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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, April 11, 1932, at 8 p.m. The President, Mr. J. A. Kershaw, C.M.Z.S., occupied the chair, and about 120 members and friends were present.

CORRESPONDENCE, ETC.

There was no correspondence.

Reports of excursions were furnished by Mr. W. H. Ingram, Beechworth, and Mr. W. Hanks, Campbellfield North.

ELECTION OF MEMBERS.

Miss Shirley Crawford and Mr. D. A. Casey were duly elected ordinary members, and Mr. F. Robbins as a country member.

GENERAL BUSINESS.

Mr. Charles Barrett, recently returned from Sydney and Adelaide, conveyed the greetings of kindred societies in those cities.

Mr. Barrett also drew attention to a book *Mosses With a Hand-lens*, by A. J. Grant, Ph.D., who had presented it to the Club.

Miss Noakes called the attention of members to the fact that vacancies existed in the Botany class of the Workers' Educational Association.

LECTURE.

Professor A. J. Ewart, Ph.D., D.Sc., F.R.S., described his researches in Central and North-western Australia. Using a full collection of lantern slides, Professor Ewart illustrated the varied nature of the country. The sands, gibber plains, "desert" vegetation and individual species were depicted. The remarkable nature of the gorges cutting through the Macdonnell Ranges was clearly shown. An interesting account of the methods used in tracing the causes of losses of stock concluded the lecture.

EXHIBITS.

Miss J. W. Ruff.—Collections from Beechworth.

Mr. S. Mitchell.—Some rare minerals.

Mr. F. H. Salau.—*Manaloto scoparia* (Prickly Broom-heath) from Cheltenham; cone of White Pine (*Pinus excelsus*) from Beechworth; photographs of Easter excursion.

Mrs. F. H. Salau.—Various fungi.

Mr. F. Pitcher.—Flowers of *Stenocarpus sinuatus* (Queensland Firewheel Tree), grown by exhibitor.

Mr. C. J. Gabriel.—*Magilus antiquus* Moul; a coral-dwelling marine shell from Mauritius.

Mr. H. Whitmore.—Fungi from Cycle: stone axe from Tooradin; large "yabbie" crayfish.

Mr. W. H. Ingram.—*Diplodactylus vittatus* (Fat-tailed Lizard), from Beechworth.

Mr. A. J. Swaby.—Bi-pinnate form of *Blechnum discolor* (Fish-bone Fern). An improved variation of *Nerine* from a root (bulb) offset.

PORT PHILLIP A "BASIN": AN ABORIGINAL TRADITION.

Reading in the February *Naturalist*, Mr. R. A. Keble's article, "Arthur's Seat as a Viewpoint," I was much interested; it called to mind a tradition told to me by a very old Queenscliff resident. Some forty years ago, during a holiday at Queenscliff, we rented a house from Mr. W. Stephens, who had long been settled there. His occupation was that of a boatman, and he had the job of taking pilots, mails, etc., to the pilot boats in the offing, as required. When he heard that I had been a "shellback," we fraternised and had many a yarn concerning ships, The Heads, and local surroundings. The low-lying land stretching from the south end of Swan Bay, past the Salt Lake, and the fresh-water lakes, towards Ocean Grove, suggested that at one time the surplus water of Port Phillip had thereby found its way to the sea; but not in any large run. This, again, suggests that there was an unbroken coastline between Points Nepean and Lonsdale; and that, due to the great area of Port Phillip Bay, the evaporation would almost equal that of the few streams poured into it. For, normally, the volume of water in the lakes is small.

Mr. Stephens told me the aborigines had said that, in past time, there was no passage between the Points and only a small flow of water passed intermittently from Swan Bay. But there came a great shaking of the earth, the narrow, solid shoreline was broken, and the sea gained entrance. The story was clear, forcible and credible. Has Mr. Keble ever heard of this?

When an old chart of The Heads is coned, there will be seen a long crack in the rocky bottom running south-east for some distance, and over this crack used to be the fairway for vessels of deeper draught. I think this was what was known as "Man of War course," and early beacons indicated it. The point is—the tradition indicates that Port Phillip Bay was a large basin with no tidal entrance.

E. R. McTAGGART (Ballarat).

COLOUR PLATES IN NATURALIST.

Plans for improvement of the *The Naturalist* include colour plates, the first of which is the feature of this issue. It is not only beautiful, but has also much scientific value, since the plants figured are, almost certainly, new species. The blocks were made by Messrs. Patterson, Shugg Pty. Ltd., of Melbourne, from the original paintings by the late Mrs. Ellis Rowan. The result is one of the finest colour plates of fungi yet published in any journal, either popular or scientific. The Club Committee has approved of another plate being prepared for the June *Naturalist*.

