleton are put aside during the feeding period, but when the wasp is weaving, they are all utilised for the outer covering of the cocoon, the threads of which are very loosely put together. If it were not for the addition of the "skin" debris, the larva would be more or less visible in its cradle.

During the following December, it will have a rapid development; day by day white "beads" lengthen until the antennae are complete; the thin sacs will ultimately become wings, and the adult creature, feeling all the forces of life vibrating in its body, will cut its way clear of the soft cradle of its own weaving, and emerge, to hawk tirelessly after flies in the sunshine of the bush. Once more the naturalist is thrilled with the little aviator's skill.

"Look! The killer has dropped its prey. Watch her descend to retrieve it!"

But she does not descend. She makes a sudden flirt to the right, and instantly secures a fresh victim. Her acrobatics are too easily performed to worry over a mere trifle. She is like the experienced soldier, who would never run after a train, "another one will be along presently".

A NEW CRABRONID WASP.

By TARLTON RAYMENT.

SUBORDER CLISTOGASTRA.

Section Diploptera. Superfamily Sphecoidea. Family Crabronidae.

Dasyproctus verutus, sp. nov.

Male—length, 4mm., approx. Black.

Head large, circular from the front; frons very wide; clypeus covered with appressed silvery hair; supraclypeal area excessively constricted, owing to the great development of the compound eyes; vertex large; compound eyes claret-brown, very large, reniform; genae greatly developed; labrum blackish; mandibulae dentate, blackish; antennae with amber scapes, slightly dilated, flagellum black.

Prothoracic collar well developed, reaching to the tubercles, which have a fringe of silvery hair; mesothorax with a delicate lineolate sculpture, and numerous fine punctures; scutellum similar, but having a deep excavation; postscutellum similar, but lateral excavation wider; metathorax large, a delicate sculpture, a lunate area anteriorly, and a pyramidal area posteriorly. Ab-

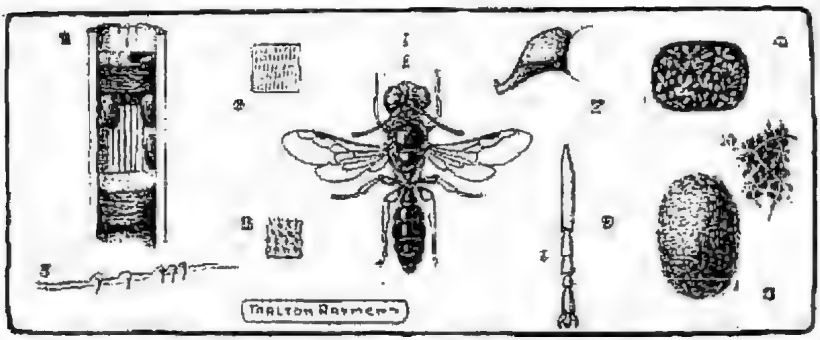
dominal dorsal segments one and two constricted to form a stout, short petiole, all segments polished, a few hairs and minute punctures basally; ventral segments similar.

Legs with coxae, median femora, hind trochanters, femora and tibiae black, other portions amber; tarsi of interior and median legs amber, hind tarsi blackish; claws amber, except the black hind ones, hind calcar short and stout, finely serrated; tegulae amber, suffused with black; wings exceedingly iridescent, hyaline; nervures blackish; cells: radial obtusely truncate at apex: one large cubital, one discoidal, one brachial; pterostigma large, black; hamuli five, weakly developed.

Locality.—Ferntree Gully, Victoria. (Rayment, December, 1931).

Type in the collection of the author.

Bred from cells in *Juncus communis*.



Details of the wasp, *Dasyproctus verutus*, Sp. nov.

EXPLANATION OF FIGURE.

1. Adult male wasp, *Dasyproctus verutus*, sp. nov.
2. The females occupy the cells of the bee, *Gnathoprosopis marianella* Raym.
3. The cocoon is black and woolly-looking.
4. The female wasp just throws in the flies without any order.
5. The five hamuli, or wing-hooklets, are weakly developed.
6. Portion of the wing-surface shewing the minute hairs.
7. Lateral view of the petiole or first abdominal segment.
8. The mesothorax is finely punctured.
9. The tarsal segments of the wasp are very slender.
10. Portion of the cocoon, more highly magnified, to shew the incorporation of portions of the indigestible "shells" of the prey.

Seasonal conditions in 1931 favoured numerous species of birds, notably water-fowl. Black Swans for many years have not been so abundant in Victoria as they are this summer. Great numbers of cygnets have been reared. Ducks also are exceptionally plentiful.

Photo—Mrs. H. Curtis

THE RAVINE ORCHID (*SARCOCHILUS FITZGERALDI*) ON TAMBORINE MT., QUEENSLAND.

By (Mrs.) H. G. CURTIS.

This beautiful orchid is very abundant in many isolated ravines and watercourses of South Queensland. I have seen it plentifully on Roberts Plateau, in Queensland's National Park; on Mt. Warning, just across the border into New South Wales; and on our own dear little Tamborine Mountain.

Having roamed this mount since childhood's days, it has been here that I have found it growing most abundantly. I have no doubt the other two localities mentioned, and many more, have

Photo (Mrs.) H. Curtis.

Ravine Orchid *(Sarcochilus Fitzgeraldi)* : close up view of racemes.

their orchid gullies, tucked away in some secluded corner, but odd visits of a few days, do not, as a rule, reveal these treasure places.

As youngsters, we gathered the pretty flowers off the rocks on the creeks where they grew, plentifully enough, in scattered groups; but I shall never forget the first time I was privileged to see the loveliness of Ravine Orchids, in bloom by the thousand. It is a sight that makes the heart glow and worship at the shrine of beauty.

One Sunday, long ago, I was scrambling and exploring in a

gorge of the mount when I came upon one of these Nature gardens. "You beauties, you dear, lovely things," I cried in astonishment, as I scrambled over the rocks towards them, with eager eyes scanning farther and farther as I climbed along, unable to believe the beauty unfolding before me. There were masses of flowers, full of colour, as delicate as that of a sea shell. The effect of a rockery of huge moss-grown boulders, decorated with these orchids in bloom, is that of coloured light flecked over the rocks. It is not only the orchids that give pleasure, but also the wild beauty of their surroundings, the quiet, the subdued light, the sun just filtering through the leaves above.

In some parts of this immense rock garden Birdsnest Ferns (*Asplenium nidus*) are set in quantity; in others, great clumps of *Calanthe* grow amid masses of Fishbone Fern (*Aspidium cordifolium*). Where some huge tree has fallen and let in more light, rocks are covered with Hare's-foot Fern (*Davallia pyxidata*), King Orchids (*Dendrobium speciosum*) and Stag-horn Ferns (*Platycerium grande*).

Long ropes of water-vines, some bare, others wonderful festoons of greenery, hang from the tops of the great trees to the ground, and round and over everything moss grows thickly; grows up the tree trunks, carpets the rocks, and blankets the great vine stems that lie writhing about the rocks, looped down from the crowning greenery of the tree-tops many feet above.

The Ravine Orchid is essentially a shade-loving rock species, growing either in masses of many plants, or in small groups; but in these rockeries of thousands the plants are also found on the bases of tree trunks, growing up the vine stems, and in heaps of peat fallen from the trees. There is little undergrowth in these rockeries, the only space between rocks being occupied by tree trunks, a few clumps of Lawyer Vines, ferns, or a palm or two it is also too shaded to encourage much growth.

The habit of the Ravine Orchid is pendulous, in fernlike masses, the flowers holding themselves gracefully with firm stems, about six to nine inches in length, on the well-established plants. Anything from a few to a dozen flowerettes are carried on a raceme; the petals and the sepals of the flowers are more than half white with a yellow pouch to the labellum, but the centre and labellum wings and stems are so generously sprayed with colour, pale pink to red, and withal so delicately traced that they have a faery-like effect of being pink. They lack one thing, the delightful fragrance of the Orange Blossom Orchid (*Sar. falcatus*), but make up for this deficiency in the generosity of their plants and flowers.

Every year the Ravine Orchids are worth a visit; they never fail to bloom well, though some seasons are outstanding. And so, through the years, if I possibly can, I visit and worship afresh the wild loveliness of this corner of my Bush house: a Bush house that is a whole mountain.

Photo—(Mrs) H. Curtis

Ravine Orchid *(Sarcochilus Fitzgeraldi)* in situation on rocks; 73 racemes of flowers in bloom on this group.

VICTORIA'S RAREST FERN.

By CHARLES BARRETT.

The story of a Meadow Moonwort, *Botrychium australe*, has been told by Mr. F. G. A. Barnard (*Vict. Nat.*, XLIV, 7, 1931), and he mentions its ally, the Moonwort, *B. lunaria*, as being extremely rare in Victoria. Records, indeed, are few, and the Moonwort may be regarded as the rarest fern occurring in this State. No specimens of *B. lunaria* were collected, I believe, between 1860 (Studley Park, Melbourne; Mr. C. French, senr.) and November, 1931, when Mr. H. Morgan found "the little green chap" at Cobungra.

The Moonwort, *B. lunaria*.

A specimen of the Moonwort was sent by Mr. Morgan to Mrs. E. M. Eaves, Caulfield, who kindly gave it to me. Subsequently, I received three more examples of the rare little fern from its re-discoverer in Victoria. In a letter to Mrs. Eaves, Mr. Morgan expresses his delight at having found a plant, in which he became interested through the late Mr. H. B. Williamson, who stayed with him during a visit to Cobungra.

"Shortly after Mr. Williamson and I started to correspond, he sent me a copy of the *Census*. I noticed that Moonwort was recorded from 'Cobungra, V.R.,' which, according to the explanatory notes in the *Census*, meant about one specimen. While Mr. Williamson was with us, we were talking about plants one evening, and Moonwort was mentioned. I happened to remark that I wondered what it was like, and he said that he had a specimen with him, which he showed to me. Of course, I saw it only for a minute or two, but from what I remembered of it it was larger than 'ours', and the fronds more crescent-shaped. His specimen

had come all the way from Norway! I concluded that it *must* be a rare plant in Victoria; said, quite jokingly, 'I'll find it some day', and it remained a standing joke between us."

Diligent searching, after the first discovery, resulted in several more specimens being found, towards the end of November. "They were not growing in a particularly damp spot," Mr. Morgan writes, "but on the level top of a low ridge. Almost without exception, they were growing up through either a dandelion or another plant like it. In fact, when I found the first two, they appeared to be so closely associated with the dandelion that I thought it was a phase of its growth."

In Culpepper's *British Herbal*, an elaborate description of the Moonwort is given. "It groweth on hills and heaths, yet where there is much grass, for therein it delighteth to grow." As regards "Government and Vertues", the old herbalist has this to say:— "The Moon owns the herb. Moonwort is cold and drying more than adder's tongue, and is therefore held to be more available for all wounds, both inward and outward. The leaves boiled in red wine, and drunk, stayeth bleeding, vomiting and other fluxes. It helpeth all blows and bruises, and to consolidate all fractures and dislocations. It is good for ruptures, but it is chiefly used by most with other herbs to make oils or balsams to heal fresh or green wounds (as I said before), either inward or outward, for which it is exceedingly good."

The Moonwort was recorded from New Zealand many years ago. It is doubtfully a native of the Dominion, not having been rediscovered since Enys found it growing at 2700 feet, on the south-western slopes of Mount Gorlesse, Canterbury. (See Dobbie, *New Zealand Ferns*, p. 382.)

Two specimens of the Moonwort are thriving in my bush-house, and as the species is said to be "easily raised from seed", I am hopeful of a crop of *B. lunaria* in due season. The spores are being shed.

The illustrations are from photographs by Mrs. Eaves.

The Moonwort (side view).

CLUB EXCURSIONS.

WANDIN.

There were fifteen members and friends present at the all-day outing to Wandin on November 14. The weather was fine. Many of the birds were nesting quite low in the bushes and scrub. The nests of the following were inspected (of some, photographs were taken) :—Bronzewing Pigeon (eggs), Grey Fantail, Whipbird, Harmonious Thrush, Yellow Robin, Kookaburra (feeding young), Eastern Rosella, Leaden Flycatcher, Red-browed Finch, Blue Wren, Bell Ninner (with young), White-throated Treecreeper, Silvereye, Golden Whistler and Blackbird. A Boobook Owl was flushed from a native cherry (*Exocarpus cupressiformis*), where he has camped for the past two years. Two very large specimens of Greenhoods were noted and photographed. These were thought possibly to be *Pt. grandiflora* and created a great deal of interest among those present.

—E. S. HANKS.

CLARKEFIELD.

Nine members made the excursion to Clarkefield on Saturday, December 5. The lowest bed of the Upper Ordovician was examined at the junction of Riddell's Creek and Jackson's Creek and some of the beautifully preserved graptolites were collected. The party then moved downstream and examined the higher beds in the series. The physiography of the countryside was discussed at the main viewpoints. The going was rough and exacting; the massive boulders in the creek valley combined with the thick undergrowth impeded our progress, so that, although the whole journey was under five miles, it took us more than four hours to accomplish it.

—R. A. KEBLE.

STUDLEY PARK.

About twenty members and friends attended the excursion to Studley Park. The leader pointed out the various features of interest, of which he gave an account *as far as he was able*.

—W. HANKS.

This excursion was thoroughly appreciated by all who attended. Mr. Hanks dealt with the features so that beginners could follow with understanding and be stimulated to further study.

—A.J.S.

BAYSWATER.

In spite of the rainy conditions prevailing during the morning, 15 members took part in the excursion to Bayswater on Saturday afternoon, November 21. On leaving the station we proceeded along the railway reserve and saw many late spring flowers in

bloom. At the Dandenong Creek it was observed that the introduced Blackberry-Bramble, *Rubus fruticosus*, had, in many places, almost hidden from view some of the beautiful native shrubs, such as the Snow Daisy-Bush, *Olearia lyrata*, Silky Daisy-Bush, *O. myrsinoides*, and Christmas Bush, *Prostanthera lasianthos*. We diverged at this point from the railway enclosure in a westerly direction, and obtained a good view of the Silver Wattle, *Acacia dealbata*, displaying its annual wealth of beautiful bloom along the banks of the stream. Here the Common Maidenhair Fern, *Adiantum aethiopicum* and Screw Fern, *Lindsaya linearis*, grew in profusion.

Along the margin of the creek species of *Cassinia*, *Spyridium*, *Pomaderris*, *Bursaria*, *Exocarpus*, *Melaleuca* and *Leptospermum* were in quantity. The Love Creeper, *Bredemeyera volubile*, was very plentiful, and its relative, the Broom Milkwort, *B. ericinum* was in good condition and probably seen at its best. Everywhere the Short Purple Flag, *Patersonia glauca*, was met with, displaying its pretty purplish flowers, and the Blue Pincushion, *Brunonia australis*, was equally conspicuous. About 40 species of plants were seen in flower, of which the more interesting were:—*Euphrasia collina*, *Stackhousia monogyna*, *Sphaerolobium vimineum*, *Vimmaria denudata*, *Poranthera microphylla*, *Caesia parviflora*, *Thysanotus tuberosus*, *Stypandra caespitosa*, *Lomandra multiflora*, *Xanthorrhoea minor*, *Clematis aristata*, and the orchids *Thelymitra carnea* and *Microtis uniflora*.

—J. W. AUDAS.

NOTE ON *PRASOPHYLLUM ARCHERI*.

To the revision of certain species of the genus *Prasophyllum* R. Br. (*Victorian Naturalist*, October, 1931), the following interesting note, from the Director, Royal Botanic Gardens, Kew, England (dated November 10th, 1931), may be added:—

"I have examined the type specimen of *Prasophyllum Archeri* Hook. f., which is in the Herbarium here, and I find that it agrees quite well with the illustration in *Flora Tasmaniae*, t. 113, in centre. The dorsal sepal and petals are *not* fringed and I cannot understand whence Bentham obtained this information since the other specimen we possess and which he saw (collected at Oyster Cove by Milligan) agrees with the type in the perfectly glabrous perianth members (the lip excepted). The few flowers on the type do not permit of sending one away, even on loan. The drawing mentioned above may, I think, be accepted with confidence as a faithful picture of the original."

—W. H. NICHOLLS.

TARWIN ETHNOLOGICAL EXCURSION

Members intending to take part are requested to communicate not later than January 16 with Mr. A. S. Kenyon, "Warringal", Heidelberg. The cost is estimated at 25/- per head. The time is from 1 p.m. Saturday, January 30, to 8 p.m. Monday, February 1. Sleeping material, crockery, etc., to found by each person. Car accommodation is available for a dozen.

The Victorian Naturalist

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THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary monthly meeting of the Club was held in the Royal Society's Hall on Monday, 18th January, 1932, with the President, Mr. J. A. Kershaw, C.M.Z.S., in the chair, and about 100 members and friends present.

CORRESPONDENCE.

The Secretary, Forests Commission of Victoria, conveyed the invitation of the Minister for representatives of the Club to attend the opening meeting of Bush Fire Prevention Week. The letter was received too late for an official delegation; but Mr. A. D. Hardy reported having attended, and spoken on behalf of the Club.

Mr. E. F. Kramer, Hon. Protector of Aborigines, Alice Springs, thanked the Club for a donation of five guineas, voted by the Committee.

REPORTS.

Excursions were reported by Mr. Miller, Mallacoota, and Mr. Coghill, Belgrave.

NEW MEMBERS.

Master Donald Hall was duly elected an associate member.

GENERAL.

Dr. Flecker criticised the continuance of confusing names for Australian plants, giving the lilly-pilly as an instance. Messrs. Pescott and Hardy supported his remarks, and moved that the question of the revival of the Plant Names Committee be referred to Committee for consideration. This was agreed to.

On Dr. Sutton's suggestion, the Club extended congratulations to the Geelong Club on their resumption of publication.

The President conveyed to the members of the Bird Observers' Club, who were present by invitation, the welcome and hearty good wishes of the F.N.C.

LECTURE.

Mr. F. C. Chapman, A.L.S., traced the evolution of birds, as revealed in the study of fossils. Lantern slides enabled the audience to follow with interest the evidence on which the history was established.

EXHIBITS.

By Miss Jackson.—Paintings of Western Australian plants, including *Eucalyptus ficifolia*, in 16 shades.

By Mr. W. Hanks.—Fossil fern of Jurassic age (*Coniopteris hymenophylloides*) excellently preserved. Locality, Wonthaggi.

By Mr. F. S. Colliver.—Non-organic "fossils" from carboniferous fish beds, Mansfield: Ripple marks, sun cracks, worm tracks, and castings.

By Master P. Flecker.—Petrified woods, spiders, Blue-tongued and Bearded Dragon lizards.

By Mr. E. E. Pescott.—*Isotoma axillaris*, *Adiantum formosum*, and *Sempervivum arachnoideum* (Cobweb plant of Central Europe).

A CORRECTION.

January list of exhibits: Skulls, in Mr. Colliver's exhibit, did not come from fossil beds. Mr. Stach exhibited *Didymograptus*, sp., not *Didymograptus*.

EXCURSION TO BELGRAVE.

The excursion put down for Gembrook on January 16 was altered to Belgrave, at the suggestion of some wishing to go into the district, but not to be so long in the train. A visit was paid to Sherbrooke Gully and Falls, and the various trees and shrubs were examined on the way. After lunch at the Falls, we found it inadvisable, owing to the proximity of bush fires, to remain, and, returning to Belgrave, we visited Mr. Maddock's property and admired his introduction of exotic plants while still preserving the natural vegetation. The day was hot, and the cool shade of the gullies much appreciated. Afternoon tea at the leader's cottage ended an enjoyable day's ramble.

G.C.

A TURRET-BUILDING WASP.

While boiling the billy on the bank of the Murray near the outlet of Chalka Creek, which feeds the Hattah Lakes, an earthen tube, a little over a quarter of an inch in diameter and some four to five inches high, was noticed. It projected directly from the ground and at first sight looked like a small stick stuck in the soil. Soon a wasp was observed flying rapidly to and fro, hovering at times above the tube. The insect's abdomen was dark grey with white patches or stripes, and the thorax dark-coloured. The wings were so rapidly fluttered as to be invisible. After many visits, it suddenly closed its wing and apparently dropped head first into the tube. All its movements were exceedingly fast. It was somewhat bigger than the honey bee.

A.S.K.

THE STINGLESS BEES OF AUSTRALIA.

By TARLTON RAYMENT.

1. INTRODUCTION.

To understand many of the traits of the cultivated hive-bee, the student will find it essential to make the acquaintance of its wild, and often times solitary, relatives. Among them one can discern the elements of the vigilant guard at the doorway; the "fanning ventilators"; the primitive huddling together at night, that higher up in the evolutionary scale, becomes the effective shelter of the clustered swarm. There are, too, the initial ventures in architectural design; the first rough experiments in the utilisation of the rhomb, and a devotion to the time-saving "short-cut" by-ways that "disfigure" the corners of the honey-comb produced on modern bee farms.

The apiarist would give much for a race of bees which would no longer use "pop-holes", but the trait is imbedded in the very fibre of the race, and it will never be overcome. Of the social wild-bees, the *Trigona* is the most interesting, because it exhibits so many of the characters of the hive-bees' craft, though most of them are in transitional stages.

Apart from Harold Hockings, few naturalists have given any attention to the habits of the native stingless-bees, and none has investigated them with scientific care. A few northern apiarists, who have secured the colonies by cutting out their combs from tree-hollows, and placing them in small wooden boxes, have kept the bees as interesting "pets", but the difficulty of removing the fragile combs, for daily inspection, is so great that really good records are extremely rare.

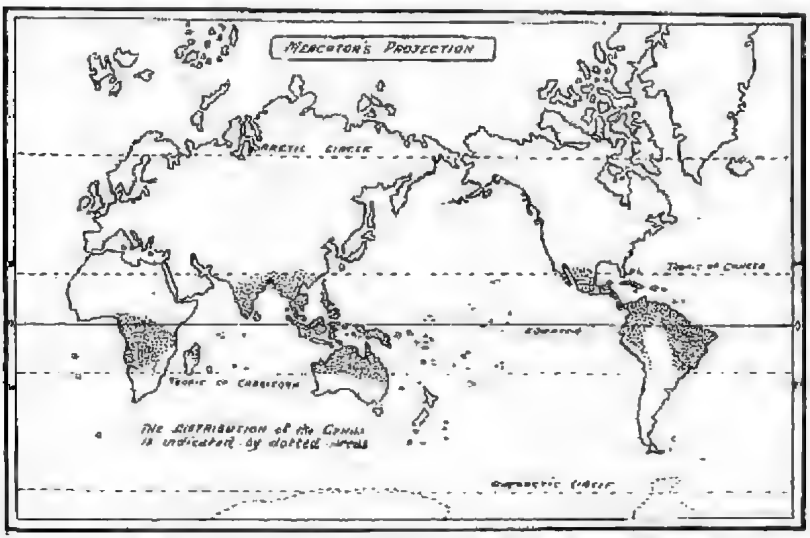
DISTRIBUTION.

The larger *Melipona* is not found in the Old World; both genera are in the New, but neither *Melipona* nor *Trigona* is found far out of the tropical regions. In Australia, the genus is confined to the warm north; *Trigona carbonaria* Sm., the most widely distributed species, being found as far south as Sydney.

The genus is well distributed over Thursday Island, Java, New Guinea, The Straits Settlements, Burma, India, Central Africa, and Central America. In all regions the structure of the bees and their habits are so similar, the student seems forced to the conclusion that the species must have originated at a common centre. One postulates the existence of a huge unbroken stretch of continent to permit the migration of such small, feeble creatures, or, on the contrary, accepts the theory of a similar ecology producing similar creatures.

After a close examination of the wings of bees in hundreds of genera, and many field experiments on their homing capabili-

ties, I regard the number of wing-hooklets as an infallible guide to the "air range" of the bee. Where the hooklets are four or so, the area of flight is but a few hundred yards; *Microglossa*, for example, has only three weak ones, whereas the hive-bee, with its twenty-two hooklets, will easily return from a distance of seven miles. My experiments showed that many hundreds of worker-bees returned home, in less than twenty minutes, after being liberated from a point in a dense forest, three miles distant.



The stingless bees, of the genus *Trigona*, are confined to the tropical zones.

The Australian species of *Trigona* have only from five to six hamuli, or hooklets, and the neuration of the wings is largely obsolete, therefore, they are utterly incapable of crossing any moderately extensive natural barrier. Professor Cockerell thinks the Indian *Trigona canifrons* Sm. may have been brought to Australia in some merchandise, since it builds in wall-crevices.

CLASSIFICATION.

DIVISION APIFORMES (Social Bees).

Family APIDAE. Sub-family MELIPONINAE.

Genus *TRIGONA*, Jurine.

(Nouv. Meth. Class. Hymen., p. 245, 1807).

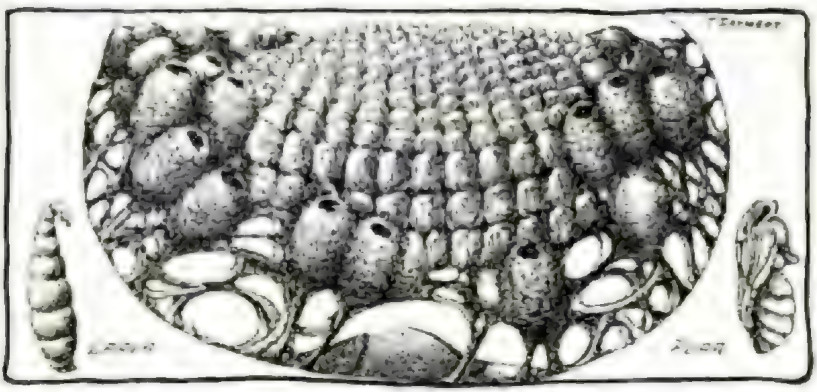
Accepting Smith's differentiation of *Melipona* as larger bees, with a superficial aspect of the hairy European genus *Osmia*, then all the Australian species are well within the genus *Trigona*, for they are very small indeed, though certain species have an architecture not altogether unlike that of the *Melipona*.

The aborigines were familiar with several species, and about Brisbane, Queensland, *Trigona cassiæ* Ckll. is known as "Koochee", and *Trigona carbonaria* Smith, as "Koobee", or "Karbi." With the advent of the white man, the more comprehensive term, "Sugar-bag", was used by the blacks for all species of social bees. The white settlers of the north not infrequently refer to the *Trigona* as "Mosquito-bees", but the name "Baldies" is limited to *Trigona carbonaria*, and owes its origin to the white hairs on the head of the bee.

The wax is sometimes utilised by the blacks as a coping to protect their rock-paintings from rain that might run down a sloping surface. The wax is put on to form a more or less curved line over the paintings to deflect the water. Love (1930) often found wax applied in this way, and gives a reproduction of an aboriginal painting of a "nest of wild honey, Ngeenya"; honey itself being named "Aianúngga" by the Worrora tribe of Western Australia.

THE ORGANISATION.

There are three "castes", similar to those of the hive-bee, namely, the perfect female, or queen, the imperfect female or worker-bee, and the male or drone-bee. The queen alone deposits



A remarkably regular comb of an Australian stingless bee, found in a hollow limb of a tree. The large urns are for honey, and the small ones are the brood cells. Note the wax "curtain" rising from the base at the middle.

the eggs directly into the cells, and always on top of a certain amount of food. This is contrary to the habit of the hive-queen, which invariably places the egg in an empty cell. She does not direct any other operation in either *Apis* or *Trigona*.

The workers perform all the labours of the colony; they secrete the wax, and collect the propolis, pollen and honey; they construct the home from the former substances, and store the latter for future use. In addition to the labours specified, they add a modi-

cum of some biological secretion to the larval food; regulate the temperature of the "nest" by a fanning action of the wings, cleanse the interior, and attack and remove various enemies, but tolerate certain symbiotic forms; they watch at the door in a manner that suggests the hive-bee, though the defensive guard is less vigorous, and has a closer affinity to the "waiting" posture of the *Halicti*. The workers do not appear to be under the direction of any other inmate, but act in a way that conforms to what has been termed "The Spirit of the Hive". In many respects the organisation is comparable to that of *Apis*, where the "civic spirit" is so strong that every citizen does what work is requisite, without coercion.

The male's sole function is the fecundation of the young "princesses", and when that has been effected, the numerous drones are still permitted to enjoy the privileges of the home. On the contrary, the mating of the hive-queen is often the signal to exclude the superfluous males, henceforth.

Trigona communistic development closely approximates the social life of the hive-bee, and, therefore, the great hiatus between them and the simple congregation of the *Halictus* sisters seems to be filled by the South African reed-bees of the genus *Allodape*. I know of no bee that can be regarded as being closer, to provide a better gradation of the evolutionary social scale.

COMPARATIVE MORPHOLOGY.

The *Trigona*, though not naked, has only short hair of exceedingly fine plumosity, like that of *Halictus*, but many of the more elemental bees such as *Paracolletes* and *Parasphecodes* are, by comparison, much better equipped with more numerous and longer harvesting-hairs. The broods of these three genera are small, only a dozen or so progeny for the season, nothwithstanding the better equipment. What the *Trigona* lacks in harvesting-hair is more than balanced by the capacity of the very broad hind tibiæ and basitarsi of the worker; a development comparable with that of *Apis*, the hive-bee. In the shin hollows or corbiculæ, a large load of pollen is carried with safety and despatch.

The apex of the scape has a concavity that partially receives the first joint of the flagellum when it is reflexed, and this peculiar feature is seen in the primitive *Microglossa* Raym. The pore and peg-organs of the submoniliform antennæ are much more numerous than those of *Microglossa*, but yet are fewer than *Apis* has. The apical joint of the *Trigona* flagellum is often flattened as in *Paracolletes*.

The mandibles seem to be in a transitional stage, for some species have the smooth spoonlike form of the hive-bee, while others, such as *Trigona carbonaria*, have the toothed form of the primitive *Hylaeus*. Smith says his species with edentate mandibulæ have naked mouth-palpi, and the toothed mandibulæ hairy ones.

The mandibles are short, somewhat like the truncated form of *Gnathoprosopis* and *Exoneura;* the labrum being between the large rectangular form of *Asaropoda* and the small oval of *Hylaeus.*

The newly-emerged queen—or should it be "princess"—is longer than the worker, this is especially true of the abdomen, and the extraordinary growth of the insect after fecundation, places it close to the queen of the bee-hive. The young queen has a more delicate form of head, in lateral view, and the malar space (that is, the area between the base of the compound eye and the base of the mandible) is large, a feature seen also in the worker, though the drone has little, if any such area. The compound eyes of the male are larger than those of the worker, but do not approach the huge holoptic eyes of the drone *Apis.* Many of the solitary bees, both males and females, lack the malar space.

In the male *Trigona* the scape is shorter and stouter than that of either the queen or the worker, and while this is a sex distinction in several genera such as *Euprosopis* and *Hylaeus*, the males and females in *Spharhylaeus* have almost globose scapes. The male *Neopasiphaë* has flat circular plate-like yellow scapes utterly unlike those possessed by any other Australian bee.

Mouth-parts are shorter and more primitive in the queen and the drone, as is to be expected, but the long hairy glossa of the worker-bee is suggestive of the hive-bee's "tongue", and fits the worker for visiting a wide range of botanical species in very diverse orders. I have recorded the *Trigona* on orange-blossom and even the roses of the garden. It is almost as versatile as the hive-bee in its knowledge of nectar-sources, and this trait gives it a tremendous advantage over bees confining themselves to only one or two plants.

The thorax is huge, and permits the development of the immense wing-muscles. The scutellum is often prominent, but an extraordinary development of that part is seen in bees of the genera *Nodocolletes,* and the parasitic *Cœlioxys* and *Crocisa.* The abdomen is exceedingly small.

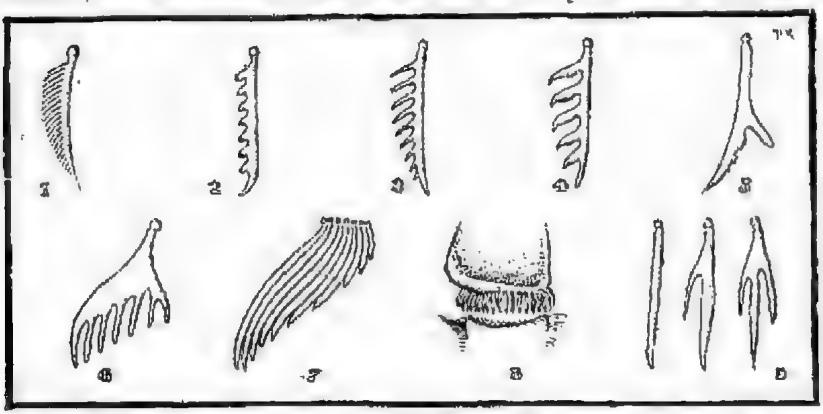
Compared with some of the *Trigona* from Burma, which have remarkably long wings, with a blackish cloud, the Australian species have short wings, that of the drone having a distinct anal lobe. The wings are also remarkable for the almost obsolete neuration: only the radius, basal, nervulus and the basal portion of the cubitus being in evidence. This deficiency is in strong contrast to the highly specialised neuration of the hive-bee, and the more primitive groups such as *Halictus* and *Euryglossa.* The pterostigma of the hive-bee is inconspicuous, as it is in *Xylocopa,* the Carpenter-bee, and several others, but *Trigona* has one of moderate development; not nearly so large as that of *Microglossa,* where the wing hooklets, or hamuli, are few and weak, and about three in number. *Trigona* has from five to six, but they are very

weak compared with the twenty-two strong hooklets of *Apis* and the beautiful twenty-four or so of *Bremus* (*Bombus*).

EVOLUTION OF THE PECTEN OF THE HONEY-BEE.

The tibiæ of almost all bees are furnished with a pair of calcariæ, one of which, in several genera, is strongly toothed; especially in *Halictus*, *Euryglossa*, *Paracolletes*, *Trichocolletes*, and *Nodocolletes*. The coarse one is the chief implement for digging in earth; the finely serrated one for rasping wood and opening pollen-sacs. *Bremus* has a pair of finely-serrated calcariæ, though Dr. Tillyard says no social bees have these appendages. *Apis* is certainly without the simple hind calcar, which has developed into the pecten or tibial comb.

Authors have asserted that the *Trigona* has no hind-calcar, but microscopical examination of the flattened hind tibiæ of the Australian *Trigona* reveals a minute group of chitinous spines in the triangular form of *Trichocolletes*. Certainly it is a very minute cluster, but there can be no doubt about its presence. The sur-



Calcariae of various genera showing the evolution of the pecten of the honey-bee.

1. *Microglossa*. 2. *Pachyprosopis*. 3. *Paracolletes*. 4. *Nodocolletes*. 5. *Halictus*. 6. *Trichocolletes*. 7. *Trigona*. 8. Pecten of *Apis*. 9. Forked spines from *Trigona*.

prising aspect is that its significance should have been overlooked all these years.

The general form of the spine-cluster demonstrates its evolution from the coarse type of calcar possessed by the earth-digging bees named above. As the necessity for excavating gradually disappeared, the long "teeth" of the tibial calcar became so slender that they finally separated into distinct chitinous spines, the majority of which are simple, a few are biforked and an odd one triforked, thus demonstrating in no uncertain manner its remarkable origin. This splitting up of the calcar into numerous fine

spines of chitin must of necessity destroy its entirety, but certainly does not warrant the statement that *Trigona* has no hind calcar. It is more exact to say the appendage is of compound form; the calcar being a subtriangular cluster of chitinous spines more or less divided; that of *Apis* having long since become a fringe of separate chitinous coarse spines forming the pecten.

In the hive-bee, *Apis*, the sting is an aborted ovipositor, therefore, the male, or drone, lacks this weapon of defense. But the worker-bees of *Trigona* are destitute of stings. The genitalia of the male *Trigona* are much more highly specialised than those of *Halictus* and other earth-dwelling bees, the broods of which are so small, yet they are not so complex as the genitalia of the hive-drone; nor is there the same necessity, since the ovaries of the queen *Trigona* are not called upon to produce up to 5,000 fertile eggs every twenty-four hours in mid-summer, a figure that often has been reached by the *Apis* queen.

The colour of the tegument is usually black or brownish; the front of the head-capsule, scapes, prothoracic collar, scutella, legs, and portions of the abdomen of some species having yellow or creamy-white marks, suggestive of the primitive *Hylaeus* and *Gnathoprosopis*. Indeed, the yellow bands on the apical segments of the male *Trigona cockerelli ornata* Raym. have a strong resemblance to those on the dorsal segments of the Australian *Neopasiphaë* and the European resin-bee *Anthidium*.

Hooks of the tarsi are simple, whereas those of *Apis*, and many solitary bees, are strongly bifid. The empodium of the foot is small compared with that of the hive-bee. The basitarsus and other tarsi of the queen *Trigona* are narrow and long; those of the drone being much wider; the worker-bee having the broadest since it has to do all the carrying for the entire colony.

The queen's activities are limited for long periods to perambulating over the combs, and naturally, she has longer and stronger legs, though her wing-power is not much superior to that of the worker. The *Trigona* worker has strong legs, and when walking seems to do so mostly on the fifth tarsi.

Differences in structure exhibited by *Trigona*, and which are really sex characters, are comparable with what obtains in the hive-bee, though in almost every character the distinction is not so marked. Just as the behaviour of the individual suggests a clever understudy of the chief character, the hive-bee, the morphology of the creatures exhibits certain tendencies that convince me only time is necessary for its ultimate development. It is permissible to say that the *Trigona*, in its structure and behaviour, has "all the elements of greatness."

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OUR RARER ORCHIDS.

(1) *Prasophyllum flavum*, R.Br.

By W. H. NICHOLLS.

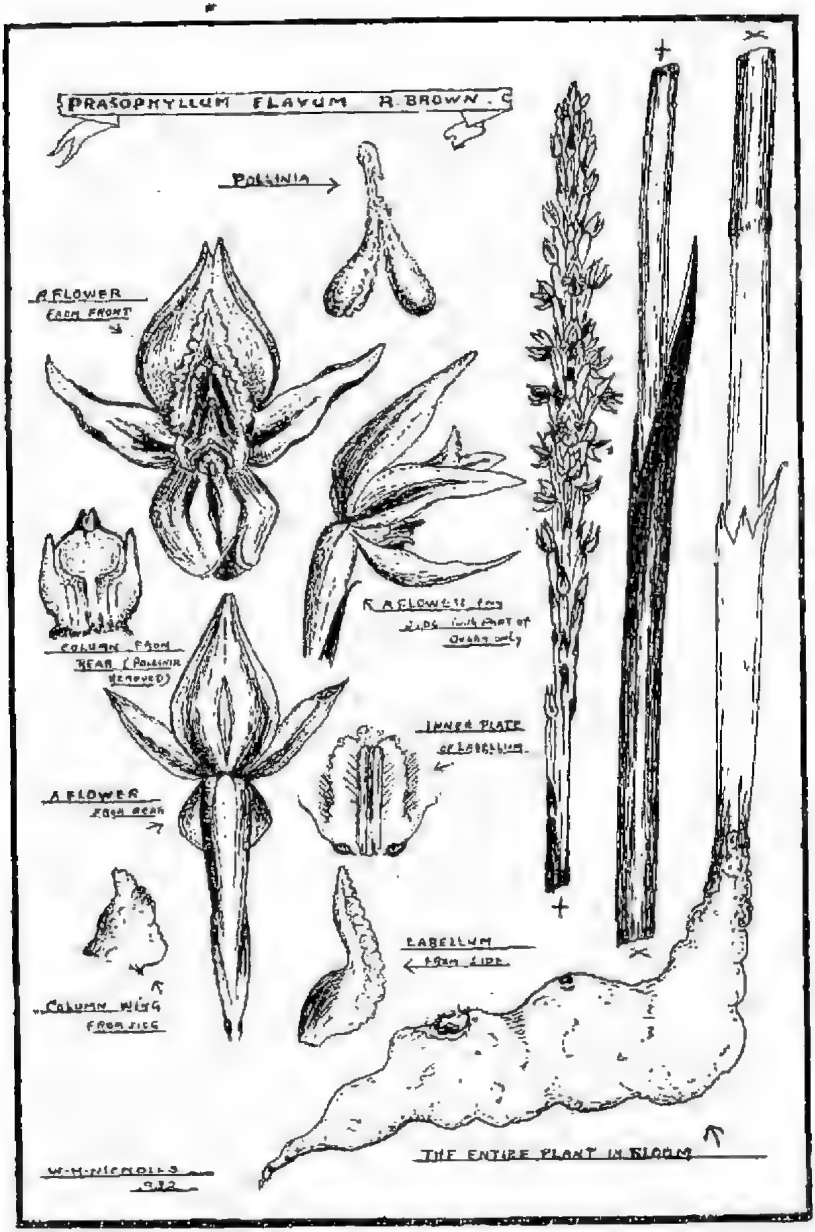
This terrestrial orchid was first collected in the vicinity of Port Jackson, New South Wales, and was described by Robert Brown in his *Prodromus* (1810). It is a most interesting *Prasophyllum*, not only on account of certain peculiarities unique in themselves, but also from the fact, despite its wide diffusion throughout three States (N.S.W., Victoria, and Tasmania) that it is not often seen. It favours forest lands, where, amid the dense undergrowth, it is well hidden.

The plant itself is dark-coloured, and its inconspicuous spike of flowers harmonises well with the surroundings. In such seclusiveness it grows, usually solitary, or at most two or four specimens together; the "additionals" owing their origin to the growth around the parent tuber.

Pr. flavum was at one time considered to be a parasite—so were the orchids, *Dipodium punctatum* R.Br. and *Gastrodia sesamoides* R.Br., on the roots of trees, etc. It is practically leafless, and its root system is unique within the genus—on a parallel, in this respect, with *Calochilus saprophyticus* Rogers. These orchids are known as holo-saprophytes—strange forms! which live (seemingly) in harmonious relationship with a minute thread-like fungus called Mycorrhiza. *Pr. flavum* prefers somewhat high and drier though not necessarily arid, situations. I have even found it arising from the very hard clayey soil bordering a main highway; but these were poor examples when compared with plants from unmolested spots in the forest primeval.

My first experience with *flavum* was in 1922. During the preparation, one evening, of a temporary camp, near the foot of Mt. Erica, a splendid specimen in bud stage (even then it was three feet tall) was found among the timber. While investigating the underground system of this specimen—a difficult procedure, as the soil was of a hard, gravelly nature, overtopped with a thick covering of growth and forest debris—I found that the stem was quite detached from its tuber—most of that portion below the ground level had decayed. Two days later I brought the specimen (tuber also) to Melbourne. It developed its blooms en route! and a week later was placed between the drying sheets, still in perfect condition!

The yellow-flowered form of *Pr. elatum* R.Br., has a superficial resemblance to *flavum*. In the past it has been taken for this species; but *flavum* expands its blooms later in the season. The two forms are rarely, if ever, found in association with one another. *Elatum* generally prefers a more open type of country, lightly or moderately clad undulating downs, similar to our heath-



Details of *Pr. flavum.*

lands, suiting it better. The finest specimen so far seen by me was collected recently in the Dandenongs (near Belgrave) by Mr. A. N. Burns. It measured 3 feet 3½ inches in height and had 47 flowers in a spike of 10½ inches.

Fitzgerald's illustration of *flavum* in his *Australian Orchids* (Vol. 1) shows the labella in a depressed position. This is evidently a characteristic of New South Wales specimens, as the Glenbrook flowers are as shown in Fitzgerald's plate. But in all the Victorian specimens I have examined, the tip of each labellum (take a side view of a flower) shows well above the upper margins of the paired petals (see figure). The pollinium is easily extracted intact from the anther case. This species is, no doubt, fertilised in the same manner as *Pr. elatum*. In this particular species I have witnessed the operation performed. The larvæ of a chrysomelid beetle* (*Aulacophora spinolæ* Hope) is, at least, one of the agents instrumental in removing the pollinia on its head from one flower to another in its quest for the sweet tissue of the stigmatic plate.

My specimens of *flavum* have been collected in the following localities:—

Victoria.—Mt. Erica (Baw Baws), Walhalla, Tecoma (W.H.N.); Belgrave (A. N. Burns); Foster (F. Barton, junr.); Gorae (Murray Holmes) *this last a new S.W. record*; Cravensville (A. B. Braine); Yarram (Miss E. Devonshire).

New South Wales.—Glenbrook (G. V. Scammell).

The description is as follows (from my specimens):—

Pr. flavum R.Br.

Plant more or less robust, from about 30 cm. to over 90 cm high; leaf sheathing with a very short terete lamina 1·3 cm. to 2·5 cm. long; stem and leaf dark-purplish; flowers 6 to 47 (in my specimens) in a rather long, more or less crowded spike; yellowish or green, with purplish markings; ovary elongated green; lateral sepals and petals lanceolate, petals narrower; lateral ones united, except *towards* the base (in very dry weather some quite free); dorsal sepal broadly-lanceolate, all about 1 cm. in length, concave; labellum sessile, oblong-lanceolate, deeply concave, erect or depressed, recurved slightly beyond the middle, 6-8 mm. long, basal margins entire; lamina green with white or yellowish crenulate margins, and a more or less prominent callous plate, arising from near the base to about the bend; column wings adnate almost their entire height, very broad and thick, inconspicuously bi-lobed, much shorter than the bifid rostellum, stigma circular; anther much shorter than rostellum; pollinia 2 bi-lobed, caudicle short. Fl., Nov., Dec., Jan.

*Kindly determined by Mr. A. N. Burns.

AFTER THE DROUGHT: LIFE ON THE GREAT STONY DESERT.

By GEO. AISTON (Marree, S.A.).

It was generally thought that the long drought had killed off all of the plants and animals of the Great Stony Desert, but the good rains that fell early in 1931 brought them all back. Everything seemed to be in a hurry to reproduce—the birds nested everywhere and anywhere; it was quite a common thing to get hit on the body by a bird that was leaving its nest in a hurry.

Nests were built where there was the slightest cover; a hollow in a post, a ledge where a branch had been cut off a post, an old billycan hung up on a fence—wherever the least privacy could be obtained. The fact that it was near a used path or gate did not matter, so long as there was some small shelter from the elements and overhead shelter from the owls. The trees were full of nests, so full that it was almost impossible for the birds to get space for another nest.

The same thing happened with the small furred animals. Rats appeared in hundreds, building their nests in any old tins, in and among the bones of the cattle and horses that died in the drought; any little hole in the ground had its nest, in some cases two or three different species of furred animal would be found in the same hole. They came in such numbers as almost to become a pest, then they passed on and their places were taken by a different species. The first lot of rats consisted of *Pseudomys auritus* Thos. and the Fat-tailed Pouched Mouse, *Sminthopsis crassicaudata* Gould. These are gradually going and a small hopping mouse and a larger kangaroo-shaped rat are taking their places.

Even the rabbit came back. No one had seen a rabbit for hundreds of miles around during the five years preceding this "revival"; but they turned up from somewhere about six months ago, and are gradually travelling north.

The aborigines are having a great time among the animals. They had lived for so long without meat that, when they got a chance, they just gorged. Every little black child goes home with as many of the small animals as he can carry (after eating as many as he can carry inside) for the old people at the camp. And was not Zekie, aged about ten years, the proud boy when he caught his first rabbit! He had it hanging down his back when he came up to me, and between his pride in having caught a big fella Miroo (rat) and his fear that it might be a white fella animal that he must not kill, he was almost speechless. Since then, all of the blacks leave work to go rabbit hunting.

As I write (January 5) I have in view two trees, about 20 yards from my window. One tree is full of Galahs and Corellas. On the ground are perhaps twenty Little Crows, *Corvus Bennetti*

North. Someone has just startled them, and, with a sound like an explosion, hundreds of Finches burst out of the two trees, their place being almost immediately taken by a flight of Shell Parrots (Budgerigahs). Back come the Finches, and one old Crow has walked into sight from somewhere. The Crows suffer terribly in the heat; every day a few fall, dead, out of the trees. The Magpies seem to suffer nearly as badly. The other day one flew in from the bush and collapsed about fifty yards from the trees. I picked it up, gave it a bath and put it in a waggon away from the dogs. It recovered about sunset, and flew away. Yesterday another Magpie flew into one of the workshops and stayed there all day, taking very little notice of anyone who went in for tools during the day.

Hullo! A turkey has driven the Crows out from under the trees; they are sneaking around just in the outer edge of the shade and cawing insultingly, the turkey apparently taking no notice. Directly it becomes dark the owls come hunting. Cheeky fellas, these. On two or three occasions they have just missed my head; they seem to drive right at the face, and only by quick dodging can one miss them. The little blackfellows kill them every time they find them in the daytime. I asked my friend, Zekie, the reason. He said they frightened him too much after dark, and he killed them in the day so that they couldn't frighten him at night.

I have never discovered the real reason why the blacks kill owls, but I have seen where they have killed dozens of them around a camp. The feathers were used for head decoration, so the birds were not coochy or uncanny. I think the reason must be in their night-flying—birds should not fly at night.

We still have some Pratincoles left, but a few months ago they were about the house in hundreds. I think they must migrate in the hot weather. I saw the first Hoary-headed Grebe of the year, and a Black Duck was on the house pond next morning. At the bore swamp, just over the hill, there are hundreds of ducks. Widgeon, Teal, Mountain Duck, and Black Duck; usually a few Swans, hundreds of Banded Stilts, and Avocets, and Dotterell by the thousand: the ground, at times, is mottled with them.

The stagnant pools of bore water breed water beetles by the bushel, and all of these birds are wading in the shallow pools, cleaning them up. It must be an ideal home for the birds—if not for the beetles!

In Melbourne, we must be content with pictures of Paradise Birds and Tree-Kangaroos; in London people go to see living examples of these natives of New Guinea! Last year a fine collection of Paradise Birds and a Matschie's Tree Kangaroo (*Dendrolagus Matschiei*) reached England. The collection also included two male Rifle Birds (*Craspedophora intercedens*) and six males of the Gardener Bower-Bird—a new sub-species.

ARTHUR'S SEAT AS A VIEWPOINT.

By R. A. KEBLE, F.G.S.

The motor road to the summit of Arthur's Seat brings within reach of all a viewpoint of uncommon interest and beauty, a panorama as varied in its make up as it is fitful in its moods. To realise its composite nature, one should ascend The Tower, from whence as the diverse scenic types come in to his circle of vision, a knowledge of the principles underlying them gives an added charm and beauty.

To the south-west The Cups, the name given to that windswept dune platform of knoll and hollow separating Bass Straight from Port Phillip and converging on Point Nepean, present a type of scenery quite unusual and strangely picturesque. From the granite massif on which we stand and to which Arthur's Seat owes its altitude, a sparsely timbered ridge extends southward and is truncated by the bold basalt cliffs of Cape Schanck, which, however, are hidden beyond the trees. On the east this ridge merges into the deeply dissected plateau of Flinders and Shoreham, which fills the south-eastern quadrant of our circle of vision. Here we have beautiful woodland and grassy slopes, with Western Port beyond; set in blue waters is Port Phillip Island with the schnapper-headed Cape Woolamai as its high point and the Bass Ranges in the distance.