SOME "CRINOLINE" FUNGI—PAPUAN SPECIES
OF *DICTYOPHORA* DESVAUX.

By ETHEL MCLENNAN, D.Sc.

Those fungi which form large and conspicuous fruiting bodies above the surface of the ground, either on soil or rotting logs, are indiscriminately classed together under the popular term "toadstool." Any student of this large and exceedingly variable group realises from the outset, that the colour and the form of these fruiting structures are two characters of much importance when an attempt is made to find the systematic position and the correct botanical name of these plants. These, of course, are not the only characters which have been made use of in compiling artificial keys as an aid to their identification, for shape and size of the actual spores, etc., are the ultimate criteria, and afford a sounder guide to the mycologist. Nevertheless, it is a well-established fact that colour and form are correlated often with specific differences.

Now, anyone knows that if we follow the usual procedure adopted when dealing with flowering plants, and we simply dry and preserve this dried specimen of a toadstool, all semblance to its original condition is lost. Although such a dried specimen may still yield the clue to spore structure and size, and so is still an integral part of the mycological herbarium, the worker in the fungal field should have resource to coloured drawings of the forms as they are gathered, or while still *in situ* in the field. In this way one is able to preserve indefinitely the two characters which are so evanescent, and therefore are lost as the specimen dries. In no group is this so essential as in the toadstools.

Mr. Charles Barrett, for the "Wild Nature in Art Exhibition," held at the "Herak" Building, Melbourne, during April, brought together a beautiful collection of drawings, paintings and photographs representative of many sides of natural science. These were obtained from different States as a result of the courtesy and enterprise of museums and other institutions, and many individuals. As a student of the fungi, when I visited this exhibition I was surprised to realise that this group was not represented among the many varied examples displayed there. However, the lack was rectified in an unlooked-for and interesting way, which incidentally provided the stimulus for this paper.

The late Mrs. Ellis Rowan, well known to most as an artist who devoted her talent to the painting of the wild-flowers of the Commonwealth and New Guinea, evidently did not restrict herself to perpetuating the beauty of our flowering plants. For during her residence at Madang, in Papua, she apparently was fortunate enough to see many examples of tropical toadstools. Exhilarated, no doubt, by their exquisite beauty, she painted many

of them. These paintings have been preserved by Miss B. Ryan, of Macedon Upper, who, on visiting the Wild Nature in Art Exhibition, and seeing examples of Mrs. Rowan's work made available to the public—even if only for a brief period—wrote to Mr. Barrett telling him of these further examples of her sister's art, and forwarded thirty of them for his inspection. Through his kindness, the writer was enabled to see these before they were hung in the exhibition, and was delighted to find that they were all paintings of "toadstools," some of them representing forms which, no doubt, are new to science. Although Mrs. Rowan probably did not know this as she—moved more by their beauty and unusual form—placed their characters in her masterly fashion on to paper, she has left a record for all time, which, apart from the paintings' artistic value, will probably serve as an impetus to mycologists to find out further facts about them.

Six represent examples of the so-called "lace" or "crinoline" fungi. The coloured plate reproduces four of these, all of them Papuan forms. They belong to the genus *Dictyophora* Desvaux, which literally means bearing a net. They are related to the common "puff-balls"; both, in fact, are included in the large group of the Gasteromycetes. While the "puff-ball" (belonging to the order Lycoperdales) is filled with a dry dust consisting of myriads of spores, which are set free by the bursting of the outer protective layer, the "crinoline" fungi when young are in the form of a soft, more or less spherical ball, which is protected on the exterior by a thick gelatinous coat. When it is ripe the ball or "egg" suddenly bursts at the top, and then there comes out of it, in approximately half-an-hour, a sort of "Jack-in-the-Box," made up of a long, hollow, spongy stalk or receptacle, bearing at its free end a more or less conical cap covered with slime—often dark green in colour [See Plate I for the parts of the mature plant: the gelatinous coat of the burst "egg" may be seen at the base of the stalk near to or partly in the ground.]