To the north-west one looks across the waters of Dromana Bay on to a tract of open undulating country, the gap between Bald Hill and Mount Martha through which the Point Nepean road comes to Dromana. The north-western quadrant is filled by the expanse of Port Phillip with the higher points of the Divide, the nearer You Yangs and the Bellarine Peninsula on the skyline. Westerly a silver streak of sunlight shows up The Heads and the Strait beyond backed by the Otway Ranges.

What charming contrasts of landscape and seascape, a colour scheme of deep blues merging into lighter shades of green, the Bay and Strait ruffled in the wake of a freshening south-westerly, the sombre gums of the mountain side and the golden brown of the dry open spaces beyond, the more vivid greens of the cultivated fields, the glint of the moving dune sand and the strandline.

It will surprise most to know that a few chains from The Tower on Arthur's Seat there is an old river bed. It is approximately 900 feet above sea level and the nearest streams flowing into Port Phillip Bay. The road leading from The Tower past Symons' Cutting to Red Hill crosses it, and when you descend from Red Hill to Moat's Corner you recross it just below the old Red Hill Post Office, but there at a much lower elevation. Patches of this old river wash occur some distance to the south

of Arthur's Seat suggesting a southerly flowing stream of considerable width. It may be recognised as an assortment of water worn pebbles and boulders of quartz, quartzite, chert, slate sand stone, and other material that has obviously come from a distance since it is resting on granite. Near the head of Splitter's Creek which rises near The Tower, it was worked by Chinamen for gold many years ago.

The fact that this remnant of an ancient river is some 900 feet above the existing stream system, less than a mile away to the west, gives us food for thought, for either our high level river bed has been elevated or the existing stream system lowered and the great fracture on which it moved must be within that distance. Known for many years to geologists as Selwyn's Fault, Alfred Selwyn, Victoria's pioneer geologist, being the first to draw attention to it, the scarp of this great fault is one of the most typical topographical features to be seen from Arthur's Seat. Looking northwards, it corresponds to the cliffs fronting the higher ground between Arthur's Seat and Frankston, and may be traced along the foot of the Dandenongs and beyond.

The picturesque shoreline between Dromana and Frankston is indirectly due to its effect on the topography. Looking southwards, the rapid fall on the western side of Arthur's Seat to Cape Schanck affords view points from which one obtains delightful and extensive views of Port Phillip and Bass Strait. Selwyn's Fault has for geological ages been the factor dominating the landscapes and seascapes of the Port Phillip basin; hill and valley, plain and plateau, bay and estuary, have all been influenced by it. But for it, Port Phillip may never have existed nor would the unique assemblage of dunes and basin of the Cups been possible.

The first Port Phillip Bay had a configuration quite unlike the existing one. An opposite parallel is Mallacoota Inlet, the drowned estuary of the Genoa River with its tributary valleys flooded and its former water divides projecting into the inlet as capes and headlands. As the Genoa flows into its drowned lower reaches, so did the Yarra. Port Phillip at this time was a broad sheet of water with several smaller inlets opening on to it. It had a wide entrance approximating to the width of water between Arthur's Seat and the Bellarine Peninsula, and was probably a deep and beautiful harbour of the Mallacoota type. At this period of its development, the sand bar that mars the utility of so many Australian streams had not formed.

But there came a period of uplift when the Bay became so shallow that it shoaled, and the characteristic sand bar formed across its entrance; eventually the floor of the Bay emerged and the drainage followed the old lines over the elevated sea bottom. The river system disclosed by a form map of the floor of the

Bay is substantially this river system, which has within comparatively recent period been again submerged. This form map made by connecting up soundings of the same dimensions, clearly indicates a well-developed river flowing southwards, joining up with the Yarra on the north and with the several streams coming into it from the east and west. Portion of the silt plain that formed where it entered King Bay is clearly shown on the map.

The bar at the mouth of the pre-Bay Yarra increased in area as the old sea floor was uplifted. It extended south and west until the head of King Bay was silted up. Continued uplift brought it within the influence of the prevailing winds, and The Cups, a dune field of considerable extent, was piled up against the scarp of Selwyn's Fault between Arthur's Seat and Cape Schanck. The streams that emptied into King Bay before the dunes existed still had to find outlets through them, and the two main streams, Dandenong Creek on the east, and the Yarra on the west, were compelled to cut channels for themselves. The former Dandenong Creek outlet may be readily traced past Arthur's Seat through the swamp depression known as Tootagarook, at the foot of scarp of Selwyn's Fault, between Arthur's Seat and Cape Schanck. It ceased to function as an outlet when it was blocked by the dunes that unceasingly encroached to the westwards, and Dandenong Creek was forced to seek an outlet through what is now known as Capel Sound and through the narrow isthmus at Sorrento; the form map clearly indicates this old outlet. Sooner or later it, too, was blocked by the migrating dunes and Dandenong Creek sought an outlet still further west. It junctioned with the Yarra opposite Queenscliff, and emptied into King's Bay through the Heads. The Yarra had forced an outlet through Symonds Channel, a deep and wide channel near Mud Island.

Looking from Arthur's Seat, Port Phillip was, at that period, a broad valley with rivers and creeks meandering into alluvial flats which on their southern fringe merged into sandy dune country. The equivalent of the Yarra found an outlet into King Bay by devious and shifting channels through the dune fringe. But that recurrent line of weakness, Selwyn's Fault, again became the dominant factor, and a subsidence of the area of approximately eighty feet brought the area below sea level, the sea encroached on the valley, and Port Phillip Bay as we now see it was formed. That portion of it north of the dune barrier became the wide expanse of water extending northwards from Arthur's Seat, and the southern outlets of the pre-existing Yarra and Dandenong Creek became respectively Symonds and the South Channel. The shallow banks between the channels are the old dunes levelled by tide and wind. The ships that we see picking their ways carefully through the South Channel are actually

using the drowned valley of the Dandenong Creek, and, curiously enough, Symonds' Channel or the flooded valley of the Yarra, the more important stream, has never been made available for shipping of any size.

Now let us turn to the south-east and another drowned river system, that of Western Port. The rivers that comprised the system, a network that is clearly defined in a form map of the channels, were not as broad as those of Port Phillip, nor was the drowning as complete. They had to cut their valleys in lava, one of the most resistant of rocks; that has checked their development. This series of lava flows is one of the striking features of Victorian geology. An attempt has been made to ascertain its thickness by boring, but to a depth of 1400 feet at Flinders and 900 feet at Cape Schanck the bores started and ended in lava. On the other hand a bore put down at Sorrento started and ended in limestone. Selwyn's Fault separates the two areas and it is interesting to speculate what bearing it has on this development of fundamentally different rock types.

It is obvious why this bold scarp separates the characteristic scenery of The Cups from the woodland of the Flinders Plateau. It is to the great lava field that we are indebted for the picturesque bush country and fertile agricultural and pastoral lands at Flinders, Shoreham, and Red Hill. We owe to the lava, too, in its tardy response to levelling influences, which is signified by the narrow but deep valleys and the deepest creeks of the plateau as they pass under verdant hills and over rocky bars and rapids on their way to Bass Strait.

To tell all concerning the varied landscapes viewed from Arthur's Seat would indeed be a comprehensive task. In geological reckoning the movements responsible for Port Phillip Bay and Western Port, and for that matter Bass Strait, in their existing configurations occurred only yesterday. The Piltdown and Neanderthal man appeared in their European environment many thousands of years before Port Phillip, as we see it, was formed.

The evolution of land forms and the composite origin of scenery is a fascinating subject. A knowledge of some of the principles involved gives a long distance view added interest and provokes thought.

CROCODILES IN QUEENSLAND.

In a recent letter to the Editor, Mr. A. Moran, of Cairns, states that Crocodiles are more plentiful than ever in the less frequented rivers of Cape York Peninsula. In the neighbourhood of Cairns they are difficult to shoot—they move out as human population comes in. "Captain Charles Hayles, in his yacht, 'Magenta' went up several rivers (on a voyage northwards), and the crocodiles were very plentiful. One particular tidal flat accommodated hundreds of the brutes."

ANCIENT HISTORY OF BIRDS.

(Notes of a lecture given before the Club on January 18, 1932, by F. Chapman, A.L.S.)

One of the most startling phases in the evolutionary history of animal life is the emergence of the avian type from the reptilian. Although the evidence itself is rare, such as it is, it is sufficiently conclusive to warrant the above deduction. In the lithographic stone of Solenhofen, Bavaria, which is of Upper Jurassic age, there is a marvellous museum of fossil remains, of jelly-fish, dragon-flies, worms, king-crabs and delicate enamel-scaled fishes. Here we found the bird-like reptile, *Compsognathus*, and the reptile-like bird, *Archaeopteryx*, lying side by side.

The evolution of the avian type of structure must have taken place fairly rapidly, in a geological sense, for although *Archaeopteryx* still had the reptilian conical, socketed teeth in the jaws, a long lizard-like tail and scales on the legs, yet its amphicoelus vertebrae were pronounced, and the skull, bent furcula or "merry thought" and wing structure were distinctly that of a bird. It had paired rectrices or tail feathers attached to the joints of the long tail.

At the time of the discovery of the two specimens of *Archaeopteryx* they were compared with the carinate birds, but about 10 years ago a fuller investigation by Dr. Petronievics was made (see *Nature*, August 19th, 1922, p. 261), the British Museum specimen being compared with a ratite (flightless) form, while the Berlin specimen he re-named *Archaeornis*, and referred to the carinate type of bird.

In the later Mesozoic period, of Upper Cretaceous or Chalk age, there were found at Kansas, North America, two-toothed birds: one of these had a skeleton resembling that of the modern Divers, whilst the other was a bird about the size of a pigeon and had a deeply keeled sternum. The fishing bird, named *Hesperornis*, was 3½ feet in height and had the teeth in a continuous groove. The carinate bird, *Ichthyornis*, was capable of powerful flight, and had the teeth socketed. In the Cretaceous period also, there was a true carinate bird, which was toothless, namely, *Scaniornis*, from the Chalk of Scandinavia: this was related to the ducks. Of the same age, a pelican (*Graculus*) occurs in North America.

One of the most interesting groups of birds, fossil or living, is that comprising the ostriches and their kindred, included under the super-order Dromaeognathae. Although undoubtedly degenerate, on account of their flightless condition, they represent a primitive type which was once more widely distributed over the world, but now occuring in a few isolated localities, as Australia, New Zealand, South Africa, and South America. From Upper Miocene to Pleistocene times they were to be found in

South Russia, China, India, Madagascar, and New Zealand. From Queensland, in the Pleistocene drift at King's Creek, De Vis has described a femur of what he takes to be a true Moa bird, *Dinornis queenslandiae*. Captain Hutton has doubted this determination, but Lydekker seems to be in agreement. In any case it was a most important discovery.

In Eocene times many interesting types of modern birds first appeared, notably the wading birds, *Alectornis*, of Wyoming, *Gypsornis*, of the Paris Basin, and *Gastornis*, of the London Clay. True ducks, of the genus *Anas*, are known from the Miocene of France.

From the Eocene of the London Clay was also obtained that most interesting bird referred to as a toothed pelican, *Odontopteryx toliapicus*, in which the edges of the beaks are serrated by large tooth-like projections having two smaller ones between. The young of the living Hornbill shows a somewhat similar structure.

As early as the Eocene of Europe, grouse and vultures had appeared, while an acciptrous bird, *Uintornis*, comes from the Eocene of Wyoming. Thence onwards in time there advances a great army of avian genera, including most of the perching and song-birds of the present day.

The most notable discoveries of bird remains in Australia are of Miocene and Pliocene ages. A unique specimen of a bird's feather was found some years ago in the Miocene ironstone of Casterton, in which the structure of the feather, even to the finest barbs, and the traces of air cells in the pith of the rachis were shown. This beautiful fossil impression has been referred on comparison with feathers of living forms, to that of a spoonbill which inhabits similar swampy conditions at the present day.

Prodigious faunas of most of the modern kinds of Australian carinate birds have been described by De Vis and other authors, principally from lake or river deposits at Chinchilla, Queensland, and also from Pleistocene deposits round Lake Eyre, collected by Professor J. W. Gregory. In the Queensland deposits there occur remains of mound-builders, pigeons, coots, moorhens, ibis, spoonbills, teal, darters, pelicans, falcons, and the crested eagle. The Central Australian fossils include wood-pigeons, curlews, ibis storks, swans, ducks, geese, cormorants, and hawks.

Of the more recently extinct birds may be mentioned the Great Auk (*Alca impennis*) or Garefowl, a flightless bird, of which the last specimen was killed in 1844. Then there are the giant Moas of New Zealand, whether destroyed by the early Maoris or not it is impossible to say; although the estimate of one thousand skeletons, in the Renmark Swamp alone, points to the destructive influence of an adverse environment, as in the case of the giant marsupial, *Diprotodon*, in South Australia.

The Victorian Naturalist

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THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary meeting was held at the Royal Society's Hall on Monday, February 8, 1932, with the President, Mr. J. A. Kershaw, in the chair, and 110 members and visitors in attendance.

CORRESPONDENCE.

Miss A. Armytage, Beaconsfield, thought that the Club might like to have a peculiarly formed tree preserved from destruction. No members had any knowledge of the tree as a scientific curiosity.

Mr. W. A. Eager, President, Mitcham Naturalists, sent a syllabus and asked for a lecturer for March 16.

Mr. B. L. C. Styles, "Kelvin," 288 Old Canterbury Road, Summer Hill, N.S.W., wishes to purchase or exchange the larger Victorian beetles.

ELECTION OF MEMBER.

Mr. E. E. Lord, of Yunaberg Avenue, Bentleigh, was duly elected as ordinary member.

GENERAL BUSINESS.

Through unforeseen difficulties, it was decided to cancel the excursions to Mt. Evelyn and Macedon.

Mr. A. E. Proudfoot, who recently visited Warrnambool, expressed pleasure at the great increase of bird life on the Hopkins River. The community showed a very good spirit in respecting the sanctuary. Mr. V. H. Miller supported Mr. Proudfoot's remarks. Much satisfaction was voiced by members.

PAPER.

Mr. A. S. Kenyon, M.I.E., read extracts from the diary of Dr. Hobson, who accompanied Lady Franklin, in April, 1839, from Melbourne to the Murray. The route lay fairly close to the present Sydney road. Mr. Kenyon added considerably to the value of the diary by careful editing. The present names of places and objects were interpolated.

The paper was introduced by reference to the history of the families concerned. A short account of an excursion down the east side of Port Phillip Bay, which preceded the main journey was also included.

Members were impressed by the evidence of keen observation and graphic description shown throughout by the pioneer naturalist.

EXHIBITS.

Mr. F. G. A. Barnard.—*Botrychium australe* (Meadow Moonwort) collected Oakleigh, September, 1887, and grown for 44 years by owner.

Mr. F. S. Colliver.—Stone axes, North Australia.

Mr. J. A. Kershaw.—*Hakea dactyloides*, from Nowa Nowa, rare to Victoria.

Mr. Robertson.—Native implements and ornaments from the Pacific Islands, and North-West Australia.

Master P. Flecker.—Pet lizards.

Mr. A. S. Kenyon.—Various garden-grown Australian flowers, for distribution; maps illustrating his report on the Tarwin excursion, and the paper of the evening; a letter (original) written by Lady Franklin.

Mr. F. Pitcher.—A very beautiful pot of *Blechnum fluviatile* R. Br. (Water Ray Fern) and a rather rare form of *Pellaea falcata* R. Br. (Sickle Fern), with very broad, rounded pinnules—both from his fernery; also herbarium specimens showing varied forms of the Sickle Fern.

Mr. S. R. Mitchell.—Stone implements from Lower Tarwin, and bone implements from coastal camps, Warrnambool.

EXCURSION TO TEN MILE CREEK.

The party for Ten Mile Creek, Parish of Waratah, comprised fifteen. Rendezvous was made on January 30 at the turn-off to Lower Tarwin from the Port Albert Road, just beyond the Tarwin railway station. Thirteen miles of good road took us to the Tarwin River near its efflucnce into Anderson's Inlet. Turning at the butter factory, the Waratah (Walkerville) road was followed through heavy sand and very poor country for 8 miles, when a track through private property for 3½ miles led to the mouth of the Ten Mile Creek, a perennial stream of considerable beauty. Running between fossil and recent dunes, the creek follows a narrow flat, timbered with Banksias and Tea-tree. The shelter is excellent, and as a camping site with fresh water, it is not to be surpassed. Camp was reached at 6 p.m. and two parties were found already in occupation.

A start was made next morning, the mouth of the creek being first examined, and many specimens picked up. A somewhat tortuous course through some dense scrub and Banksia forests was then followed, to middens around swamps lying about half a mile inland. Here we spent the day, crawling around on hands and knees picking up micro-littis or pygmy implements, of which there was an abundant supply. A symposium was held at night around the camp fire.

On Monday, a gentle saunter was made along the top of the cliffs towards Cape Lipstrap. The beach was reached opposite the Arch Rock and return made along it. Numerous anthropological specimens were found. After lunch, return was made to Melbourne, all cars keeping together through the sand.

A. S. KENYON.

THE STINGLESS BEES OF AUSTRALIA.

By TARLTON RAYMENT.

2. THE ARCHITECTURE.

All of the Australian species known to me build in hollows in trees. As botanists are well aware, the growth of *Eucalyptus* trees takes place in the outer layers of the bole, and the interior is often a long, irregular, tube-like cavity encompassed by dark-brown decayed wood which, shrinking as it dries, falls to the base of the tree. The result of the decomposition is an uneven tube, the sides of which are formed of dark, thin shells of old timber. Branches decay and fall off, and the scars make openings to the interior, which is then available to swarms seeking a new home. Cracks, due to various causes, also provide a means of ingress and egress.

The introduced honey-bee, *Apis*, is not one whit behind the *Trigona* in establishing itself in such propitious quarters, though *Apis* demands a much larger cavity. Both genera proceed to render the home waterproof and clean, by covering the whole of the interior with a coating of dark resinous material which is singularly resistant to water, soaps and acids.

Many of the *Trigona* build on the outside of the entrance a porch, of a like resinous material. It is shaped like a slightly-bent human index finger: others construct an ill-shaped excrescence, containing several by-ways through which the bees pass. These latter kind may be a development of the resin-ball nidus constructed by the *Anthidium* of Europe, while the former finger-like cylindrical projection probably has its origin in the mud porches of the *Anthophora*.

The European *Anthophora pilipes* excavates in sunny banks, but instead of casting the "spoil" away, she builds a tube-like projection with the earth. The finished material resembles the "rough-cast" work of the fairy-martin in miniature. As the bee requires her interior cell-partitions, she gradually removes the necessary material from her porch, and when her nest is completed, the entire projection has been utilised in this economical manner. The funnel-like porch of *Trigona* is sometimes four cm. in height, and often is constructed of resin from the turpentine tree, *Syncarpia*.

T. cassiae constructs a "covered way" from the interior of the entrance, and some that I investigated had a waxy structure straight for ten cm. in length; it then turned up, at a right angle, for a further three cm. The diameter of the interior of the tube measured one cm.; the thickness of the material being almost two mm. Where the entrance of my box-hive was at a median position on the bottom, the tube was built along the interior of the angle;

the wax being laid down on the wood of the floor, but on the vertical wall of the front, apart from the film coating the entire interior, the wax is limited to a raised longitudinal median line.

It seems that the insects must build from a transverse position and, after filling up the angle, continue the curve of the bottom of the tube, but thinning out the material on the wood. When the roof is constructed the same rule applies, and the two curves meeting result in the raised line. The structural materials of *T. cassiae*

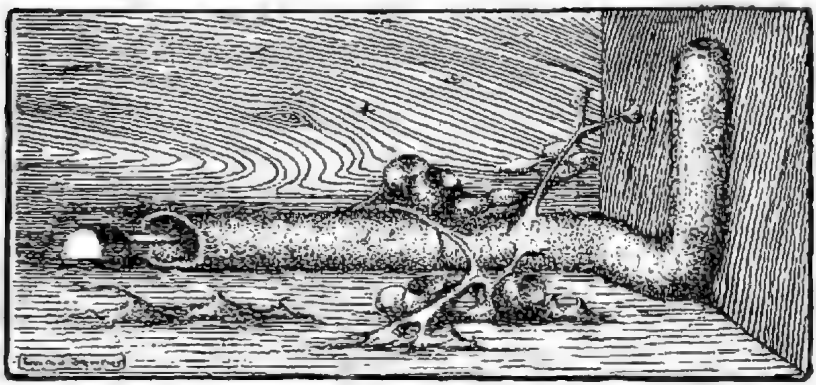


Fig. 1.

The Covered Way.

The workers of *T. cassiae* construct a covered way from the interior of the hive-entrance to a point nearer the centre of the brood-nest. (The gallery is torn away from the entrance to show a graphic section of it.)

are decidedly paler in colour, more plastic, and not nearly so resinous as those of *T. carbonaria*, consequently, the workmanship of the former is of a higher order; the cells, too, are of thinner construction.

Both the hive- and the stingless-bees use two substances for building, viz., wax and a resinous material—termed propolis by the ancient Greeks, who observed the wax curtains, often pendant over the portal of the hive, to reduce the size of the aperture.

The beautifully regular waxen structure of the hive-bee, *Apis*, has one septum composed of rhombs, three of which form the base of each cell. Since the septum and the hexagonal cell-walls on each side are integral portions of the comb, the centres of the bases of all cells on one side are interstitial with the junctions of the cell-walls of the opposite side. Darwin, in two pages of text, endeavoured to prove that the hexagons were really the result of "mutual pressure" applied to a number of cylinders.

A simple experiment demonstrated the futility of his contention. I placed in colonies of hive-bees, hundreds of hexagonal cells, and

after fifty hours the bees had rebuilt them into hundreds of cylindrical cells. I then gave the same colony many hundreds of small cylindrical cell-bases, and after twenty-four hours, the bees had transformed the round cells into the regular hexagonal form. When the building conditions are favourable, the result is always the same. The bees require a few typical cylindrical cells for nurturing perfect females, but prefer hexagonal cells for the numerous undeveloped females or worker-bees.

The queen-cradle of the hive-bee, then, is the typical form of all bees' cells. The silver purse of the primitive *Euryglossa*, and the rude earthen chamber of *Halictus*, both conform to the elemental pattern, but *Trigona* is experimenting in the use of the rhomb.

T. carbonaria are, numerically, the strongest colonies, and their architecture is remarkable for the excessive use of struts and toms. These peripheral supporting structures are often a veritable maze of interlaced "strings," attached to the sides of a cavity, which is generally in the rotten "pipe" of a tree. On this surprisingly firm framework, the large honey-storage cells are built in curious disorder. Where two cells are contiguous, one integral wall serves for the division, and here are the elements of the highly efficient rhomboid structure of the hive-bee.

These large, misshapen cells are halfway between cylinders and hexagons, but the true contours are partially buried in the compact waxy mass. Strange to say, the hive-bee exhibits this trait when it attempts to surround the queen-cells with honeycomb, a natural propensity not at all relished by the professional breeder of queen-bees.

The storage cells are vertical, measuring 9 mm. in diameter, and have a capacity of 75 c. mm.; the thin lip being extended up as the cell is filled. The hive-bee builds up the lower lip of its horizontal cell for a similar purpose. The storage cells of *T. cassiae* are of a lighter-coloured, finer quality wax, and, as one would expect, the structure is superior. The honey-cells are loosely attached, but each is a perfectly formed sub-spherical "basin," equalling in beauty the vessel of the common cup-moth. This species has only a few struts; the cells frequently adhering to the hive-wall; some of these, when viewed by transmitted light, reveal the elements of the rhombs.

The pollen is stored in similar containers, and when sealed cannot be distinguished until the cell is broken. Microscopical examination shows the stored pollen to be a mixture from many widely divergent botanical species, including *Eucalyptus, Hardenbergia, Cassia, Angophora, Xanthorrhoea, Helianthus, Cryptostemma,* and many other plants. This comprehensive diet is comparable with that of the hive-bee, but it is in strong contrast to the restricted range of *Trichocolletes*, which confines itself to *Daviesia*

species. The pollen is of a moist, mealy constituency, and contains the small percentage of honey that characterises the stored mixed pollen of the hive-bee, which, however, does not usually seal over the pollen-cells.

Each cylindrical brood-cell of *T. cassiae* is a separate entity and though there is often a very thin septum between the groups of cells, yet each cell can easily be detached without injury to the contiguous ones. Moreover, the attachment is very frail, and the cells are often at all kinds of angles.

It has been observed that the "tube-porch" of *Trigona* is frequently contracted, and sometimes entirely closed with resinous pellets, but this reduction of the portal is also a feature of the hive-bees' labour, and thin sheets of this material were responsible for the Greeks' name.

It has been suggested that the propolis barriers are an additional defence against insect enemies, such as ants, wasps, beetles and flies, but I desire to stress the fact that numerous inquilines are found in the hive-interior. The barriers are built for the sole purpose of securing a greater control over the temperature of the interior, the honey-bee being extremely assiduous at this labour as winter approaches.

Like all bees, *Trigona* has a "horror" of anything movable about the interior of the hive, and it promptly secures all loose objects with a few struts or strands of resin. That the door-barriers are for controlling the conditions of the brood-nest is proved, I think, by the fact that colonies packed for travel, and provided with wire-screen ventilators, will at once proceed to "plaster up" the extra "air-ports" to nullify the observer's intention. Bates stated that mud is mixed with the wax of some American species.

Under the microscope the exterior of the curtain on the wire shews that small pellets have been just thrust through the interstices without order; a careless tipping-in of mere "filling" composed of a debris of vegetable red kino, from the tree itself, scraps of resin and fragments of wax. This careless workmanship is exactly duplicated by the hive-bee, when "filling in" the interstices between the circular caps covering the honey-cells. The interior is much smoother, having been "trowelled" by the mandibles of the workers. The *Trigona* excells the hive-bee in its rapid closing with propolis all superfluous cracks and crevices, other than the recognised doorway. In three hours, a *Trigona* colony closed an aperture 12 cm. long by 2 cm. wide. The pellets are carried in the mandibles, and each pellet equals in volume the head of a small pin. Both stingless- and hive-bees use the propolis over and over again, especially when the old and previously discarded material has been re-softened by the warmth of the sun.

The bees, both hive- and stingless, have the ability to reduce the vegetable resin to a thin liquid that can be used as a yellowish

varnish of great durability. Though I have not been able to determine how this is effected, yet I have no doubt that the viscid liquid is "brushed" on by the glossa. The coating is extremely tenuous, and shows no "trowelling" by the mandibles. Indeed, the new creamy-white honey-comb of the hive-bee later receives a delicate covering of a like yellow varnish.

In among the masses of honey-cells and wax-struts, I have observed a number of small "pop-holes," or alley-ways, affording a "short cut" to the other side of the combs. There is not the

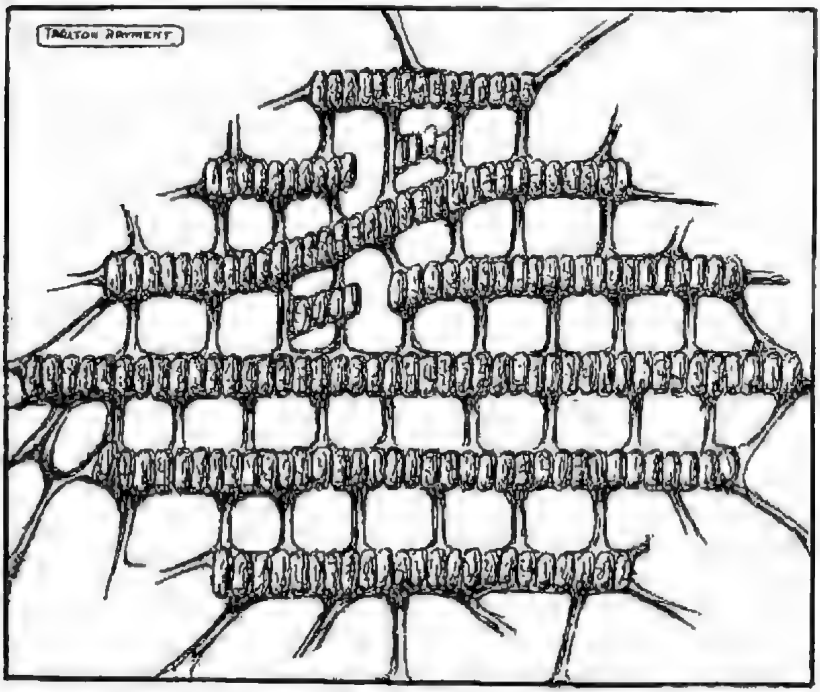


Fig. 2.

A section through the "brood-nest" of *T. carbonaria* reveals a spherical form, suggesting the arrangement of the British wasp, *Vespa vulgaris*. Here are the elements of the spherical cluster of the hive-bee. Note the deflection of the upper combs, a deviation common to the structures of the hive-bee.

slightest doubt that these passages are time-saving highways obviating the necessity for crawling over a large mass to reach the antipodes. They are in every way comparable to the unsightly, but eminently convenient, "pop-holes" in the corners of the honey-combs produced in modern apiaries. The trait will never be eliminated, but the commercial apiarist may modify the demand for

"short-cut-alleys" by making the interior furniture of the bee-hive conform more closely to the requirements of the insects.

To prove that the honey-cups of *Trigona*, and the incipient queen-cells of the hive-bee, are of typical form, I have transposed larvae of the latter to cell-cups of the former, and the hive-bees readily accepted, and completed, the building of them into normal queen-cradles. The wax cups, though shaped like the initial honey-vessel of the queen *Bremus* (*Bombus*), are of more delicate modelling.

A close study of the interior walls of the hives of *Trigona* reveals many efforts to experiment with hexagons, and since these angular foundations are usually very large, and traced out directly on the flat wood, the "mutual pressure" theory cannot apply. The walls of almost any colony of hive-bees will reveal similar hexagonal tracings in wax. I was interested, too, on finding among the waxy framework, many evidences of hexagonal structure, and the drawing was made from an actual piece of comb from a colony of *T. cassiae*.

For purposes of comparison I have obtained accounts of *Trigona* nests from observers in many other countries, but a few South African reports—hitherto unpublished—will serve to reveal the striking similarity to the biology of the Australian species.

The oval queen-cell of *T. cassiae* is considerably larger than the worker-cells, being 7 mm. at its long axis, and 4·5 at its short axis. It is, too, reinforced with a number of ribs; undoubtedly, these are the elements of the elaborate hexagonal reinforcement of the queen-cell of *Apis*. There is also a further likeness in the apex of the cell being reduced in thickness; the wax being removed until the cocoon itself is visible. The queen-cell of *Apis* being inverted, the bottom is the place of exit, and the cell is thinnest there. In addition to the wax ribs, the thin wall of the cells receives a number of circular "dabs" of dark propolis in irregular order.

At one time it was contended that the mere inverting of the pregnant queen-cells of *Apis* was sufficient to kill the young queens, a catastrophe that retarded the issuing of swarms, and so gave the apiarist a more efficient control over his colonies. Indeed, a certain type of hive was patented to permit inversion of the entire combs in one operation. I have been able to demonstrate that any rude shock during the process would most certainly destroy the females, but the mere turning of them upside down did not have any harmful result. Queen-cells of *Apis* and *Trigona* were placed at all angles, and queens of normal development emerged in proper sequence. The pendent inverted position of the queen-cells of *Apis* is probably an inherited character, for all the worker-cells of *T. carbonaria* are mouth down. On the other hand, *T. cassias* builds them at any angle.

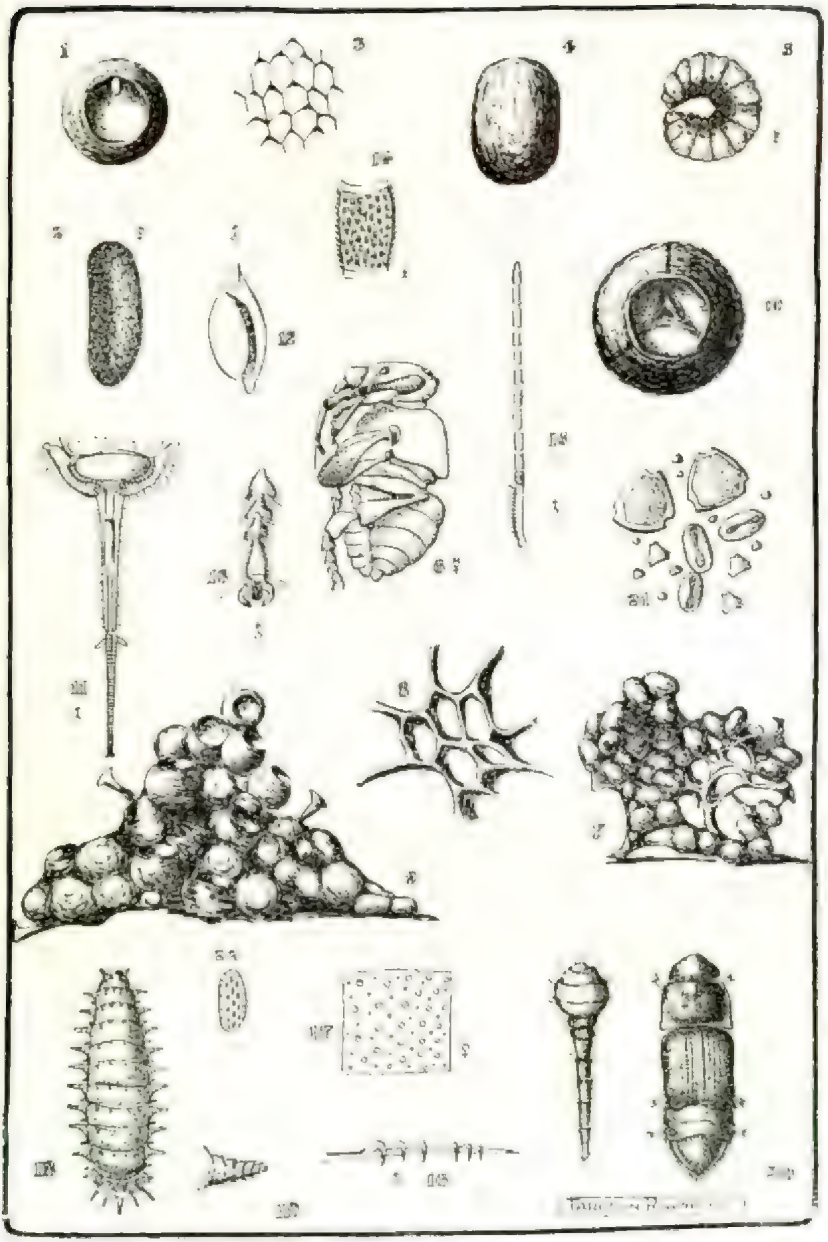


Fig. 3.
Details of *Trigona cassiae* Cockerell.

There is little difference in the size of the worker-cells of these two species, the less compact ones of the latter measure almost 5 mm. in length, those of the former being slightly smaller, but better arranged in horizontal layers. One nest of this species being very symmetrical indeed. I am unable to discern any differences in the drone-cells.

The wax on the worker-cells of *T. cassiae* is exceedingly thin in places owing to its being unevenly distributed, but when the cell is immersed in turpentine, the cocoon is soon cleared of the small amount of wax, and the skin shines with a brilliant golden lustre. Microscopical examination of the cleared skin shows no threads of coarse silk, such as are prominent in the cocoons of *Apis*, but resembles the clear tissue of the cell of *Euryglossa*. The newly-spun silk threads of the hive-bee do not completely fuse together, but the glandular material of *Trigona* and *Euryglossa* most certainly solidifies into a homogeneous membrane capable of holding liquids. The capacity of the worker-cells is about ·06 c. cm.

The white, dry, powdery appearance of the honey-comb of *Apis mellifera* is due to the inclusion of an air-film which separates the wax from the contained honey, but the product of *A. ligustica* often lacks this desirable appearance, since the wax cap lies flat on the honey, giving it a "water-soaked" translucence. This "sodden" surface is found on all the honey-containers of the Australian *Trigona* I have studied.

I append a few notes from various correspondents in South Africa, and which demonstrate clearly a general similarity in habits.

Mr. Lang, Fig-tree Station, Rhodesia, writes:—

"The M'bongolwane is a tiny black bee like a miniature fly. It makes its nest in the 'mopani' ground, usually an ant's nest, and lines the inside with a brown wax. It stores the honey in cells in the bottom of the holes, and the eggs are deposited around the side-walls. The whole swarm could be put into an ordinary match-box. The honey is deep-brown, and tastes sour; a very large hive may contain a cupful." This is probably *T. braunsi* Tohl.

"There is another stingless bee, a large kind that builds in hollow trees. The wax-frame is about six inches in length, with a diameter of fourteen inches. It is sometimes a solid block of capsules, each of which is the size of a thimble. The wax is very dark, and as the capsules are filled the edges are drawn together.

"The honey, though thin and slightly acid, is very refreshing. The bees are larger than the house-fly, and are of a dark reddish-brown, slightly striped. The queen is larger, about the size of a full-grown blue-bottle fly. When the colony is in full work, the flight has the appearance of a twisted rope entering the hole in the tree." The description here given may indicate *T. zebrae* Friese, or *T. denoiti* Vachel.

"There is a third kind of bee, not much larger than a gnat, with a longish black body. The nest is in hollows in trees, and the capsules are about half the size of a pea. I once cut off a small limb containing a colony of these bees, and closed the ends with Boer meal. I then carried it some hundreds of miles in a kit bag, and finally railed it to Grahamstown. The journey occupied six weeks, the young developed, and most of the adult bees were alive when I presented it to the Museum. The native name for these bees is 'Gubenchani'." I have been unable to determine the species referred to in the final paragraph.

A few of the *Karbi* nests had several layers of horizontal brood-combs arranged in such an ordered fashion as to recall the architecture of the paper-wasps of Europe. The general outline was subspherical, and the first or uppermost comb was only 2·5 cm. in diameter; the second 5 cm.; the third 8 cm.; the fourth 10 cm.; and the sixth 5 cm.

The cells of several of these combs were almost true hexagons, and ten of the "worker" pattern equalled in length 2·5 cm. One might say that each superficial inch of "comb-face" contained approximately 100 worker-cells. The distance between the horizontal combs was 5 mm., and the average distance between the struts or toms supporting the layers was 7 mm.; the struts having a height of 2 mm., widened out at their bases and apices to secure a better "bearing surface." This is in accord with the accepted practice of human engineers, and the tendency of supporting columns, of small diameter, to "punch" through the material supported is thus reduced considerably.

One of the above colonies of *T. carbonaria* must have contained about 4,300 worker-cells, some of which looked very dark and hard, as though they had been abandoned for brood-rearing. However, it was a very strong colony, and I have never found any other species of *Trigona* to have such a numerous brood nest. This more or less spherical arrangement of the nursery-combs may not be so uncommon as I imagine, but since they are always surrounded by a maze of honey-cells, and wax struts and supports of all descriptions, only rarely is the naturalist able to bisect the nest without destroying the symmetry of the sphere.

Frequent deviation from a symmetrical arrangement of the combs is also characteristic of the architecture of the hive-bees, and I feel inclined to believe that the defect is due to the character of the walls of the hive; where these are not strictly upright, the honey-bees still build their combs on a vertical plane, and odd-sized pieces of comb are constructed in the angular spaces, care being taken to preserve the essential quarter of an inch space between the comb-faces, and which constitutes the bees' gangway.

It seems, then, that the "bee-way" for *Trigona* is about 5 mm.

EXPLANATION OF FIGURE 3.

1. Looking inside a brood-cell, with an egg on the pollen-batter.
2. The egg of *Trigona* is only slightly bowed.
3. The surface is sculptured with a hexagonal pattern.
4. A sealed brood-cell.
5. Larva when the food has all been consumed and the cell sealed.
6. Worker-pupa three days before emerging from the cell.
7. Cluster of brood-cells showing the loose structure.
8. Portion of the framework, or struts; note the more or less hexagonal pattern.
9. The cluster of honey storage-cells is not so compact as that of *T. carbonaria* Sm.
10. One of the storage-cells, viewed partly by transmitted light, demonstrates the elements of the rhomboidal construction of the honey-bee.
11. Labrum, mandibulae, glossa and palpi of the male *Trigona*.
12. Strigil or antenna-cleaner of the male.
13. Tarsal segments and claws of the male's foot.
14. A segment of the male flagellum showing the pore and peg organs.
15. Antenna of the male.
16. Hamuli or wing-hooklets of the male.
17. Tegument of a pupa almost fully developed, shewing the puncturation.
18. Many thousands of these spiny larvae were removed daily by the bees.
19. One of the appendages under higher magnification.
20. Many of these beetles, *Brachypeplus planus*, Er., were found in the colonies.
21. *Eucalyptus* and other pollen-grains found in the larval food.
22. One of the thousands of white eggs attached to the walls of the hive by a fly.

In the course of a report on his recent visit to the Union of South Africa, Sir Arthur Hill, Director of the Royal Botanic Gardens at Kew, England, makes the following observations:—"I cannot help referring to the possible disappearance of rare and remarkable plants through the activities of "collectors" of "Wild Flowers" for flower shows, and to the lavish use of unique native plants for the decoration of motor cars, etc., at such functions; a practice which is causing alarm to botanists and plant lovers in South Africa, Great Britain and throughout the botanical world."

The Insect Menace, by Dr. L. O. Howard, is an outstanding work, both popular and scientific, recently published in the United States. The author is one of the foremost entomologists of the world and writes with the authority of great knowledge, yet in a very readable style. A copy of his latest book has been purchased for the Club library. Other books will be added, a sum of £5 being available for such purchases from the Special Best Fund.

FROM PORT PHILLIP TO SYDNEY IN 1839.

INTRODUCTORY.

At the February meeting of the Club Mr. A. S. Kenyon read extracts from the diary of Dr. E. C. Hobson, whose record of a trip to Sydney from Port Phillip in 1839 is of deep interest to naturalists of to-day. Mr. Kenyon gave a biographical introduction, dealing with the Franklins and the pioneer naturalist.

THE FRANKLINS.

John Franklin, son of Willingham Franklin, a farmer of Lincolnshire, was one of 12, five brothers and seven sisters. one sister, Sarah Sellwood, was the mother of the first Lady Tennyson; another, Isabella, the mother of Sophie Cracroft, referred to later on. As a midshipman, John Franklin saw battle in H.M.S. Polyphemus, at Copenhagen, and in the Bellerophon, at Trafalgar. In between he accompanied Flinders to Australia, in the Investigator. Through his gallantry at the ill-advised attempt upon New Orleans, he was made first lieutenant. He married Eleanor Porden, a woman of remarkable intellectual attainments, but whose commonsense views of life accorded barely with the rigid puritanism of Franklin, in 1823. She died in eighteen months, a few days after Franklin had left for his North American survey. He was knighted shortly after.

Lady Jane was born a Griffin, of a silk-weaving Huguenot family. She well justified the family name. She was a close friend of Mrs. Eleanor Franklin. In 1828, at the age of 37, she married Sir John, then 42. Lady Franklin was an ardent traveller, having made some notable journeys in Europe in the troubled year of 1815. Almost immediately upon her arrival in Van Diemen's Land she set out to explore the south and west coasts, in company with Gunn, the botanist, and Gould, the ornithologist Whether her continued interference in administrative matters and misunderstandings with Montagu, Governor Arthur's nephew, and Franklin's Official Secretary, and a definite opponent of any soft-hearted or philanthropic effort, made it necessary occasionally to absent herself from Hobart, she certainly did let her husband have a rest at intervals. Setting out to see Port Phillip, in April, 1839, she was presented on arrival by an address from the Civil officers, magistrates, clergy, landowners, merchants, stock proprietors and others residing in Melbourne, 65 in number, beginning with W. Lonsdale and winding up with Robert Russell.

In reply, Lady Jane referred to the "substantial, well-built and populous town in a spot where, eighteen months ago, were to be seen only the few rude huts of the first settlers." The party, which included Sir H. Elliott, G.C.B., then civil A.D.C. and private secretary, took nearly four weeks from the Hume to

Sydney, diverging at Illawarra. Lady Jane stayed there until the end of August, when the party sailed direct to Hobart. For five months peace had reigned in Van Diemen's Land.

THE HOBSONS.

Edmund Charles Hobson, born at Parramatta in 1814, was a son of a clerk in the Commissariat and a cousin of Captain William Hobson, of H.M.S. Rattlesnake, after whom Hobson's Bay was named. In 1816 the Parramatta family moved to Hobart, where Edmund Charles studied medicine under Dr. Jas. Scott, the Colonial Surgeon, later completing his course at the London University. He married Margaret Adamson, of Walbrook, in 1837 and returned to Hobart in 1838. He was appointed Secretary to the Board of Education in 1839, and, in April of that year, accompanied Lady Franklin to Port Phillip. In 1840 he went to Port Phillip again, living first at Currencurrencalk, then, 1842, in Lonsdale Street, Swanston and Collins Streets, 1843, and, finally, 1843, at Bona Vista, South Yarra, where he died on March 4, 1848, aged 33 years. He was registered as a doctor in 1843 and in 1844 became a member of the Medical Board. He supplied Sir Richard Owen with specimens of the Platypus and other Australian animals. He was one of the founders of the Melbourne Hospital. His widow died at Malvern in 1894, aged 84 years. A fine monument was erected in the Old Melbourne Cemetery by a number of his admirers.

A.S.K.

THE NARRATIVE.

We sailed from George Town for Port Phillip on Monday, the 1st of April, in the Government Brig, Tamar, and on the Wednesday morning we made the heads of Port Phillip. . . .

4th April.—Lady Franklin came up the Yarra Yarra to Melbourne in a boat, where she was very cordially received not only by the old Van Diemen's Land settlers, but by the Sydney people. Her Ladyship spent the day in examining Melbourne and inspecting the various tribes of aborigines, who at this time are very numerous, amounting to from 300 to 400. . . .

5th April.—Arthur's Seat, the station which my brother has chosen, is distant thirty miles from Melbourne. . . . Our road lay over some very level country parallel to the eastern side of the bay and about a quarter of a mile within the low sandy ranges, which are so characteristic of the shores of New Holland and Van Diemen's Land whenever the shore is sandy. The trees were generically, and, in most cases specifically, the same as those of Van Diemen's Land. We passed through several marshes to-day, which, in the winter, are very wet. The surface is encrusted with common sea salt. In one of these we saw a pair of those splendid birds, the Gigantic Crane, or native companion. They are of a beautiful slate colour. The head I fancied was denuded of feathers on each side, which was covered with a reddish skin—here also I saw for the first time the native turkey (Australian Bustard). . . . They are remarkably shy and difficult to come at. The natives are obliged to resort to stratagem. They cover themselves with the branch of a tree and move towards the bird as slowly as possible, and in this way they are enabled to approach within shot

without being perceived. The same plan is adopted in coming upon other shy game. After having proceeded about ten miles on our journey we came down upon the sandy beach. Here is a rich field for the naturalist. The shore, strewed with Medusae, Sponges and Periphysa, Polypipherae, or Zoophytae, of the most brilliant and varied colour and shape. None of these have been ever yet described. Sea eggs (echinida) were abundant, of the most curious forms, very much resembling some of the extinct forms in the chalk formation of England and France. Starfish of various species covered the beach. . . . I understand the bay is abundantly supplied with fish of various kind—perch, cod, schnapper, rays and sharks of various kinds, parrotfish, etc. . . . The country betwixt this point and Arthur's Seat, with one or two patches for exception, is barren and totally destitute of water. We saw some splendid birds on the road. . . . About a mile from my brother's hut we fell in with two splendid emus, but the rattling of the gig gave them a fright and I was unable to get a shot. The great kangaroo perfectly swarm in this part of the country. I am sure there were upwards of 300 in one flock, many of which, when erect, would stand betwixt seven and eight feet. The small or brush kangaroo (*Macropus minor*) does not exist in this part of the country. Petauri of both species, Dasyuri, not *Cynocephalus*, Phalangistae of both kinds, *Phascolomys*, or Koala, *Perameles*, *Hypsyprimnus*, Phascogale. The trees consist of eucalypti, acacia, casuarina, etc., most of them specifically agreeing with those of Van Diemen's Land. The country about Arthur's Seat is decidedly of a more humid character than that near Melbourne. The dews are so heavy that a stranger would suppose a considerable shower of rain had fallen. The grass is green and luxuriant (kangaroo) and the nature of the country is better fitted for stock than sheep runs. In the waterholes there are various kinds of duck and black swans. The white crane is found here, though not commonly, and a white falcon, resembling the white hawk of Van Diemen's Land, except in having two white spots on the wings. . . . I obtained from a native some information relative to the generation of the *Ornithorhynchus*. He says he has removed the young platypus and porcupine from the belly. This was confirmed by several of the intelligent natives at Melbourne.

April 6th.—I left Kongeronong with regret from its being so rich a field for the naturalist, not having had time to go more than a quarter of a mile from the hut. . . . We stopped in a dry lagoon, which had the same salt incrustation. On removing the slight layer of earth I found the sub-soil white sea sand, which explained the deposit of salt on the surface. The sand was salt and, to my great surprise, on raking about I found the fragments of astraeidae and madrepora, neither of these hythoptrites I believe are existing in the neighbouring seas. . . . Within a few miles of Melbourne we again fell in with our native companion and the turkey. Great numbers of the ground dove (*Turtur punctata*) were also running in the grass. Quail of several species, I understand, are found here, one corresponding in description to our mountain quail of Van Diemen's Land, and the brown quail is identical. They have also a grey quail, which migrates, and, towards Westernport, a black quail, also a very small quail not bigger than a lark. We arrived at the punt, which is on the Yarra Yarra, opposite Melbourne. . . . Her Ladyship had started and got to Mr. Thornelow's station (Craigieburn) on Saturday evening, where she was to halt till Monday morning, which enabled me to overtake her.

April 7th.—I started from Melbourne about half-past eleven, accompanied by my brother. . . . The country at the back of Melbourne is fertile and beautiful. It presents one extensive, undulating surface

of green. The high grounds consist of a light alluvial soil which seems to be well adapted to potatoes. The intervening lowlands, I understand, are extremely wet in the rainy season. The soil is of a rich, dark, stiff argillaceous character, well suited for wheat or oats. The country is very lightly wooded with mimosa, sheoak, gum and lightwood. The size of the latter is said here to be a good indication of the depth of soil. Ten miles from Melbourne we came upon the temporary stock station of Mr. Darlot. . . We proceeded on our road but the country between this station and Thorneloe's was inferior to that we had passed in the morning. A great deal of barren forest land covered with gravel and broken pieces of agate. Before arriving at the station we passed a creek where I heard the peculiar sound as if from a small bell. This was the note of the bellbird of New Holland. It is never found anywhere save on the banks of rivers or large ponds of good water. On arrival we were kindly received by Lady Franklin and the party. . . . Before tea we made a strong party to see the bellbirds. . . . A beautiful specimen of the *Podargus* was shot by Mr. Elliott, and an owl by myself, identical with the small one of Van Diemen's Land. . . .

April 8th.—Our camp was put in marching order and we were on the way by half-past seven. Our party consists of Lady Franklin, Miss Cracroft, Capt. Moriarty, Hon. H. Elliott, myself, two mounted police, a woman and man servants (Mr. and Mrs. Marshall), the driver of the cart (Shelldrake), a constable we brought from Hobart Town to look after horses; and also Messrs. Thornelue and Cobb gave us their escort. The country between this station and Mr. Thom's is a good grazing country, very lightly timbered with banksia, lightwood, sheoak and gum. The rising grounds are stony—the lowlands present that stiff dark soil which, from its irregular surface (or dead men's graves), appears to be very wet in the winter. We arrived at Mr. Thom's by eleven o'clock, a distance of nine miles; here we baited our horses. . . . It was at this place I first observed the luxuriant crop of parasites supported by the lightwood. . . . Near the house I obtained a beautiful species of magpie, half the size only of our white magpie, with a bluish black satiny back, with white stripes, from the eyes down to the neck. A little farther on the road I shot another bird, evidently related to the pies. From this point the character of the country begins to change. We see no more of the undulating ground clothed with the oak and lightwood. The eucalypt usurps the place of these. The stringy bark (*Eucalyptus obliqua*) forms a complete forest about five or six miles on the north side of Thom's. At five miles from Thom's we came to a range of hills that are visible from Melbourne. The road, though steep, is not by any means bad. This range consists of light alluvial red soil. The pasture is green and thick. After descending the hill we came into a flat country neither possessing water, grass, or a good soil, and from the stunted character of the trees I should say cold and wet in the winter. The face of the country on this side of the range is parched up, whilst the other is covered with a good sward. . . . We continued our journey and arrived at the station of Messrs. Powlett and Green (Moranding); here we were kindly received. Lady Franklin suffered a little from the jolting road. The evening was spent in skinning our birds and preparing them.

April 9th.—. . . We passed by the side of a creek, or, rather, now a chain of ponds. Many even of the very deep holes are perfectly dry. The soil here seems to be based upon pumice. In every hole I found the same volcanic product—except in one—where there was a rising of clay slate at angle of about 40 degrees. The country here is completely parched up. The trees on the road to-day were principally eucalypti.

About eleven o'clock we arrived at the station of Mr. Mundy (Pyalong). He is on the same chain of ponds as Powlett (Kurkurruck), but the water is more abundant and better. Mr. Mundy has a very comfortable hut, furnished in the true baronial style. The hut is covered with the bark of the box the same species we call in Van Diemen's Land swamp-gum. . .

April 10th.—I took my gun before breakfast, intending to go in search of duck, but I was delighted to see, perched on a tree over a hole close to the house, a beautiful crane. I succeeded in killing him without doing any injury. The body was a beautiful slate blue, the neck and head down to the furcular bone was of a fine cream colour with a few black spots on the front of the neck; the upper part of the breast and coverts were clothed with fine plum coloured plumage. I shot a crow and I think it is much smaller than the crow of Van Diemen's Land; its iris is white and the bill less curved and shorter. . . . I saw in one of these ponds one of those beautiful little Emydes that inhabit the pools in this part of the country but their quickness in sliding from the log prevented me from getting a shot. On our route to-day we observed most of the eucalypti to be coated with parasites (specimens preserved). The parasites in some cases were the only green parts of the tree. These bloodsuckers had completely supplanted the rightful owner of the nutrition. The leaves were not impregnated with the essential oil of the gum. The same parasite as fixes upon the lightwood is found on the mimosa decurrens. We arrived at the Goulburn about five o'clock and encamped on the bank. . . . There is a punt and a ford at Mr. Clark's (Mitchelstown).

April 11th.—This day we halted to give our horses refreshment. . . . The heat to-day was very oppressive. Thermometer: midday 84, evening 64. Mr. Elliott shot a swan in the river which is not a small addition to our larder. My day was spent in making notes and the evening I devoted to skinning the beautiful specimen of the crane and in writing letter to my dear wife (Margaret). . . .

April 12th.—At daylight our preparations were made for crossing our baggage and carts and horses. The baggage we crossed in Mr. Clark's punt. The river being fordable, the horses and carts were crossed over by the ford; the carts were reloaded and we started at eight, the day beautifully clear. The country through which we passed was flat and barren, and at the present time perfectly devoid of pasture. From the appearance of the soil it looks as if the land was wet in winter. The forest through which we passed was of eucalypti (box). I saw a few mimosae and casuarinae. The road to-day has been intersected with several dry creeks, but all the water appeared to have long evaporated; so that till we arrived at the seven creeks, a distance of 30 miles, there was not a drop of water on the road. I saw several new species of honey birds and wattle, but from the large size of my shot I did not shoot them. A very large eagle passed over to-day. We arrived about half-past seven at the third of the seven creeks (Pranjip Creek), where we bivouacked for the night. Very soon after our tent had been put up it came on to rain and, to our great annoyance, the sail cloth was not long enough to cover the rugs, so that our feet were enclosed the whole night between two wet opossum rugs. Before arriving at this station I was in considerable danger of being lost. The light cart having gone on considerably in advance of the baggage cart, I followed on foot, but on coming within a few miles of our halting place I was fearful of being benighted, so moved on at a rate so rapid that I found it impossible to keep up, and, as the natives were seen here yesterday in a very considerable body, I felt myself in rather an unpleasant condition, especially when I remembered that this tribe are the most

sanguinary and cruel of any natives in New Holland. They also move at night which is a feature of their character, marking at once their superior courage. I accordingly prepared for exigencies, loaded my gun with buckshot and put in new flints and made the best of my weapon. It soon became pitch dark, and as the track was very narrow I found it exceedingly difficult to keep it and on several occasions actually lost it, but I found the darkness became so intense that I was actually obliged to feel for the track, and in this uncertain condition I travelled several miles. At last, as a *dernier ressort*, I fired my fowling piece and had the satisfaction to hear it answered by Mr. Elliott. In a few minutes after I caught the glimpse of a distant fire, which I knew to be that of the postman. I soon came up with my friends and had the satisfaction of putting them on the road which they had strayed from. I was welcomed by my companions, especially the ladies, who were afraid I had lost myself and perhaps fallen into the hands of the blacks.

April 13th.—We started from our last night's bivouac not much refreshed after our night's rest. . . . There are mussels, shrimps, and *Emydes*, the eel fish and cod, as in all the rivers that flow westward from the Australian Alps. The country through which we passed is flat and sandy, with a hungry clayey subsoil which had become boggy from last night's rain. Saw several cockatoos and Red-crested Cockatoo. We passed over some slight undulating ground just before coming to the Honeysuckle Creek—which was covered with broken quartz. We halted about 2 o'clock at the distance of 12 miles from our last night's camp (Violet Town). There are here a great number of banksias, from which the place has received its name. . . . I shot two parrots and a hawk. The hawk is identical with the Sparrow Hawk of Van Diemen's Land. The parrots, I fancy, are the young of *Platycercus Pennantii*. Mr. E. shot an owl identical with the Spotted Owl of Van Diemen's Land. We dined on the swan and the duck shot the day before. I can't say much for flavour or tenderness. As night came on it began to assume a threatening appearance. Large cumuli came tumbling over each other, and now and then a large premonitory drop would fall, as a foretaste of joys to come. We hastened to construct a tent with one sail cloth on a better plan than last night's. We fastened the back to a log, and drew the front up to a pole supported on two sticks, which gave the cloth a good fall. The front of the tent was left open. Here we slept comfortably. This evening was spent in skinning the birds I had shot and in giving Lady Franklin lessons in the same art.

April 14th.—Moriarty was early on the move, and few sleep after he is awake. We started early, having rather a long stage. The country was low and flat and boggy as yesterday, and the rising grounds were covered with quartz. Box is almost the only tree found on this ground. Saw several cockatoos, Rose Hill Parroquets, and various meliphagidae. A species of mimosa was found to-day very like the *Acacia hispida* in Van Diemen's Land. . . . We arrived at the Broken River about 2 o'clock. The peals became nearer and nearer, and just as we arrived premonitory drops began to fall, and scarcely had we pitched our tents when it began to rain, thunder and lightning in a most fearful manner. We were politely invited to dine in a hut that was in progress of building, belonging to the mounted police the only room that was at all roofed was covered with an old tarpaulin in which there was not a foot without a hole. Under this shower bath our dinner table was laid. It rained in a perfect torrent all the time we were at dinner. The lightning danced among the trees with a rapidity and brightness that laughs at de-

scription. The claps of thunder were as if some huge mountain had been rent in twain and was vomiting its contents upon the plain below. The floor of our dining-room was knee-deep in water. After dinner it was a problem for solution how to convey the ladies to the tents. Moriarty and Elliott offered to support them on their shoulders. Moriarty started first with Lady F in his arms, and was followed by Elliott with Miss Cracroft. They staggered along with their loads, and after sundry and divers groans and puffs they landed safely and dry at their tents. . . . It continued to rain and thunder the greater part of the night. Lady F. was disturbed during the night by what she imagined was a shot succeeded by a cooee. She came to our tent. To quiet her ladyship we fired several guns and halloed, but no answer could be heard. We had one of the mounted police to keep sentry, but nothing was heard during the remainder of the night. The banksias grow luxuriantly on this river. Various species of Meliphagidae abound in these trees. This is the spot where Mr. Faithfull's servants were murdered by the natives—8 out of 15—and here also Major Mitchell crossed this river and lost one of his men in crossing. The natives are fond of this view and often encamp near the plateau, but never come down. We lighted a large fire at the front of one tent, which dried the clothes as fast as they became wet. Innumerable quantities of the large moths, which the aborigines are very fond of, both in their larval and imago state (called Bogong) came fluttering about our fires, and at last, in spite of every effort to prevent themselves, dashed into the midst.

April 15th.—On examination we found our tent had been pretty waterproof. Our guns had got wet, and the percussion only could be got off. The clothes and etceteras were tolerably dry. We started this morning with our two fresh policemen. Lady F. went to see the grave of Major Mitchell's man. The country is very flat for the greater part of our stage. The forest was composed principally of the box. We saw flocks of parroquets, lories, wattle birds, a different species from our V.D.L. This flat is sandy with clay subsoil and is very boggy from last night's rain. Our carts have several times sunk in up to the axle. After crossing over twelve miles of such country we came to rising ground covered with ironbark, stringy bark and box, strewed with laminated iron stone and broken quartz. On reaching the summit of the range, Glenrowan, we had a most extensive view of the country we had passed over and a peep into futurity. We saw before us a plain of forest land, 30 or 40 miles in extent—intersected by a slight range which marks the position of the Ovens River, and over a range of hills beyond we saw a line of vapor sailing which indicated the course of the Hume. Our halting ground was about 2 miles from this elevation. Here I saw several of the "Superb Warblers." . . . The creek on which we bivouacked is a mere chain of ponds. The water is, however, tolerably good. The holes contain shrimp and some species of "astacus." Duck are also abundant. The soil is here alluvial but far from being poor. Eucalypti are here the forest trees and the parasites, very numerous at this season, covered in their crimson blossom (*Loranthus*). The night was clear, cold and frosty.

April 16th. . . . The land over which we travelled to-day was flat and poor. I observed for the first time that species of eucalyptus which is called the Cider Tree in Van Diemen's Land. Saw the recent track of an emu across this road. We arrived at the Ovens about 4 p.m. I incautiously left the party and went down the river to shoot ducks. After arriving at the bank of the river I found a well-beaten path which I soon discovered to be the track of the natives by the bones of kangaroo, turtle shells and mussel shells. I soon had the more de-

cided proof—a foot mark. The temptation of getting some duck induced me to go to the spot I had been told they were so numerous in. I, however, found none. I now thought of the condition I was in and how easily I might be cut off by this worst of all the tribes of savages in N.H. I was much relieved from this unpleasant feeling by seeing Mr. Elliott advancing. I shot a beautiful kingfisher with a purple back and head and reddish-brown breast and little white dots below the eyes. . . . The Flying Squirrel is here most abundant. They were gambolling and screaming in every tree around us. . . .

April 17th.—The morning was extremely cold. . . . I observed at this place several fine plants of *Indigofera*. After passing across the half-mile of made soil, we came to the counterpart of the road of yesterday. This last country continued for 18 miles when we began to ascend and continued to do so for 600 or 700 feet. These ranges are composed of beautiful micaceous granite and schorl upon quartz. This primitive rock is fast crumbling and decomposing into soil, the detritus of which the soil in the valley is formed. There are also heaps of broken agate. The hard compact granite seems to resist the action of the elements, whilst micaceous kinds rapidly decompose. These hills were clad with various kinds of eucalypti, cherry, casuarinas and native hop. We arrived at the Rocky Water Holes (two miles past Springhurst) at four o'clock. The country is very arid; there is scarcely a blade of grass to be seen. . . .

April 18th.—. . . The first part of our journey was over the same low ranges of granite. . . About 11 miles from our starting we began to descend. The hills over which we had been travelling ran pretty nearly north and south. After coming upon the flat we had two deep and difficult dry creeks to cross. The last is called the Indigo. Near the creek are some high granite hills, almost bare and running east and west; from this point Mitchell extends his survey upwards and downwards. . . . We came to Mr. Hume's station about 2 o'clock. Here we bivouacked by the side of a lagoon. . . . This is a cattle station. Mr. E. and myself as soon as we arrived took our guns and went to the Hume. We saw numbers of ducks at which I had several shots without effect. We also saw abundance of cockatoos, parrots, and a beautiful specimen of the White Hawk. The river is about 80 yards wide and in many places still and deep. The trees on its banks are high luxuriant gums. Quail are here about this river; the beautiful and clear note of the bell-bird (*Myzantha flavirostris*) is heard incessantly. I shot a specimen of the Common Blue Crane of Van Diemen's Land. Mr. E. shot some cockatoos, a specimen of the *Dacelo gigantea*, Laughing Jackass, or Squatter's Clock, and a bird called by the natives here "goriesack," by the colonists the "Old Soldier." The lagoons contain an abundance of *Ornithorhynchi* and *Hydromys*, or Musk Rat, and Eel-fish. I shot a fine specimen of the Musk Rat in a small pool near our tent. The pond was full of them, gambolling and careering about in all directions. . . .

April 19th.—We continued our route for twelve miles farther, which brought us to the police station at the ford. I shot on my way a fine specimen of the Bronze-winged Pigeon and a fine specimen of the Fly Catcher, which, I think, is identical with one we have in Van Diemen's Land. On approaching the Hume we saw several ducks, teals, plovers, cormorants, quails, pigeons, bell-birds, etc. I had two shots at the duck without effect, my shot being small and the birds wild. Whilst walking along the side of a lagoon Mr Elliott and Paddy started a very large snake, which immediately took to the water, and, on being struck at, either dived or sunk to rise no more. The day was clear, still and beautiful, and the

silence was only broken by the clear and distinct note of the bell-bird. . . At this point the mounted police have just formed a station. There are at present two privates and a corporal stationed here. These men were remarkably civil and attentive to our wants. The threatening aspect of the day obliged us to accept one of their rooms as a dining room. We here got the luxury of milk to our tea which we always use at dinner in the bush. This is a universal custom in N.H. A Mr. Brown, a native, has a store here, and some land, about 3 acres, in Indian corn, which, although no rain has fallen since it was sown, is ten feet high and a remarkably fine cob and grain. He expects about 150 bushels per acre. Melons, cucumbers, cabbages, and other vegetables grow here luxuriantly. Several families of aborigines are living here. They are short and ill-made, and in many points resemble the natives of Van Diemen's Land. The hair is more nearly approaching to the woolly nature of the Van Diemen's Land than those of Port Phillip. The women are thin, ill-formed, and repugnant in expression—short faces, wide mouths and low foreheads are the characteristic features of the lady of the Hume. They are harmless. Their language is perfectly different from that of the Port Phillip tribe. . . .

April 20th. —We halt to-day to give our horses rest. . . . The native came with us to give an exhibition of his dexterity in killing opossums and squirrels. The first tree he climbed was a very large gum. His sagacity was extremely acute. Before commencing operations he examined carefully the recent leaves that were lying under the tree to see if they had been bitten the night before, then searched for excrement, and, lastly, examined the trunk for recent scratches. The result of all this preliminary investigation was in commencing to ascend the tree, which was a very large one without a limb for several feet. In two minutes he had ascended to a considerable height and in as short a time he cut into a dead limb some distance from its broken extremity, in which there was a hole, and lugged out a large grey opossum. He climbed a great many trees of great difficulty with the greatest dexterity in Lady Franklin's presence. This man was clothed in a shirt and jacket only!

April 21st.—Rose early and found it still raining. Our tent, as usual, proved perfectly waterproof. Finished drying my clothes before the ladies got up. . . . We breakfasted upon mushrooms this morning—a contribution from a native. These people have a natural and unassuming manner that shames the lower order of Europeans. At 9 the rain clouds cleared away, and our cavalcade was on the road in a few minutes. The country about the Hume is undulating and of a very pleasing character. The hills are blunt cones and covered with pasture to their tops. The country on our track to-day was of a much better nature than on the south side of the Hume. The ground became still more undulating and richer as we approached the Mullingandra Station (Morrice and Osborne). Here the soil is of a reddish loamy nature based upon the detritus of granite. The trees were here of the most verdant color. A person by the name of Clark keeps what he designates a store, which is nothing more than a piece of canvas stretched over a ridge pole. The most cruel thing of all was the perfect emptiness of this store. All we could get was a little dark sugar, which this scamp charges poor people 1/6 per lb., but Lady F. only 1/-! Here we pitched our tent in one of the most delightful spots possible. . . . I employed myself this evening in searching for Petauri, but the moon is still too young—the remainder was taken up in preparing the specimens obtained to-day.

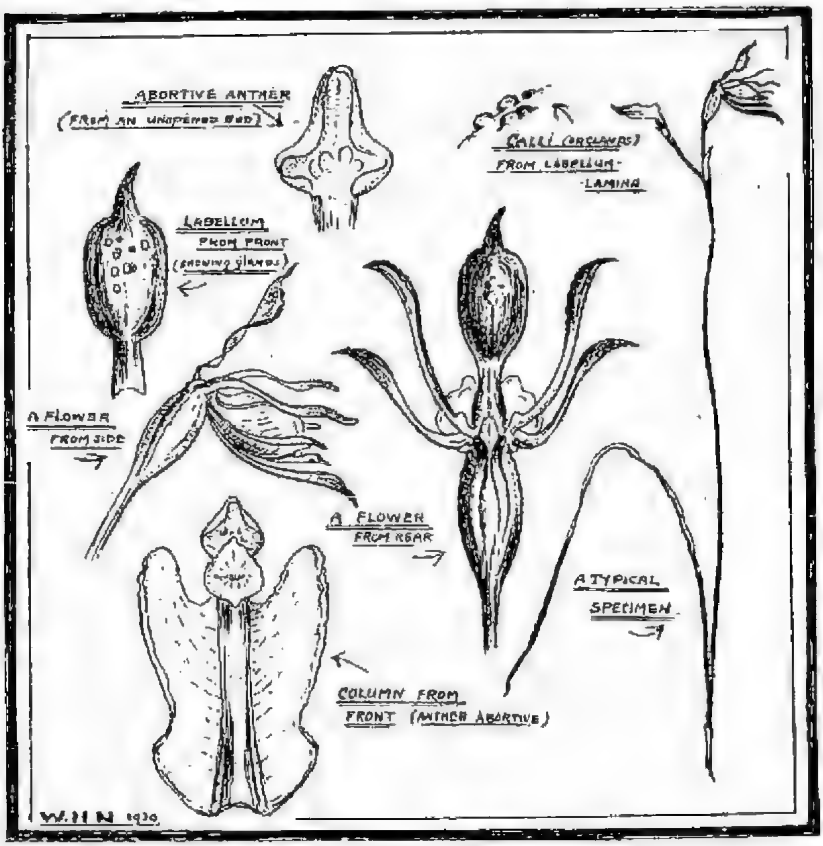
[This is the ending of the manuscript copy of the diary.]

OUR RARER ORCHIDS.

(2) *Caleana Sullivanii* F. v. M.

By W. H. NICHOLLS.

This extremely rare species was named by Baron von Mueller after Mr. D. Sullivan, F.L.S., sometime head teacher in the State School at Moyston, a township situated between Ararat and Mount William, the highest peak of the Grampians. Having previously interested himself in botanical work, Mr. Sullivan was



Caleana Sullivanii F.v.M.

encouraged by the Baron (then Government Botanist) to devote his spare time to the study of the district's flora. He was a member of our Club from 1881 to 1895*

Very few botanists have been fortunate enough to examine a

**The Victorian Naturalist*, June, 1895.

specimen of this "duck"-orchid in a fresh state. On December 12, 1926, I received specimens from Mr. C. W. D'Alton, of Hall's Gap, Grampians. The specimens were collected in the Wonderland Range, approximately 18 miles from the locality (Mt. Zero), where the species was found originally in 1882. This rare orchid bears a somewhat superficial resemblance to *C. minor* R. Br., which species was in abundance in the immediate vicinity of the Wonderland colony.

C. Sullivanii was first discovered in this particular locality (by D'Alton) in 1924. Owing to its small stature, it is very difficult to locate, though growing in quite open spaces facing the sun, on rock faces and in mossy crevices. The flowers are paler than in other species of this genus; light green with reddish markings, the upper portion of stem pale green, at the base red; the leaf is in a more or less withered condition at the time of flowering, which is during November and December.

The original description of *C. Sullivanii* is as follows:—"Its stem very slender, comparatively short, lowest portion enclosed in a membranous, narrow, slightly downy cylinder; leaf narrow, linear, inserted some distance from the base of the stem; no bract between the leaf and the flower bracts; flowers two to three, very small; inner pair of segments of the calyx-limb conspicuously distant from the outer pair; labellum lanceolar-ovate, passing from a gradually attenuated base into curved stipes of hardly half the length, pointed at the summit, very bulging above, amply concave beneath, beset with papillular glands, only towards the centre, not appendiculated; membrane of the column terminated on each side by a small deltoid lobe; fruit oblique, egg-shaped." (F. v. M. in *Melb. Chem. and Druggist*, Vol. 44, p. 68, 1882.)

A more detailed description (by Dr. R. S. Rogers, M.A., M.D., F.L.S.) appears in *Trans. Roy. Soc.*, S.A., Vol. LI, 1927.

In neither of the descriptions is there any reference to the pollinia; none existed in the flowers of my specimens, the stalked anther in all instances being abortive.

As the Treasurer will be presenting his report to the Committee at the next meeting for the end of the financial year 1931/32, he would be glad if members who have not yet paid their subscription would do so at once.

Suggestions or offers for the next excursion syllabus will be greatly appreciated by the Committee. Any matter at all related to excursions will be considered; but should be made as informative as convenient. Offers or recommendations for subjects or leaders for meetings will also be welcomed.

THE WHITE-NAPED HONEYEATER.

By D. DICKISON.

The range of the White-naped Honeyeater, *Melithreptus lunatus*, is more or less confined to the coastal areas of Eastern and Southern Australia. The species is numerous in heavy forest country, though its presence generally is discovered by the harsh, graring call, uttered at frequent intervals throughout the day.

In the tall White Gums growing along the Olinda Creek at Lilydale, and the Cardinia Creek at Beaconsfield, the species is always in evidence, but keeps generally to the topmost branches of those trees from which it obtains most of its food, which consists largely of nectar and insects. This bird is particularly fond of bathing in small pools of water, and on warm days in summer it has been seen to descend from the high branches at brief intervals and bathe itself in the creek.

This is an active little bird, always on the move, and the olive green plumage on the wings gives it a fine appearance. The breast is white, the head black with a white crescent across the nape, and there is a bright orange stripe on the upper eyelid.

The first specimens of the White-naped Honeyeater known to science were taken in the vicinity of Sydney early in the last century. In 1822 William Swainson, a famous British naturalist and artist, published a beautifully coloured plate of it in his *Zoological Illustrations*. Even at that time, nearly twenty years after its discovery, practically nothing was known of the bird's habits.

Around Melbourne the White-naped Honeyeater does not usually commence to breed until towards the end of the year, and I have found nests, with eggs or young, only in December. The nest is generally placed at no great distance from the ground, and is suspended at the extremity of a thin, leafy branch of a green sapling. It is a small and rather deep structure, built largely of thin threads of Messmate bark and lined with a few petals of the flower of the common Christmas Bush (*Prostanthera*) which is in flower at that time of the year. The number of eggs to a clutch varies from two to three. Like those of most of the Honeyeaters, they are light pink in colour with a zone of pink spots around the larger end. The Pallid Cuckoo often deposits its egg, which is almost twice the size of the Honeyeater's, in the latter's nest. The young Cuckoo, when grown to the size of the Honeyeaters themselves, must find the nest uncomfortably small.

The eggs take nearly a fortnight to incubate, and the young remain in the nest for a similar period. Even before they are ready to leave the nest, the young birds begin to assume plumage similar to that of the adults, though it is some time before they actually gain the deep-coloured feathers.

Rarely is a nest found conveniently situated to enable a photo-

Photo by D. Dickison

White-Naped Honeyeater at Nest

grapher to obtain pictures of the home life of these birds. They pay little attention to the presence of a camera near the nest, especially when they are fully occupied in feeding three ravenous nestlings or a young Pallid Cuckoo. Owing to the olive-green plumage of these birds, photographs fail to do justice to their appearance.

Although the nest is so well concealed among leaves, the female Honeyeater often betrays its presence through her pugnacity. Whenever another bird comes near the tree, she darts off the nest, drives the intruder away, and then flies directly back on to the nest again.

NEW NATURE BOOKS

Steadily the number of Australian nature books is increasing. Most notable of those recently published is *Nature Fantasy in Australia*, by Alec H. Chisholm.

Mr. Chisholm's book deserves a place on the shelf which holds W. H. Hudson's works and those of John Burroughs. It is the book of a naturalist who sees beyond the veil which science has woven; a book beautifully written and shining with sincerity on every page. Australia, in Alec Chisholm, has a nature writer who understands the moods and tenses of the Bush and interprets them as charmingly as Burroughs did those of forest and stream in North America.

He gathered, he says, the observations recorded in *Nature Fantasy* for their own sake. And the book is so pleasant to read, one is way-fellow with the author on his rambles "about the tattered sandstone gullies and plateaus near Sydney, and in the forests that intervene."

This is our *"Natural History of Selborne"* and could only have been written by a lover of the wilds, who, to wide knowledge, adds delight in living things, from the smallest orchid to the fantastic old Angophora trees whose roots are clasped about the sandstone and often have split it asunder. A close observer of animal life at all seasons, and an appreciator of the landscape, which, around Sydney, is more distinctive than that of the Melbourne region, and richer in wildflowers and birds.

This is the second of Alec Chisholm's books published by J. M. Dent & Son, London. It is finely illustrated, with a coloured frontispiece and many half-tone blocks from photographs.

A Melbourne book of the kind is needed. But we must go farther afield from our city than Sydney folks do to enjoy the varied charm of wild nature.

C.B.

FLOTATION OF MATERIALS IN THEIR OWN MELT.

By W. HANKS.

Noticing a statement in different text books on geology to the effect that only ice floats in its own melt, on account of it expanding on passing from a liquid to a solid state, I think the following facts and description of experiments arising therefrom will be of interest.

First, such a statement is incorrect, for many metals float, although they contract on cooling. Taking cast iron, the specific gravity of cold iron is 7·20, that of molten iron is 6·64. Theoretically, cold iron should sink; actually it floats, although no one seems able to say why. Various reasons are given, such as surface tension, convection currents, gas, etc. None of them is of much use, as you can push the iron to the bottom and it will bob up like a cork. Recently I attended a lecture on geology, and among the diagrams thrown on a screen was one showing solid basalt sinking to the bottom of a molten mass. I was so interested that, having the means to do so, I made a number of experiments with basalt.

The first experiments were made with crucibles of about 60 lbs., which were abandoned in favour of a cupola furnace with melts of 5 cwt. at a time, the basalt taking about 15 minutes to melt. I found that, no matter how melted, it was a seething, bubbling mass that would not float anything of any weight on the surface. It was difficult to say whether the gases were exuded or contained in the basalt itself as, according to experiments, by Chamberlain, all basalts contain gas. In an early copy of the *Volcanic Letter from Kilauea* is described molten basalt secured some feet below the surface, which was a bubbling, seething mass.

All observers describe very liquid basalt as seething and bubbling. Needless to say, any rock thrown on such a surface would not float. But I found that, by pouring the basalt, which was at a temperature of approximately 1800° C., into a ladle 3 feet deep and 2 feet wide, only the upper two feet was vesicular, starting from slightly vesicular to very vesicular at the surface. A piece of basalt dropped into the mass always floated on the top of the non-vesicular portion. Granite floated about 2 inches higher than basalt, and a piece of coke, still higher, but not on the surface. A piece of iron went to the bottom.

These experiments were all made in very fluid basalt, where viscosity could not effect the result, and I concluded that solid basalt would float in a non-vesicular melt. The basalt, when cold, is a shiny brown glass, but I was able to get a very close resemblance to tachylyte by immersing small quantities of basalt in large quantities of furnace-melted basalt and letting the high temperature remelt it. The tachylyte recrystalises much more readily than the glass. The blocks were broken when cold to find the position of the different objects.

THE BOGONG MOTH.

By CHAS. DALEY.

During the early months of this summer there was witnessed in Victoria an unusual visitation of millions of Bogong moths. Regularly in these months the moths swarm out, but rarely in such immense numbers as in this instance.

It is about six or seven years since they appeared in similar swarms. On that occasion the sea-beach past Sandringham, Black Rock, and Mentone had successive waving lines of them, washed up on the shore in myriads. On the recent swarming the beach for a great distance past Elwood showed a similar phenomenon, the heaps appearing, until closely inspected, just like lines of seaweed left on the fringe of the shore by successive receding waves.

The living moths were in great numbers, and most troublesome on the western side of Port Phillip, and, where they gained access to the houses, were a great nuisance. Near Laverton and Point Cook during their flight the moths were almost shovelled out of some houses. It would seem, from these facts, that the line of flight of this plague was from the north, that untold numbers were drowned when driven by the wind over the Bay, and that their bodies were washed up on the eastern shore of Port Phillip. It is not improbable that these swarms may have issued from amid the granite masses of the You Yangs and neighbouring range.

Occasionally, during the last century, press references have been made to these visitations in overwhelming numbers at different places. The crushed oily bodies from swarms have been known to impede the passage of railway trains, obscure warning lights, and destroy gas mantles. Mr. W. W. Froggatt, the well-known entomologist, refers to an incident, recorded by Icot (*Trans. Ent. Soc., N.S.W.*, 1867) when the moths were so numerous one Sunday at North Shore that the services at St. Thomas's Church could not be held, and some observant persons counted 80,000 moths on the windows.

This troublesome moth belongs to the *Noctuidæ*, or Cutworm Moths, a large family, the members of which, in the cutworm stage, do an enormous amount of injury to pastures and gardens, destroying grass, cereals, young tobacco plants, etc., which they "cut" level with the ground. Recently reports have been made of such ravages.

The moths are nocturnal in habit, resting usually under or amid rocks, in clefts or caves or under bark. At the Buffalo Mountains is a cave shown to visitors which in the season is infested with a moving mass of moths ready to swarm.

The Bogong Moth (or Plague Cutworm) *Euxoa infusa*, form-

erly *Agrotis spina*, is about an inch in length. Its head is spiny. It is dark brown in colour, the forewings being marked with two black lines, and a greyish spot in the centre of each, the hind wings being lighter in colour. The word "Bogong" or "Bugong" is a native one, and the Bogong Range takes its name from the moth, for from among the rocky masses of the range the moths issued at certain times, "a multitude that no man could number."

The moths were a staple source of food supply to the natives, who, at the proper season, from near and afar, sought the rocky haunts in the recesses of the Australian Alps, the Bogongs, the Buffalo, and other resorts.

Dr. G. Bennett, an early Australian naturalist, makes mention in his *Naturalist in Australia*, of the preparation and use of the Bogong Moth by the aborigines. The natives, with expert knowledge of the insects' habits, swept the moths into their bags, then singeing off the wings and scales made the bodies, when gravid with eggs, into a paste having a nutty taste and a nutritious property. The repast was relished with much gusto.

From some M.S. notes of James McArthur, who in 1840 financed the exploring expedition, and accompanied its leader, Count Paul de Strzlecki, into Gippsland, from Yass Plains to Western Port, the following reference is taken:—

The party, with two natives, diverging from the southerly route at Nowang, on the Hume (now Murray) River, ascended the highest peak of the Australian Alps, which the Count named Mt. Kosciusko, after his renowned compatriot.

On March 12, 1840, they reached a spot which, McArthur writes, "was the favourite camping-ground of the natives during their annual visit to feast on the Boogan Moth. Traces of their camps were visible in all directions. Our sable friends arrive here thin and half-starved. A few weeks' revelling on this extraordinary food clothes their skinny frames in aldermanic contrast."

Members who would like to render assistance in such matters as stock-taking, fixing book plates, label writing, etc., are asked to register with the Secretary, giving telephone number, if any. It is scarcely necessary to remind members that any such assistance will be amply rewarded by the opportunities afforded of getting in touch with activities and privileges of the Club. Work parties will be held principally on Saturday afternoons.

Mr. Henry Brew, a new member, of Ballarat, has presented to the Library a copy of "Pages from Nature," by his father, the late Captain Henry Brew. It is a collection of appreciative sketches. The book is now out of print.

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Vol. XLVIII.—No. 12. April 6, 1932. No. 580

THE FIELD NATURALISTS' CLUB OF VICTORIA.

The ordinary meeting was held at the Royal Society's Hall on Monday, March 14, 1932, at 8 p.m. About 100 members and friends attended. Mr. J. A. Kershaw, C.M.Z.S., presided.

CORRESPONDENCE.

Mr. J. Cecil Le Souef asked for evidence of injury to native animals caused by poisoning of rabbits. The Secretary will receive any reports, especially from country members.

Mr. E. E. Pescott had received for distribution a collection of herbarium specimens and rocks. Members may apply to Mr. Pescott, 35 Seymour Grove, South Camberwell, E.6.

ELECTION OF MEMBERS.

Mrs. J. W. Audas and Miss E. Cameron were duly elected as ordinary members.

GENERAL BUSINESS.

Mr. W. Ramm intimated his intention to move, at next meeting, that Sunday excursions be officially recognised by the Club. On the advice of the President, Mr. Ramm consented to refer the matter to Committee for report at next meeting.

The following matters, which had been considered in Committee, were brought forward by the Secretary:—

(a) The need for offers and suggestions for the next excursion list.

(b) Request for assistance in routine work of the Club. Members willing to render assistance were asked to hand in their names.

(c) A proposal to pay more attention to the lower cryptogams.

(d) The desire of the Committee to know the special interest of each member, for a new list of members which it is proposed to publish.

(e) The wish of the Committee to maintain a closer touch with bodies on which the Club is officially represented, and with kindred associations generally.

GIFTS TO LIBRARY.

It was announced that books had been presented to the Library by Miss J. W. Raff, M.Sc., F.E.S., and by Mr. A. S. Blake.

DISCUSSION.

An open discussion of Aboriginal Art was led by Mr. A. S. Kenyon, M.I.E., Aust., vice Mr. C. Barrett, who was unable to attend.

Mr. Kenyon considered that art arose from the necessity for communication of thought—gesture being followed by picture

probably before speech. Early pictorial art was purely utilitarian. Appreciation of colour and of beauty was, as yet, latent. Tracks of game and men came first. Association with life followed, and then the medicine man called in the picture as part of his magic. Several lantern slides illustrated the various types of painting and carving.

Supplementary remarks were furnished by members. Mr. S. R. Mitchell and Mr. R. H. Croll thought that modern art was going back to the primitive. Mr. Croll regretted that much time and money was being spent in studying the aborigine as a decaying museum specimen, rather than preserving him as a human document.

Mr. Daley referred to the high attainment of the natives of the North-West. It was more than utilitarian, and showed a fine sense of decorative design. The tragic fact was that contact with the white man was destroying all the fine technical skill of the blacks.

Miss Chisholm displayed work done by students of the Emily McPherson College, in which the aboriginal style of decoration was copied with pleasing effect.

The President upheld the study of the aborigine. It was one of the few remaining means of ascertaining the working of the primitive mind. Totem poles and feather ornament, he thought, were the highest attainment of the natives, and were proof of imagination and appreciation of beauty.

EXHIBITS.

Mr. C. Daley.—Carved boomerangs from Wilcannia. For the Historical Society, a corroboree painting by Barak, Last of the Yarra Yarra Tribe.

Mr. F. G. A. Barnard.—*Lomaria alpina* (or *Blechnum penna-marina*), collected at Mt. Bogong and pot-grown by exhibitor.

Miss Chisholm.—Corroboree painting; wall hanging, by students, Emily McPherson College, using aboriginal design.

Mr. J. A. Kershaw.—Lower incisors of a wombat, taken from an aborigine's grave near Wilson's Promontory; Lepidoptera, collected on Christmas excursion to Mallacoota.

Mr. W. H. Nicholls.—Paintings of orchids.

Miss Butler.—Flowers of New Zealand Lace-bark tree.

Mr. W. Hanks.—Basalt melted in a cupola furnace, illustrating article in March *Naturalist*.

By Mr. W. H. Nicholls.—Nine water colour studies of Australian Orchids, including *Sarcochilus FitzGeraldi* F.v.M., *S. parviflorus* Ldl. and *S. Cecilie* F.v.M. (these three *in situ*); also two pots of Victorian ferns, cultivated by exhibitor, viz., the Water Ray Fern, *Blechnum fluviatile* R.Br., and the Alpine Fern, *Blechnum penna-marina* Kuhn. The latter was grown from a minute piece found among moss from Cravensville (N.E. Vic.).

OUR RARER ORCHIDS.

By W. H. NICHOLLS.

(3) *Chiloglottis Pescottiana* Rogers.

This orchid, named in honour of Mr. E. E. Pescott, F.L.S., is restricted, so far as is known, to a few spots adjacent to the Bucheen Creek, near the old township of Cravensville, at the southern extremity of the famous Tallangatta Valley, North-East Victoria.

How necessary it is to view orchids in their wild state! I had examined quite a number of specimens of *Chil. Pescottiana* received from residents of the district where it grows and also from the late Mr H. B. Williamson, but not until November, 1930, did I, when in the company of Mr. A. B. Braine (late schoolmaster of the Cravensville school, an original discoverer of this orchid in 1907) realise what a stately little orchid *Pescottiana* is.

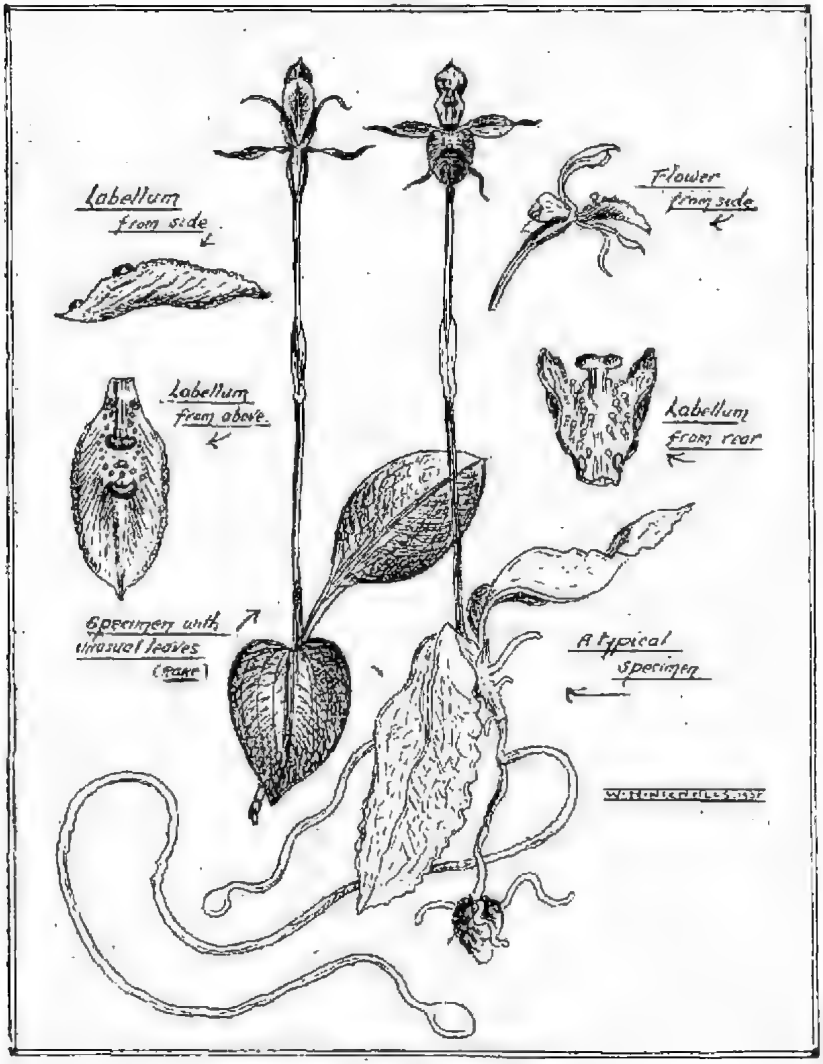
The stem is invariably rigidly erect and the plants are of comparatively sturdy appearance. *Chiloglottis Pescottiana* is easily singled out among the other species with which it is always associated, viz., *Chiloglottis trapeziformis* FitzG. and *Chiloglottis Gunnii* Ldl.

There seems little reason to doubt the theory that this form—now seemingly well-established—originated from a cross between its two allies, for, although the majority of the plants possess the twin, light-green narrow-oblong leaves, similar to those of *trapeziformis*, specimens (rare though they be) have been found with the dark-green, broadly-ovate leaves so characteristic of *Gunnii*.

Our visit to Cranesville district was indeed a fortunate one, as we found the three above-mentioned species in bloom. They love moist and well-sheltered positions between the buttresses of giant eucalypts, and cosy places under *Bursaria* bushes (*B. spinosa* Cav.). We found a few scattered colonies in the reserve and another patch was located on the other (west) side of the creek.

It is to be regretted that the home of this—and other rare orchids—is now given over to sheep. Signs of their depredations were to be observed throughout the valley slopes (including the Cravensville reserve!). A few days after our orchid hunt, the hillsides and valleys were alive with hungry forms.

The labellum of this very rare orchid is unique, bearing as it does, from a side view, a somewhat striking resemblance to an aborigine's bark canoe. The description (given briefly here) is taken from the original [in the *Proc. Roy. Soc. Victoria*, 30 (N.S.), Pt. II, 1918]:—"Plant slender, 3-7 inches high; leaves on long petioles, oblong-lanceolate; flowers single, greenish-bronze, with dark-purple calli; lateral sepals linear-lanceolate, recurved, connate at extreme base; dorsal sepal spathulate-acumin-



Chiloglottis Pescottiana Rogers.

ate; lateral petals spreading, lanceolate; labellum oblong; calli dark purple, distributed as follows:—(1) One large crescentic sessile callus in middle line in advance of all the others; (2) a large bibbed stalked callus about midway between this and base of lamina; (3) numerous stalked calli, small and medium sized, between (1) and (2); (4) a somewhat irregular row of small stalked calli running on either side of the middle line from the

bend in the lamina to its base; column winged above; anther blunt."

Flowers, September, October, November.

In the foregoing description it will be observed that the author (Dr. R. S. Rogers, M.A., M.D., F.L.S.) refers to the colour of the flowers as "greenish-bronze." Some of the specimens collected by Mr. Williamson, in 1928, were uniformly coloured pale verdant green. Those observed *in situ* were wholly (stem and flower) of a very rich purplish-black, thus harmonising with their shady retreat; but when the sun shone through the forest at early morn the plants were given an added touch of crimson!

THE BIOGRAPHY OF ROBERT DAVID FITZGERALD, F.L.S., AND ARTHUR JAMES STOPPS, F.L.S.

By (MRS.) C. A. MESSMER.

R. D. FitzGerald! A. J. Stopps! What memories do these two names not conjure up for those Naturalists still among us who enjoyed the pleasure of their genial friendship and society?

What memories of days of delight, freedom spent with naught but the sky for roof, and for walls the boundless horizon. What memories of excursions undertaken in that atmosphere of intimate companionship and tacit understanding between friends, drawn together by a common love that only the wilds can give.

Yes, fortunate are they in their memories; and fortunate are we of the younger generation, to have had such men as these patiently and painstakingly to contribute their share in the fields of research that have been opened to us.

I have called this a biography. Such it is not, in the strict sense, since is has no continuity nor chronological order. Merely have I tried to set down, as I know them, those events of career and attributes of character which led up to the publication of FitzGerald's *Australian Orchids*.

Born in 1830, the son of a prominent banker, who was a highly respected and much loved citizen of Tralee, in the south of Ireland, Robert David FitzGerald was destined to open up new avenues of thought to a family who had hitherto taken little interest in matters extraneous to those of the church and social welfare. The father, a rigid supporter of the Church of England, together with other members of his family possessed the strictest and strongest views of an orthodox religious nature.

An atmosphere of the very bitterness of sectarian feeling and fierce tension existing, at that period, between the churches in the south of Ireland, left such a deep impression upon the clear and balanced mind, which even in youth manifested itself, that in after-

life Robert FitzGerald had a strong disbelief in any form of religion, seemingly based upon any particular creed, or used by any particular sect. Nature, in every form, appealed to him. A keen ornithologist, geologist, and botanist, the unbounded horizon meant and contained far more for him than the four walls of the most magnificent building, be it cathedral, temple, or mosque.

At an early age the instincts of a naturalist-scientist manifested themselves. Conjointly with his studies at Queen's College, Cork, in civil engineering, he made ornithology his principal hobby, and at the age of fifteen not only made a complete copy in the finest of typescript of Selby's famous work on British ornithology, but also illustrated it with perfect replicas of all the original figures. He also made a collection of skins and eggs of British birds, containing many type specimens, which came to Australia with him when the family emigrated, in 1856, and settled in Balmain. In August of the same year he joined the Lands Department of New South Wales.

An accomplished taxidermist, many of his bird skins were exquisitely mounted. Unfortunately this valuable collection has been lost to science, having fallen a victim to the depredations of insects. At his home, at Hunter's Hill, the present head of the family, Mr. R. D. FitzGerald, in his own collection of eggs has many that were obtained by his illustrious father in early collecting days in Australia.

Among many notable friendships were those of both John Gould and Sylvester Diggles, and FitzGerald was the envied possessor of the first five original parts of the famous work of the former upon British birds. Greater even than the tragedy of the lost skins and eggs is that of the loss of these priceless books. Within quite recent years, following upon their being moved from the house of one member of the family to another they most unaccountably disappeared.

A keen fisherman also, it was seldom a Christmas or Easter was spent by Robert FitzGerald other than in camp up the Hawkesbury River or Brisbane Water, and many were the hours placidly spent between sunset and dawn, angling successfully off the rocks of the foreshores of his home at Hunter's Hill, on the Parramatta River. Every nook and corner of Sydney Harbour was explored in his own boat, and it was upon one of these excursions that his son, Robert, definitely discovered *Pterostylis Baptistii*, at Hen and Chickens Bay, Abbotsford. Previously John Baptist, who did so much for Australian horticulture in its infancy, thought that he had seen a magnificent specimen of *Pterostylis curta*.

FitzGerald was a splendid shot with an old double-barrelled muzzle-loading "Manton," brought out from Ireland with him

This he used, in early years, for purposes of obtaining a scientific knowledge of Australian birds, but his love of bird life and regret at its destruction proved a great factor in his eventually seeking an outlet for his scientific mind in the field of botany. This field, once entered, its countless paths supplied him with an unending and ever-widening field in which to labour with interest and love.

Mr. L. S. Campbell, late Director of Agriculture and a well-known botanist, has related the circumstances in which FitzGerald first became interested in orchids. In 1864 Mr. Campbell was invited to join FitzGerald on an excursion to Wallis Lake, for the purpose of collecting specimens of birds.

The trip was made in a timber trader's ketch, aboard which the two naturalists shipped their 16 ft. dinghy. Upon entering the lake, and as soon as they landed, they were surprised to see large clumps of *Dendrobium speciosum* growing on boulders just above high-water mark. One clump of huge dimensions so greatly attracted FitzGerald's attention that he longed to take it intact to his home at Glebe Point, Sydney. Mr. Campbell assured him that it could be done; and it was this clump that proved to be the origin of *Australian Orchids*.

The original intention was to work south, to Smith's Lake and thence to the Myall Lakes, portaging the dinghy with the aid of any blacks with whom they might come into contact, across the intervening country. Birds were scarce, with the exception of Black Swans and Ducks, and nothing of any importance was obtained. The idea of the southerly trek having been abandoned, and fish being in such countless numbers that there was no sport in angling, the two friends decided to explore the plant world, and became interested in, though wholly ignorant of the names of, the epiphytic orchids. The first to be noted (identified upon the return to Sydney) were *Dendrobium tetragonum*, *D. Fairfaxii*, *D. linguiforme*, etc. Happy hours were spent puzzling over these and other orchids.

Upon the return of the ketch, and with the aid of two aborigines, the huge clump of *D. speciosum* was secured and successfully transported in perfect condition, notwithstanding the fact that the whole outfit was very nearly wrecked upon the jagged "Seal Rocks," having met with a southerly squall.

Ever ready to assist the new recruit to orchidology was William Carron, of the Botanic Gardens, Sydney. He was the botanist attached to Kennedy's disastrous expedition from Rockingham Bay to Cape York, and the sole European survivor. With the idea of helping him financially, FitzGerald asked Carron to give botanical lectures to a selected few Lands Department officers after hours once a week. Carron was the discoverer, in the Dorrigo or Comboyne country, of the famous Antarctic or Nigger head

ROBERT D. FITZGERALD.

Beech, *Nothofagus Moorei*, which was originally named *Fagus Carronii* in his honour.

Not only was R. D. FitzGerald, as we have already gathered, surveyor, civil engineer, geologist, ornithologist, botanist, artist; truly a varied and versatile personality; but in early youth a

strong poetical nature was evidenced. Poems, written in his teens, are still treasured by his children. They were contributed to the *Kerry Magazine* and *Dublin Penny Weekly*. Full of Irish humour and tales, he belied a somewhat stern appearance. In the happy circle of his family (he had three sons and two daughters), in company of his colleague of the Lands Department, A. J. Stopps, well known as the lithographer of his orchid plates, many were the evenings of tale and anecdote and chuckles over such works as Lewis Carroll's *Alice in Wonderland*, his favourite. Stopps, though English, proved a fitting companion for such a man, in so much as he portrayed all the humour, good fellowship and *joie de vivre* of his Irish-born friend.

Artist to the finger-tips was Robert FitzGerald. Every change of light and shade, every varying glade and open space afforded enjoyment and drew forth remarks and references still lovingly remembered by his children. Artist we certainly know him to have been, from the exquisitely and naturally portrayed figures he has given us in *Australian Orchids*. Each plate was carefully prepared from living specimens, collected by himself or sent in hermetically-sealed surveyors' cylindrical cases by his collector friends.

With what infinite patience each segment was dissected, examined and drawn we can gather from the fact that FitzGerald had specially constructed for the purpose a small microscope and forceps which held the flower, or part thereof, in a position of nature, and could be held with one hand up to the eye while the artist worked with his other hand without having to alter the focus of the eyes, one of which was on his object, and the other on the paper. The rapidity with which he worked amazed his colleagues.

Not one of those original specimens has been preserved for us! For R. D. FitzGerald had a horror of dried plants, maintaining that no accurate description of any orchid could be obtained from a specimen, so contorted as it must necessarily become in the pressing. In contrast to this is the fact that his friend, Baron von Mueller, would never attempt to describe a new species until it had been thoroughly dried.

All the plates of the great work were not only drawn by the author himself before being passed on to his lithographer, but after the process of lithographing and printing, proofs of each finished plate were individually hand-coloured by himself to ensure perfect accuracy before the others were passed on to the artists who coloured them.

In the early stages of the work the plates were lithographed by FitzGerald himself as were those done towards the end of his life, Stopps' eyesight having become seriously impaired by the

arduous task so ably undertaken by him that he was compelled to abandon the work.

Poetry, artistry and science. What a combination making for idealism and happiness, but how often associated with a somewhat biassed temperament. Not so in the case of Robert FitzGerald. With a wonderfully balanced mind all matters requiring a decision were examined and reviewed with a care and thoroughness, exemplified in his remarkable drawings of natural objects.

A work by T. W. Rhys Davies upon Buddhism was closely studied, but the works of Charles Darwin may be said to have effected a major influence upon his trend of thought. In keeping with his characteristic actions, the fullest recognition was made, of such influence, when, in 1882, the first volume of his work on Australian orchids was published. The inscription reads:—

"This work on the Australian orchids is dedicated to the memory of the late Charles Darwin, as a token of the veneration in which that great naturalist and fearless exponent of science is held by the author."

A personal correspondence with Darwin had existed. Unfortunately all letters were accidentally destroyed. References in Darwin's *Fertilization of Orchids* to FitzGerald's observations will be well remembered by all students of that work.

As before stated, FitzGerald entered the office of the Surveyor-General of New South Wales in 1856, and in that department he remained for 31 years, retiring in 1887. He had a very great respect and regard for Sir John Robertson, with whom he was brought into close contact over the administration of the Land Act of 1861, and out of which sprang an intimate friendship. But it was by the Parkes Ministry of 1873 that he was appointed to the post of Deputy Surveyor-General.

Though the fact is known to few, his efforts, departmentally supported by Sir Henry Parkes, when in power, secured the reservation for the public of the areas fronting the famous Katoomba, Leura and Wentworth Falls. His son tells me that he well remembers accompanying, as a lad, his father on a tour of inspection of these localities, then practically unknown. FitzGerald showed intense appreciation of their grandeur, and prophesied that in the course of but little time the world would recognise it, too. Every effort within his power would be made to secure these frontages for the public. This was done, despite strong opposition and pressure on the part of those who wished to obtain them for private use.

Subsequently a tour of the Clarence and the Richmond resulted in the reservation of the beautiful Elizabeth Island and other islands on those rivers. FitzGerald felt very strongly upon the subject of securing for future generations the reservation of such

wonderful sanctuaries of the natural fauna and flora as these. In November, 1876, under direction by the Colonial Secretary, a special trip was made to Lord Howe Island, a report being desired upon the state and condition of the people resident thereon.

The visit resulted in the discovery of many plants now recognised as horticultural gems, such as the Kentia palm, *Todea Moorei*, *Hemitelia Moorei* and *Dendrobium Moorei*. Here he also discovered one of the largest of Epacrids, *Dracophyllum FitzGeraldii*. Mention must not here be omitted of his own lovely *Sarcochilus*, which is one of our most beautiful Epiphytic orchids. It was discovered by him in the dark gorge at the head of the Bellingen River, and named *S. FitzGeraldii* by Baron von Mueller as a token of esteem. By his researches in the northern and western parts of the continent, FitzGerald also rendered valuable service to science. The business of the Lands Department, as time went on, grew to such dimensions that it had perforce to be split up into various sections, and the service became so popular that hundreds of recruits presented themselves for entrance and examination. FitzGerald was the examiner of these candidates and never lost interest in those who were appointed to his office. He was also one of the board of examiners for the qualification of surveyors seeking to obtain licences.

The Crown Lands Act of 1884 sounded the death knell of the Department as it then stood. FitzGerald was appointed one of the Commissioners to inquire into the conduct of the Department, and to investigate schemes of decentralisation, and suggest channels for carrying out very necessary but drastic economies. To use his own simile, "The grain which was ground in one large mill now passes through 15 smaller mills."

As Deputy Surveyor-General, FitzGerald had practical control of the whole office staff, and, like the good captain he was, would not desert them in their extremity, and, if need be, would go down with his ship. So drastic were the reductions of staffs that far-reaching disaster fell upon the officials. The work in hand was so odious to him, and caused him so much distress of mind, that it seriously affected his health.

Foremost among the sufferers was FitzGerald himself, who personally recommended the abolition of his post of Deputy Surveyor-General, and he, in consequence, retired in 1887. This is the period in which his active brain redoubled its energies in the direction of his botanical studies, and the task of adding to his already enormous number of drawings and descriptions of orchids provided congenial occupation, and the publication of *Australian Orchids*, commenced by the Government in 1882, was enthusiastically proceeded with.

The first volume of seven parts was complete, and the second had already run into four parts, with material in hand for the fifth, when, at the height of his powers, and only in his 62nd year, the author-artist died, on August 12, 1892.

Nothing can better show the estimation in which FitzGerald was held by contemporary scientists than the following extract from a letter from Baron von Mueller to the Rev. Dr. Woolls, F.F.S., in response to a letter informing him of the death of their mutual friend and fellow scientist:—

"It is indeed an irreparable loss, not only to our favourite science but to ourselves personally, who have learned to appreciate his sterling character in life. Your communication came to me with all the more sadness as I was not even aware of his illness. Were the distance not so great I would have endeavoured to be in time to pay my last worldly homage to him on the way to the grave.

"My telegram, despatched as soon as I heard the tidings, will have conveyed to you my request to express my deep condolence to his family. May I also beg of you to communicate also to the Linnean Society of New South Wales the expression of my profound sadness on account of this great and sudden loss. So long as the lovely orchids of this part of the world embellish with singular and varied beauty the natural features of Australia, so long will the memory of our leading orchidologist be held dear in the study of God's works."

Not only was this irreparable loss felt by all his intimates, but sorrow was expressed by all with whom he had come into contact in his varied career. In every country town and every survey camp the news of his death brought grieving for the loss of one who had been looked upon as a much loved adviser and friend, for he had always, even in his high official capacity, been easy of approach, at the same time commanding infinite respect and dutiful obedience from his departmental juniors, particularly among the young people.

The drawings and notes left by FitzGerald which were to have completed the fifth part of his second volume were carefully collected by the late Henry Deane, F.L.S., an enthusiastic botanist, and A. J. Stopps, who, between them, had the last number published in 1894.

Apart from the immense work of the publication of *Australian Orchids*, FitzGerald made a large number of exquisitely coloured drawings of native flowers, with their parts in detail, as in the orchid plates. These also were all made from living specimens. They represent some hundreds of species and were done merely for amusement without any intention of publication. These drawings are now in the possession of the artist's son, Mr. R. D. FitzGerald.

R. D. FitzGerald's Home, "Adraville," Hunter's Hill, Sydney

Not only in Australia was Robert FitzGerald recognised as a botanist of outstanding merit, but judging by the number of medals awarded him at international exhibitions, his fame was world-wide. In 1871 he received a bronze medal from the Agricultural Society of New South Wales, awarded as a special prize for his work upon orchids. In 1878 a gold medal, awarded by the Exhibition Internationale de Paris, was won by him for his masterpiece, which was soon to be published. Other awards were:—1879, a heavy bronze medal from the Sydney International Exhibition; 1880, a silver medal from the Melbourne International Exhibition; 1883, Amsterdam Medal D'Or; 1886, Colonial and Indian Exhibition, London, bronze medal.

These notes would not be complete without reference to the unique and remarkable fernery which FitzGerald built entirely, rock by rock, with his own hands. It contained, in a thriving condition, many rare and beautiful ferns never before nor since really successfully cultivated in any Australian city. It consisted of a large excavation measuring about 31 feet by 15 feet in living sandstone rock, with a glass roof. One half of the floor space was occupied by a deep tank, also excavated from the rock and overlaid with rafters an inch or so apart so as to form a strong floor.

At the time there was no metropolitan water supply at Hunter's Hill, and householders needs must conserve every drop of rain water collected. In order to maintain the high percentage of humidity necessary for the successful growth of ferns, FitzGerald conceived the idea of utilising his limited supply of water over and over again to the last drop, and for this purpose the tank was constructed.

The water for the fernery came from an immense tank higher up in the garden, supplied by surface drainage. The watering was accomplished by means of perforated pipes, so ingeniously covered with natural-looking rock and rough cast as to be quite invisible in their hiding places among the general rock work of the fernery. At the turning of a tap myriads of tiny jets of spray sprang into life, or a gentle trickle slowly flowed over all the rock surfaces. The surplus of the water which flowed down the walls and from the rockeries was all collected in the floor tank, to be pumped back again into the huge storage tank in the garden.

To enter the fernery one had to walk down a little winding path through a small forest of palms, tree-ferns and other plants, each bearing its load of staghorns, climbing ferns and orchids, and then descend about half-a-dozen winding stone steps into this fairyland-like grotto. Within this small area, growing happily together, were about 300 species of ferns, mosses, selaginellas, orchids, arums, begonias, saxifrages, palms, and other plants,

creeping and crawling about walls, arches and grottoes of most beautiful water-worn rock, with every here and there water-worn basins filled with water.

FitzGerald had an ingenious method of casting rough natural-looking small cement basins by throwing a lump of wet cement into a depression in a sandheap, and these he affixed to his other rock work and water-pipes to form rough rocky excrescences and depressions to hold a little necessary earth for his treasures.

Those who knew this fernery tell me that one would not for a moment believe that any of this wonderful rock-work had been made by hand. It was to grow the glorious fern named by an English botanist, *Todea Mooreii*, which was discovered by Fitz-Gerald near the misty summit of the mountains of Lord Howe Island, and other moisture-loving species, that this bush-house was constructed with its irrigation scheme for keeping up the percentage of humidity necessary in the atmosphere for such things as the exquisitely frail Hymenophyllums and Trichomanes. *Todea Fraseri* (*Leptopteris Fraseri*), *Todea superba*, of New Zealand, which is considered the most beautiful fern in the world, and the green transparent disc-like leaves of *Trichomanes reniforme*, also from the Dominion, all thrived as in their natural haunts.

His garden, comprising about two acres, was as remarkable as his fernery. Growing together in delightful and natural confusion were found indigenous vegetation, gnarled old fruit trees, and rare delicate exotic plants from all parts of the globe. In this garden many were the experiments made of great horticultural value, and many the interesting hybridizations, one of his remarkable crosses being that between the white arum and native green cungehoi, to give the former the delightful perfume of the latter.

This fernery and garden alone would have been more than an ordinary man's life work. It merely satisfied FitzGerald's love for living things and perforce had to take a place subordinate to that of his greater work going on indoors, and of which we shall always treasure the immortal results. The lovely garden, alas, has fallen into decay.

THE LITHOGRAPHER.

Arthur James Stopps was born in Devonshire on November 11, 1833, his father being steward and manager of some of the Duke of Devonshire's estates. Before proceeding to College at an early age, he was educated at a "Dame's School," the mistress of which, Mrs. Townsend, exercised a strong influence upon his whole life. To the end he held her in affectionate remembrance.

His school life was cut short at the age of fourteen by the death of his parents, but he had that keen mentality which could take every advantage of what he had already learnt, and no opportunity was lost for improving upon his early education. His guardians

articled him to the artist, W. Spiratt, for five years during which time he lived as one of the family. He remained for a while, assisting Spiratt with his drawings, and then made his way to London with his small means and precious drawings, being then just twenty-one.

The young artist applied at many lithographic offices for work, but obtained only temporary occupation, all business being at a standstill as the result of the Crimean War. A year later, deciding to try his luck in Australia, he took a berth in a sailing vessel, then in port, and arrived in Melbourne on April 26, 1856. He soon became known and gradually got work from various

A. J. STOPPS.

architects, and finally for the Government. In his own words, "All was fish that came to his net," and he assiduously set to work to draw and lithograph churches, seeds, shells, fish, natives, and last, but perhaps not least, noted men of the day.

Stopps, for a brief period, was employed in the Surveyor-General's Office in Melbourne, and when the Surveyor-General of New South Wales asked that office to recommend a lithographic draughtsman, he was appointed to the post, in 1862. It was then that he met FitzGerald. They were co-examiners later of

entrants to the Department. Attracted to each other by the same genial personality and love of the beauties of nature, they collaborated in much of their work, and Stopps later undertook to do the lithography for *Australian Orchids*, then in course of preparation. There was no gaslight in Hunter's Hill in those days, and Stopps' daughters remember their father, always short-sighted, with his eyes close to the grey lithographic stones, working on one tiny spot, upon which a ray of light was directed from a kerosene lamp through a round bottle, full of water, which did service as a light condenser.

After forty-five years' service he retired, having for a period held the office of Acting Surveyor-General. He was much loved and respected in the Lands Office, and at a valedictory the then Minister for Lands said, "Mr. Stopps, throughout the whole of his career as an officer of this Department, has been actuated by the highest and best of motives and the strongest sense of duty. Mr. Stopps leaves the Department with the respect and goodwill and the best of wishes of everybody in it."

He lived for more than sixty years at Hunter's Hill. Unfortunately he was totally blind for the last few years of his life, but, despite this affliction, was interested in all events, and maintained his humour and brightness to within a few weeks of his death, in August, 1931, at the age of ninety-eight years.

The whole of A. J. Stopps' lithographic work in connection with *Australian Orchids* was done upon a table of historic interest to Australians, and which most assuredly should be preserved to the Australian public in some institution housing such historic objects. This extract from his diary tells of how he came by this table:—

"In the fifties of last century a German gentleman named Ludwig Becker, after getting experience as a digger, and of camp life on several of the Victorian gold fields, settled in Melbourne, where his varied scientific knowledge brought him into associations with persons of similar acquirements, one of these being Professor McCoy, palæontologist of the Melbourne University and Museum. Mr. Ludwig Becker was also an artist of ability and had made clever sketches of life on the gold fields. Under Professor McCoy's direction he made careful drawings of specimens of natural history, geology, etc., for the Museum, and these he was able to reproduce in facsimile, having acquired the fascinating art of drawing upon lithographic stones (an art due to German discovery and development). The prepared stones were heavy and could not easily be moved to accommodate the draft. To lessen the inconvenience Mr. Becker caused to be constructed a strong table with a hinged leaf on top, capable of being raised to a suitable slope to draw on. It was upon this table that much excellent work was done by Mr. Becker.

"In the year 1861 the Burke and Wills Expedition (Australian Exploration Expedition) was organised, and Mr. Ludwig Becker was appointed artist, naturalist and geologist to the expedition. On the night of August 19, 1861, the writer of these notes visited the whole encampment in Prince Albert Park, Melbourne, on the eve of its departure. On bidding Mr. Becker good-bye and good luck, he gave me an order to receive from his solicitor, Mr. Brahe, his drawing table, knowing that I should value his gift and probably use it for purposes similar to his own. Indeed, since then the table has borne the weight of many a heavy stone upon the face of which laboured drawings have been made, prints from which are seen rarely elsewhere than in museums and public libraries.

"The ill fate of the Burke and Wills expedition is a matter of history, and poor Mr. Becker was the first to succumb to the privation and disease suffered by the party. He died of scurvy.

"It was said that Ludwig Becker was a brother to Dr. Becker, who was tutor to the elder children of Queen Victoria, *i.e.*, the Empress Frederic of Germany and the Prince of Wales (since King Edward VII)."

Happy am I in being the possessor of the complete set of *Australian Orchids*, owned and treasured by the late A. J. Stopps himself. FitzGerald's own set and most of his unpublished plates were purchased by the Trustees of the Mitchell Library, Sydney.

My thanks are due to Mr. Robert David FitzGerald, of Hunter's Hill, and Mrs. L. G. Thane, of Woolstonecraft, Sydney, daughter of A. J. Stopps, with whom I have a valued acquaintance, and who have so kindly supplied me with many hitherto unknown intimate details of the lives of their parents.

For inclusion in the list of members to be printed shortly, all members are requested to give the Secretary an indication of the particular branch of natural science they favour.

On September 24, 1931, while examining a few small ponds at Carrum, with a hand-net I caught two small Blennies and many other small fish. On arriving home only the Blennies were alive. They were placed in my aquarium, and the larger one was taken to the recent exhibition of the Field Naturalists' Club, but, unfortunately, it died. The other survived in the fresh water of my tank, and soon began to know that when people came to see it it would be fed. It always rose to the surface when someone came into the room in order to get the food before its tank mate, a Pigmy Perch, could sense it. It would cling to the glass with its pectoral fins, which formed a sucker. One morning I found a large yabbie in my tank; and the Blenny, a poor swimmer, had been killed by the clumsy crustacean. I now know that Blennies will live in fresh as well as in salt water, and they make better aquarium pets than do goldfish.

PAT. FLECKER.

THE STINGLESS BEES OF AUSTRALIA.

By TARLTON RAYMENT.

3.—BEHAVIOUR OF THE INDIVIDUAL.

Though I have had colonies of *T. carbonaria* and *T. cassiæ* under close observation, in trees and in glass-sided hives, yet owing to the complicated ramifications of the waxen structures, the insects were always able to secure a no small measure of privacy. The best results were obtained by housing the colonies in hives with easily detachable sides and roof. When these were removed, I was able to follow the bees' movements with greater accuracy. Nevertheless, so strong is the insects' natural antipathy to light in the home, the most careful uncovering of the glass, or the removal of the hive-wall, always produced more or less panic; a frenzied rushing over the combs, apparently without rhyme or reason. No amount of handling accustomed them to the light, whereas the hive-bees, although at first they show a similar reaction, will, in time, become inured to the change, and behave almost normally although fully exposed.

A series of six hives was secured in New South Wales and Queensland. After removing the entire combs, and many of the adhering bees, from the trees, they were placed in small boxes 25 cm. long by 12 cm. wide by 25 cm. high. The tops and one side were screwed on to facilitate subsequent removal for inspection. Ventilation was provided by an opening in the cover, 12 cm. long by 3 cm. wide; the aperture being covered with fly-wire gauze.

Flight-holes of about 1·5 cm. in diameter were bored at various situations in an endeavour to find the preferred position. The colonies were then left undisturbed for a few days to enable them to secure the combs to the hive-wall—a very rapid process. They were closed finally one evening, when the field bees had returned for the night. All the colonies were imprisoned for over ninety hours, and the transportation involved several changes of railroad vehicles. On arrival at Sandringham, Victoria, all of the wire gauze, and every other opening, had been completely stopped up with propolis; *T. carbonaria* using the greatest quantity of thick, viscid, brown resin; *T. cassiæ* only partially covered the gauze with a much thinner, paler, more waxy material.

On re-opening the entrances, the bees flew freely, taking short circles, and always with their heads towards the hive when orienting the new position. This was done as carefully and as surely as it is by the hive-bee. Within ten minutes the workers were extremely busy carrying out the larvæ and pupæ of the small fly at the rate of fifty every ten minutes. An incredible number were removed during the ensuing forty-eight hours, during which time many thousands were strewn about the hives. The ejection of these spiny larvæ is constantly taking place, though the number diminishes somewhat under normal conditions.

During the first day the fly larvæ were carried out at the rate of five a minute, indicating the immense number of inquiline larvæ present in the hives. The bees are just able to struggle along with their load, which is grasped by the mandibles, and not infrequently the carrier falls upside down on the alighting board before taking wing. Owing to the high, convex scutellum, the bee has considerable difficulty in regaining its feet when once thrown fairly on the back.

When the outside temperature falls below 12°C. the bees do not leave the hive, but cluster about the interior of the entrances, their heads closing the aperture. This watching at the door is a strong character in the gregarious furrow bees of the genus *Halictus*, and the solitary tea-tree bees, *Euryglossa*. During such periods the other bees are not idle; they mount in train-like formation to cracks and other openings, carrying in their jaws a small, flat pellet of propolis with which they seal the aperture.

Like the worker of the hive, the stingless-bees can be taught to "rob" the combs of other hives. I placed a number of workers on a heavy comb from the honey-bees, and almost immediately they began to fill themselves from the open cells. While they were so engaged, I put the comb in a box, leaving only a small entrance. The bees continued to visit the sweet in company with *Apis*, and for many days they carried home the honey until the supply was at last exhausted. Finding no more, a few persistent workers began to test the defences of the neighbouring hives, but without success, owing to the vigilant guard. These "robber-bees" fly just like "pilferers" of the *Apis* species, *i.e.*, the hind legs are drooped, as though ready for use to aid the wings. Robbing honey-bees frequently attempted to molest the stingless-bees' homes.

The ventilation of the colony is accomplished by honey-bee methods, that is, the workers get a purchase on the floor with their tarsal hooks, and then set up an extremely rapid "fanning" with the wings, the draught being distinctly perceptible to my hand. The hive-bee invariably faces inwards when fanning; the *Trigona* always faces outwards. At 10°C. the bees crawl slowly over the combs, and do not take wing.

The young queens, not yet fecundated, apparently do not appear to receive much attention from the workers; they stroll about unattended, and visit the out-of-the-way places in the interior. After the mother has mated, the workers feed and show great regard for her. I have not heard the young queens make any sounds comparable to those of the young hive-queen, which often calls *"teet teet."* Should a laden worker pass a hungry one, then a drop of nectar is regurgitated, freely offered and accepted immediately. Bees accidentally covered with honey would be in danger of suffocation if it were not for the help they receive from their fellows in the shape of "a good licking" to cleanse them.

During my manipulations the tiny workers will sometimes align themselves along the edge of my shirt-cuffs, and grappling the cotton with their six legs, they obtain a "bull-dog" grip with the mandibles; without changing or relaxing their hold, they hang thus for ten minutes or so. The same attack is made on the sable-hair pencil used for picking up individuals.

A worker-bee, *T. cassiæ*, placed in the portal of *T. carbonaria*, is seized suddenly, and after a rather frenzied rolling over and over, the intruder is clutched by the legs, and a grip is secured by the mandibles on the axillæ of the wing, which is then steadily twisted until the bee is disabled. As soon as the victim is robbed of its power to take wing, it is carried away by the victor and dropped at a distance from the hive. The honey-bee, *Apis*, will nearly always accept very young workers from another colony, but *Trigona* attack all, irrespective of age, and I have no doubt that odour is the medium of identification.

The young *Trigona* emerge from their cells often before the pigmentation is complete, and amber-coloured workers may frequently be seen walking over the combs, whereas the hive-bee is always fully coloured on emergence, though it looks paler, owing to its thick and unsullied coat of hair. The abdomen of *Trigona* is the first to blacken.

Only infrequently will the hive-bee accumulate such an enormous quantity of propolis that the interior fittings become almost immovable, but the stingless-bees are always searching for resin. When the combs are first placed in boxes, the bees concentrate on making everything fast, and wax struts soon attach the combs to the hive-walls. Much of this propolis is gathered from *Cassia* scrub, and in the observatory hives, *T. carbonaria* often obscured themselves by forming thin horizontal wax sheets over the combs.

This resinous material is carried on the broad hind tibiæ of the worker-bee, and may be water-white, pale amber, or even dark brown in colour, but when on the bee's leg, it looks like two shining half spheres. It is very sticky, but "cracks off" the bee's tibiæ, and instantly becomes glassy hard. When used for stopping up holes, it is manipulated by the worker into a more plastic consistency. The hive-bee will pare off thin shavings of pine-resin which it then carries home on the tibiæ. Old propolis, resoftened by the sun, is much sought after by both the hive and the stingless-bees.

There is always a busy traffic carrying out round, flat cakes of brown excrement, which is held by the mandibles, and tucked in well under the head. The stingless-bees void their excreta in the hive; a desecration never performed by the healthy hive-bee. The numerous fine submoniliform threads of excreta, 2mm. or so in length, and found in odd corners of the hive, and on the false ceilings, are the product of the inquiline beetle larvæ, and I have

never seen this material being removed. The flat cakes may be so shaped for facilitating transport, or they may be simply the larval pellets from the base of the cell.

The hive-bee will not foul the interior of the home, and detention in the hive, from any cause, always results in dysentery, with severe mortality, when the condition is prolonged. That the stingless-bee voids its excreta in the hive is the probable reason for its good condition, when confined for the long journey from Queensland. Should it be proved that the fly larva assists in the destruction of this material, which is soluble in water, then a weak symbiotic relationship may exist.

The removal of larval excreta from the empty cells has few precedents among the wild-bees, and even at the apex, the hive-bee, it is never all removed, so that the accumulation of old larval skins, together with the black excreta sandwiched in between, so seriously reduces the capacity of the cells that the honey-bee will, at length, tear down the oldest combs, and replace them with new. I do not think the pellets carried by the *Trigona* are from the inquilines.

The workers are indefatigable, and when the temperature registered 25°C. on still evenings, the bees continued to work after sundown. Even in October, I repeatedly observed them ejecting debris until well past seven in the evening. The amount of air required by the *Trigona* household is very small, and two large colonies, exhibited by me for two days at the "Wild Nature Show," in the Melbourne Town Hall, November, 1930, were sealed in by having white paper pasted over the whole of the exterior of the box. The only ventilation provided was by an aperture 12 mm. in diameter, covered with fine wire gauze, and the bees did not appear to suffer the slightest inconvenience.

In certain circumstances, the communities are capable of producing a "colony voice" that may be compared with that of the hive-bee, but when human breath is exhaled into the *Trigona* home it does not provoke the fierce "mutterings" of the honey-bee. Whenever the sun warms up the colonies after a cold night, then there is a similar murmuring that betokens a rapidly accelerating activity. Rapping on the exterior of the hive-walls of the honey-bee is always answered by an excited buzzing in a low key, but under similar tests the stingless-bees remained dumb. The "colony voice" of both genera is of varied intensity and quality, though that of *Trigona* much more limited.

In one colony of *T. cassie* that I studied, the sole young queen had only just started to deposit eggs, but notwithstanding this, I was able to discover a queen-cell that contained only a very young larva which did not reach its full development until two months later. Of course, this is much longer than the period required for the growth of the hive-queen, which reaches maturity in six-

teen days: the worker taking twenty-one, and the drone twenty-five days.

The young female depositing the eggs was very small, measuring only seven mm. in length, and having a breadth of two mm. The queen in full production is much larger. Various authors have claimed that the ovaries of the stingless-bee do not fully develop until after egg-depositing has commenced, and my observations seem to bear out their contention. The hive-queen, on the contrary, has fully developed ovaries shortly after she mates.

One of the South American species has a globose abdomen, and the natives of Brazil keep the colonies in earthen-ware vessels. Both in Africa and America it is claimed that more than one fecund queen may be present, but in Australia I have found only one "laying" queen in each colony, though additional queens may be present at some period other than when I examined them. When I have investigated for queens I have suffocated the entire colony, and counted the bees by hand, so that none could pass without scrutiny.

The *Trigona*, after confinement to the hive by long periods of bleak weather, emerge in great numbers on the first warm, clear morning, and indulge in what the apiarist calls a "play-spell." The bees do not fly far away, but execute airy circles and spirals about the home as though re-orientating its position. A study of this trait in the hive-bee reveals a similar tendency to resurvey the locality, and this always takes place before the harvesters depart for the fields. After these short flights, hundreds will cluster on the hive-wall, as though enjoying the sun. The insects have a remarkable memory for a locality, but evidently they find it necessary to have a refresher after some days have elapsed.

So far as my observations go, there is no ordered company flight of the *Trigona* swarms, such as that exhibited by the hive-bee. The high treble note of the hive queen, when on the wing, is plainly audible to my ear, and since it is much more shrill than the note of the worker, it may be that the queen acts as a centre about which the company wheels in admirable co-ordinated action.

Any loud sound, such as the time-honoured beating of metal pans, frequently causes the insects to cluster compactly, so it is possible the note of the queen is drowned, and in its absence the bees are misled into thinking the mother has alighted. The insects are extremely attached to the odour of the mother, and perhaps scent, as well as sound, guide the flying individuals of the swarm. When the queen is captured from the mass the flight is never co-ordinated, and is inevitably disorganised into aimless flying hither and thither in search of the leader.

When conducting experiments on the loyalty of hive-bees to their queen, I have caged a number of workers, thirty or so, together with the queen, and the supply of food was, of course,

gradually reduced as the bees consumed it; without exception, the dwindling amount was always equally distributed, without "fear or favour." When the time came that all the stores were exhausted, the worker-bees continued to feed the queen from the remnants of the reserves in their honey-sacs, and in every case the "workers" all succumbed to starvation before the queen was affected. I did not find an exception to the rule.

Professional apiarists, especially those devoting their energies to the breeding of queen-bees, are well aware that when queens, accompanied by worker-bees, are sent long distances through the mails, the queen is frequently the sole survivor, the workers having given the last "sup" to sustain the mother. This intense loyalty is not exclusive to the hive-bee, for the *Trigona* workers, too, render a similar last dread service to their queen. I noticed that whenever a colony of stingless-bees had died of hunger, the queen remained alive for a day or two longer, wandering over the desolate combs with one or two miserable attendant worker-bees.

The circumstances in which several of the colonies died is of interest because of the strong contrast afforded by the hive-bee, the colonies of which frequently dwindle away to extinction, even though the hives be full of honey. The explanation, of course, lies in the utter absence of pollen, thus leaving the insects without nitrogenous protein. But some of the *Trigona* colonies dwindled away, and close examination of the nests revealed an extraordinarily large (½ lb.) amount of pollen, but not one drop of honey. In these cases the honey in the nectaries of the botanical species visited was beyond reach of the tiny bees, whereas the pollen was readily collected. The longer tongue of the hive-bee experienced no such difficulty, and it was able to thrive where the *Trigona* died. In other districts the position was reversed with these two species; the honey-bees died and the stingless-bees survived.

Professor W. M. Wheeler, an authority on the biology of the social insects, and leader of the Harvard University Biological Expedition to Australia, in 1931, on looking over portion of this paper, related some of his observations on the habits of the social bees of Central America:

"I was working in the Panama Canal zone in connection with the problems of disease being disseminated by insect agencies, and I often saw the larger, hairy *Melipona* frequenting the primitive latrines of the country. The insects were congregating on human excreta, and such hairy bodies must have been in close contact with many dangerous germs. I was very surprised to see bees attracted to such unwholesome spots, because in other lands they are so dainty in their selection of food, and singularly clean in their habitations. The natives said it was not unusual for the indigenous bees to visit the urinals, but people did not use the small amount of honey stored in the numerous nests. It seemed to

be common knowledge that such honey was dangerous to human beings, so the colonies were seldom, if ever, molested. I have no doubt that the fears of the natives were well-founded."

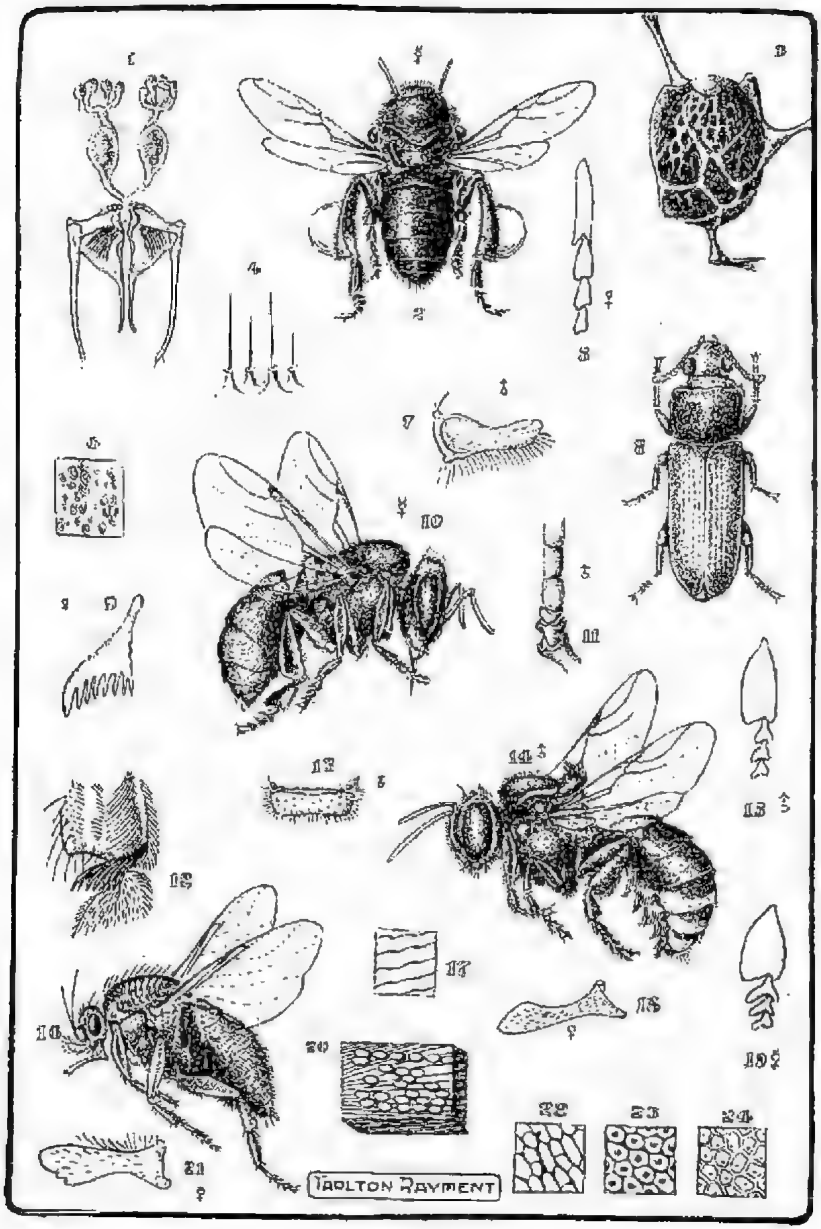
It is extremely difficult to account for such depraved taste in a group of insects known the world over for refinement. The honey-bee is very partial to water containing a small proportion of salt, and I have observed wild and hive bees visiting the damp sand of the beaches of Port Phillip to secure a taste of the mineral. In North Gippsland, during a hot, dry summer, I was annoyed by many small black *Halicti* alighting on my face, arms and hands to lick up the perspiration for the sake of the salt. In several European countries small *Halicti* are known as "Sweat-bees" owing to this habit. It may be that the bees observed by Professor Wheeler were only seeking the same material.

Activity in Winter Not Beneficial to Social Bees.

One of the colonies was established in a hive 25 cm. high by 14 cm. square. The timber in the walls was white pine, slightly more than one inch in thickness. The only other protection was a cover of sheet-metal, rising to a common centre, and sloped out well beyond the walls to protect them from rain. The interior contained approximately 2,500 c. cm. and a number of tests showed that to be about the capacity of the average *Trigona* colony.

Every two weeks a piece of honey-comb was taken from a colony of honey-bees, and laid flat over the top of the *Trigona* "nest." To do this the movable wooden top was prized loose from its tight sealing of resinous wax, and considerable power had to be exerted. This unexpected addition to their store always resulted in great excitement, the insects running over the combs and many taking wing from the doorway just as honey-bees do when fed by the apiarist in times of drought.

There was some activity throughout the winter, and a few heads could always be seen at the entrance. I can find no other record of a *Trigona* colony surviving in this State, and it is interesting to learn that, with the assistance afforded by the extra stores, the bees thrived so well. During August they were very populous, but carried out each day a large number of bees that had died just before reaching complete development. It seemed that although this brood could not survive the low temperatures, it was plain that the attempted increase was the direct result of the stimulative feeding which simulated the normal spring flow of honey. A colony of honey-bees, receiving a daily ration of sugar syrup, reacted in a similar manner, but owing to their more numerous population, and consequently, greater control over the hive-temperature, none of the brood succumbed. When the weather reaches exceptionally low registers not all the brood of the honey-bee reaches maturity. The winter of 1931 was not unduly cold, and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TARLTON RAYMENT

Fig. 1.

though the rainfall was above the average, the number of sunny days was much below.

A colony that was taken indoors, where the room temperature was constant, increased its activity, and numbers of bees left from the entrance under the stimuli of warmth and additional food, but they did not return to the hive after taking wing. Had this condition been permitted to continue, the colony would have dwindled to extinction just as surely as hive-bees do in similar circumstances. On restoring them to the open air, with its lower registers, the bees at once settled down with diminished activity and no flight. This behaviour was duplicated by a colony of *Apis*.

It was clearly demonstrated that these two genera of social bees pass through the winter in better condition when the temperatures are low enough to reduce the body activities to the minimum. Warmer weather always resulted in increased activity and a higher mortality. At another period I demonstrated that the amount of brood reared during the winter by both genera was not nearly sufficient to compensate the colonies for the increased rate of mortality, so that in every case, spring found the colonies in a greatly weakened condition that often persisted into the summer, and in a few cases the colonies did not recover.

EXPLANATION OF FIGURE 1.

1. Portion of genitalia of *T. cassiæ* Ckll.
2. Posterior view of worker *T. carbonaria* Sm., showing the large globules of clear, viscid resin carried on the tibiæ.
3. Queen-cell of *T. cassiæ*.
4. Sensory hairs on apical abdominal segment of the male.
5. Basitarsus and three tarsal segments of queen.
6. Surface of the genital glands viewed with 1/6" lens.
7. Mandible of male.
8. Beetle, *Tribolium myrmecophilum* Lea, taken from the nest of *T. carbonaria* from Queensland.
9. Calcar or tibial spur of *Trichocolletes nigroclypeatus* Raym.
10. Adult worker of *T. cassiæ*.
11. The second segment of the flagellum of the male is exceedingly short.
12. Portion of hind tibia and the tarsus of worker *T. carbonaria* showing the cluster of chitinous spines.
13. Labrum or lip of the male *T. cassiæ*.
14. Male *T. cockerelli ornata* Raym.
15. Basitarsus and three tarsal segments of the male.
16. Fly taken from a nest of *T. carbonaria*.
17. The inside surface of the chitinous tegument appears to be of laminated form.
18. Mandible of queen *T. cassiæ*.
19. Basitarsus and three tarsal segments of the worker *T. cassiæ*.
20. Portion of the interior of hive-wall showing eggs of the fly.
21. Mandible of the worker *T. cassiæ*.
22. Cell-structure of connective tissue of the abdomen of the male *T. cassiæ*.
23. The large epidermal cells are in a single layer.
24. Cell structure of the sac.

THE STUDY OF AUSTRALIAN MOSSES.

By G. O. K. SAINSBURY.

The object of these notes is to give some assistance to those who may wish to commence the study of Australian mosses. At the outset, I must emphasise the fact that my bryological studies are almost exclusively confined to the New Zealand mosses, and that I must therefore disclaim any competence to deal with those of Australia except as regards such of them as are common to both countries.

I have come to the conclusion that any help I can give will be much more effective if, in addition to what is contained in these notes, typical specimens are made available to students; and I have therefore arranged with the Editor to supply him, for distribution, with some mosses reputed to belong to Australia and New Zealand. These specimens will be numbered, and the genera and species will be dealt with here, shortly. In this way, those interested will have the opportunity of examining the plants for themselves, and will not have to rely on technical descriptions, which beginners would probably find very difficult to follow.

Everyone is familiar with the appearance of a moss. No other plant is likely to be confused with it, except, occasionally, a liverwort, and a knowledge of the plants themselves is the only cure for this. Mosses grow on earth, rock or bark, and are most plentiful in damp situations, some of them being even aquatic. The stem is simple or branched, and the habit of growth may be as isolated erect individuals, more or less dense tufts, or straggling tangled masses. The fruit, which consists of a stalk of varying length (the seta) surmounted by a capsule, is borne on the apex of the stem or of the principal branches (acrocarpus mosses), or on the sides of the stem or branches (pleurocarpus mosses). This difference is of great importance, because the pleurocarpus system of branching, by allowing the growth of the stem to be indefinitely prolonged, instead of being terminated by the formation of female flowers, gives an open straggling appearance that is usually quite distinctive.

The leaves are always sessile and undivided, and may be either nerveless, or furnished with a nerve which is usually single, but sometimes double. In the latter case it is always short, but when single it is of varying length and may even project far beyond the apex of the leaf, the projection being either smooth or denticulate. The leaf-blade, or lamina, almost invariably consists of a single layer of cells, except the marginal portion which is often thickened and formed of differentiated cells. The leaf margin may be entire or furnished, especially in its upper part, with denticulations of varying size and shape. The leaves surrounding the base of the

seta (perichaetial leaves or bracts) are usually different from the others.

The systematic position of a moss is largely determined by the character of the leaf-cells, which, of course, require the help of an efficient compound microscope for their proper study. The cells may be uniform throughout the lamina, but more often they are smaller above, and become enlarged or elongated towards the base. Differentiation of cells towards the margin, especially below, is also a frequent character. At the insertion of the leaf on the stem (alar cells) they are often inflated and coloured. Their shape is very variable—oval, square, hexagonal, rhomboid, etc.—and their walls range through every degree of thickness. The walls, too, may be furnished with pores which connect adjoining cells.

A striking feature of the leaf cell of a moss is often the papillæ which are borne on its surface. They give a very characteristic appearance to the leaf under the microscope. The leaf margin may be plane, incurved or recurved, and its character in this respect often gives useful help in determining the moss. The capsule in its young state is usually furnished with a lid (operculum) surmounted by a deciduous hood (calyptra). The calyptra is either split down on one side (cucullate) or entire (mitriform), and may be smooth or hairy. Later on, the operculum falls away and discloses the circular mouth of the capsule which is fringed round by the peristome. This latter appendage, which is often a thing of marvellous elegance and beauty, is of the greatest importance in the systematic treatment of the mosses. It consists, when single, of one row of teeth, four (or a multiple thereof) in number; or, when double, of this outer row with the addition of an inner delicate membrane which is split into teeth and which often possesses fine processes (cilia) between the teeth.

Outside the peristome and encircling the mouth of the capsule is often to be found a ring, or portion thereof, of large colourless cells (the annulus), but this is not always present, and, moreover, is frequently detached wholly at the time of the falling of the lid. The spores are contained in the capsule, and are, of course, liberated in due time when the operculum falls off. They are usually globular bodies of varying size, and may be either smooth or papillose. The capsule is of a great variety of shapes, as will be realised when the specimens come to be examined. The angle which it forms with the seta is also very variable, and is a character of importance. As this angle varies, so may the capsule be erect, *i.e.*, perched straight up and down on the top of the seta, slightly or horizontally inclined, or even bent right down so as to be almost parallel with the seta.

The female flower, from which the seta and capsule are produced, consists in its young state of a bud of perichaetial leaves

containing elongated flask-shaped organs called archegonia. These organs are of a dark red colour, and are usually surrounded by transparent jointed rods known as paraphyses. When an archegonium is fertilised by the spermatazoids produced from the male organs it develops in a complicated manner into the capsule, and is carried up on the seta until the latter reaches the limit of its growth.

The male flower consists of a bud which is usually small and insignificant, but sometimes conspicuous and discoid, *i.e.*, like a tiny sunflower. The bracts or leaves of the flower (perigonial bracts) surround the antheridia or male organs, which, to use a homely simile, resemble semi-transparent sausages, light brown in colour, and with a reticulated skin. Paraphyses are often present in the male flower. If both male and female flowers are borne on the same plant the inflorescence is said to be autoicous; if on different plants, dioicous; and if the antheridia are in the same bud as the archegonia the terms synoicous or paraoicous are used according to the position of the antheridia.

The foregoing description contains only such information as is essential for the commencement of the study of the mosses. I strongly recommend the use of Dixon's *Students' Handbook of British Mosses*.

METHODS OF STUDY.

Before dealing with the first specimens which have been sent to the Editor for distribution, it might be as well for some information to be given about the examination of the plants. The general appearance of a dried moss should of course be noted, for the position of the leaves when dry and the appearance of other organs in that condition are more often than not characters of importance. The plant, cannot, however, be dissected and examined in detail until by soaking in water the tissues have regained their former condition. If old specimens are being dealt with, or if the tissues are tough and hard, immersion in very hot water will greatly hasten the softening process.

For dissecting work some kind of dissecting microscope is an absolute necessity, but the instrument need not be elaborate or expensive. A lower-power objective (say 2-inch) used with the compound microscope will do quite well for the work, though, of course, the student will have to get used to working with the object apparently upside down. Steel knitting-needles cut in half and ground to a knife edge at one end make quite efficient dissecting needles. A pair of thorn forceps will be found indispensable for holding specimens.

Everyone, of course, has his own ideas about suitable powers for microscope work, but I think it will be found that 2/3rd and 1/6th objectives with 6X and 10X eyepieces will be satisfactory

for bryological study. Another low-power objective—such as the 2-inch—is very useful for getting a comprehensive view combined with more detail than a pocket lens will give. Anyone contemplating using a compound microscope in his study of the mosses will be well advised, if he is not familiar with the work, to obtain information from someone skilled in it before buying an instrument or using it. A thorough study of mosses often involves a certain amount of sectioning, but it is never of a very delicate nature or such as to necessitate the use of elaborate apparatus. By holding the specimen between sunflower pith satisfactory sections can be cut with the aid of a good razor and plenty of practice.

The specimens to be distributed comprise three that are cosmopolitan, and one that has a much narrower range. When any part of the moss has been dissected it must be as well to preserve the fragments separately, as this will avoid the necessity of dissecting further material when it is desired later on to re-examine the specimen.

1. *Funaria hygrometrica* (L.) Sibth.

This is a cosmopolitan moss, and should be looked for on the ground, especially where wood has been burned. When young it is easily recognisable by the *strongly-arched* seta, which later on straightens out, but is always somewhat waved (flexuose). It is an acrocarpous moss. The leaves will be found to be pale and membranous, ovate-oblong in shape, with cells more or less hexagonal and uniform, though somewhat narrowed at the leaf margin. The nerve is continuous to the apex (percurrent), or slightly projecting (excurrent). Capsule *asymmetrical* and *furrowed* when dry, and its mouth is red and very *obliquely* placed. Annulus well developed. Operculum slightly conical. Calyptra (detached in the packets) cucullate and *inflated* below. Peristome double; the outer of 16 red teeth inclined to the right and conjoined at the tips; the inner of 16 broadly lanceolate yellowish processes. Towards the base of the capsule will be found numerous pores (stomata) which are often present in other mosses, but which are in the present case particularly distinct and plentiful.

I have emphasised in the above description the characters which can usefully be especially noted as distinguishing this moss from others more or less like it. It must be borne in mind that none of the descriptions to be given in these notes profess to be full or completely accurate. They are merely intended to furnish an informal guide to beginners and to facilitate the study of the specimens. In addition to this species others belonging to the genus *Funaria* will be found growing on the ground, but in their case the capsule is symmetrical and more erect, and the seta straighter and shorter. The pale membranous leaves and short tufted habit will

help to place the generic position of other species that may be found.

2. *Ceratodon purpureus* (L.) Brid.

In this species we have one of the commonest mosses in the world, and rather a stumbling-block for bryologists, because owing to its extreme variability it is often hard to place in spite of its well-defined characters. The stem is very variable in length, but in New Zealand at any rate is nearly always quite short, and seldom longer than in the specimens now distributed. In fruit the moss is known by the *reddish* or yellow seta, surmounted by a suberect or inclined capsule, *deeply furrowed*, and with a *curved* conical lid. The leaves are oblong-lanceolate, practically entire, except at the extreme apex where there are often a few teeth, and with the margin throughout *narrowly revolute*. Cells small, *square* or nearly so, somewhat elongated towards the base. Nerve continuous or shortly excurrent. Calyptra cucullate (not present in the packets). Peristome single, of 16 long narrow teeth, divided almost to the base into two segments which are joined here and there by transverse bars, and slightly papillose. At the neck of the capsule will be found a swelling (the struma) which is often present in mosses, and which is a character of systematic value.

This species is dioicous and terrestrial, but found also on logs, walls, etc. It is, of course, acrocarpous.

3. *Stereodon cupressiformis* (L.) Brid.

This is also a very widely-spread moss, but in spite of its polymorphous nature it seldom causes difficulty in identification. As will be seen, it is plenrocarpous, and it should be looked for on grassy ground or roots of trees. Stems pinnately branched. Leaves golden-yellow, oblong-acuminate, decidedly *curved* (falcate), *nerveless*, entire or with some faint denticulation above. Cells long and narrow, uniform throughout except the alar which form a *conspicuous* group of small *quadrate* or subquadrate *opaque* cells. Capsule erect, or nearly so, asymetrical through its arched back. Operculum (not present in packets), *shortly* beaked; calyptra (not present) cucullate. Peristome double: outer of 16 yellow teeth; inner of same number of keeled hyaline processes, split above and with interposed cilia.

This species is often found without fruit, but can be recognised in all its forms by the falcate nerveless leaves, with the all-important group of dark dense alar cells.

4. *Papillaria acrocea* (Hampe) Jaeg.

In contrast with the foregoing cosmopolitan species the present one represents a genus that is confined to tropical and subtropical regions. It will be of special interest to Australasian students

because nearly all the New Zealand species appear to be found also in Australia. Very few fruiting mosses of this genus have ever been found, and it is not worth while to describe the sporophyte here. The plants can usually be recognised by their somewhat rigid branches, with appressed sharply-pointed leaves, but the separation of the species (of which six have been found in New Zealand) is sometimes anything but easy. This is also a pleurocarpus moss, with irregular pinnate branches, somewhat wiry and rigid. Leaves cordate-acuminate, concave, entire except for some denticulation below, *plicate* when dry with the nerve showing prominently at the back. Cells small, obscure, *papillose*, one or two rows at leaf margin being thick-walled (incrassate) and forming a pale translucent border. Central lower cells elongated, smooth (*i.e.*, not papillose) and transparent.

Species of *Papillaria* should be looked for on bark.

THE TERTIARY GEOLOGY OF EAST GIPPSLAND, VICTORIA.

Under this title has been published by the Palæontological Branch of the Commonwealth Department of Home Affairs, as Bulletin No. 1, an account of the examination of material obtained during the borings for oil in the Lakes Entrance district, and further west between Stradbroke, on Murriman's Creek, and Longford, a few miles south of Sale. The authors are F. Chapman, A.L.S., F.G.S., Commonwealth Palæontologist, and his assistant, Irene Crespin, B.A., who have spent some four years in the examinations.

The Bulletin is illustrated by two locality plans and a plate containing ten figures of typical tertiary fossils met with. One of these is new to science, and has been named by the authors *Vaginulina gippslandica*. This occurred in the Upper Oligocene at a depth of 180 feet, and constitutes a good zone fossil in this and other areas. Definite geological horizons, as the authors point out in their comparison with other areas, are indicated by the presence of genera and even species of foraminifera which have been previously recorded only from the oil-fields of the East Indies, such as *Lepidocyclina radiata* and *Spiroclypeus margaritatus*. The fossils chiefly relied upon for evidence of age in the above work are, primarily, the foraminifera, though the mollusca and sea-mats or polyzoa are often of considerable importance.

It is regrettable that the localities have been grouped as "East Gippsland," for this term is usually restricted to that portion of the State east of the Snowy River. The conclusions arrived at show that there exist in the district under notice well defined, and easily recognisable "marker beds," which serve as "geological landmarks" by the aid of which the structure of the petroliferous basin can be elucidated, and much unnecessary boring obviated.

F.B.

CORRECTION.

In Mr. W. Hanks's article, March *Naturalist*, p. 226, third paragraph, for "gases were exuded" read "gases were occluded."