The presence, in addition, of a remarkable reticulated expansion attached below the apical cap and campanulate in form, spreading out around the stem like a frill or crinoline, often with a circumference of 20 inches or more, characterises the genus *Dictyophora*, and distinguishes it from other allied forms. It is a genus included in the order Phallales, another order of the Gasteromycetes. It includes gelatinous fungi commencing their fruiting stage in "egg" form, which later bursts and exposes the spore mass, which is slimy, and borne into the air on some kind of stalk or receptacle. Popularly they are known as "Phalloids." When the egg is ruptured, the spore part is exposed, and at first the springing surface is firm and solid, and emits a faint but not unpleasant odour; very soon, however, even before the elonga-

tion of the receptacle is complete, the spore surface begins to darken, and the odour becomes foetid; at the same time, it becomes converted into a slimy, sticky mass. These changes begin at the top of the cap, but rapidly extend downwards, and they seem to depend on light. When examined under the microscope this foetid, slimy mass is found to contain myriads of small spores. These fungi fruit when insect life is abundant, and as soon as the odour is developed they are visited by a large number of flies or other flying insects, which suck up this fluid mass, for it contains a quantity of sugar.

In this way the spores are imbibed by the insects, and in addition they adhere to their legs, etc. The excreta from flies, which have been observed to feed on this slimy mass, was found to consist very largely of spores, microscopically similar to those observed on the plant itself. Such spores are not injured by the sojourn in the insect's body, for they have been shown to be viable when placed in suitable conditions, so in this way insects serve for the dissemination of the species.

Compared with the large number of other fungi, which as a group might be described as dull in colour, the colours developed in the "Phalloids" are brilliant and of pure tints, approximating to the tints found in flowers. This, no doubt, renders them conspicuous, and differentiates them from the commoner, duller colour of the more abundant fungi; also the remarkable reticulated "veil"—or more correctly called the "indusium"—round the stem is an additional factor which renders the "crinoline" fungi conspicuous objects during their sporing stage. So that in this genus it can scarcely be doubted that we have a group of fungi with highly-specialised fruit bodies, specialised for the dispersion of their spores by the agency of insects and, especially, by those insects which habitually affect putrid substances.

The "Phalloids" have always aroused a good deal of scientific interest, for they are of infrequent occurrence and usually beautiful in form. Lloyd (1) in 1907 published some notes on Australian Phalloids. In the introduction he states: "Practically all that has been published on the Phalloids of Australia and New Zealand is based on the specimens now preserved at Kew (England) and the British Museum, which were originally studied by Berkeley. Excepting what he wrote, now 40 or 50 years ago, little has been written on the subjects. It was brought together in Cooke's Handbook of Australian Fungi, but the account is quite inaccurate."

Lloyd did not recognise the genus *Diclyophora* as distinct in itself, but merged it in the genus *Phallus*, creating a separate section for forms characterised by a long, conspicuous veil or indusium, and he included in this section four (4) Australian species:—

1. *Phallus indusiatus*.—The description he gives lacks any mention of spore measurements or measurements of the various parts of the plant. He describes the "veil" (indusium) as long and White and the receptacle as White. Its occurrence in Australia is based on specimens at Kew collected along Endeavour River by von Müeller and at Brisbane by Bailey. He says "that the net in the Australian plants is White as far as is known, but forms with Pink nets occur in other countries, and probably also in Australia."
2. *Phallus merulinus*.—No measurements are given; the veil is White; the stem is also White. It is known only from Australia from a single collection by Bailey from Brisbane. Lloyd considers it only a form of *P. indusiatus*.
3. *Phallus multicolour*.—No measurements are given. The cap is described as Orange-red, the veil bright Lemon-yellow, stalk Lemon-yellow, the cup at the base (remains of the "egg" coat) Pink. It was collected at Brisbane by Bailey, and the colour descriptions are from notes by him taken from the fresh plant. Penzig finds the same species abundantly in Java.
4. *Phallus catichrous*.—No measurements given. The species was originally described from Brazil. It is evidently close to multicolour, but differs in having a White stripe and veil and an Orange cap. There is at Kew a specimen collected by Bailey, at Brisbane, and a coloured sketch.

Cunningham (2), as recently as last year, discusses the genus *Dictyophora* as it occurs in Australia. He gives as the distribution of the genus Africa, North and South America; East and West Indies, India, Ceylon, China, Cook Islands, Australia. He considers there are only four (4) valid species in the entire genus, "the many others described being synonyms of this or *Claustravia* (a closely allied genus), or at most colour forms":—

1. *Dictyophora indusiata*.—With a wide distribution through the tropical and sub-tropical regions, and characterised by a white veil, cap and stalk.
2. *Dictyophora duplicata*.—Confined to North America. It closely resembles the preceding (by many workers considered to be identical), but separated by the more definite character of the reticulations of the cap.
3. *Dictyophora farlowii*.—Confined to Brazil. It differs in the structure of the veil and reticulations on the cap.



Papuan "Crinoline" Fungi (*Dictyophora*)

From paintings by the late Mrs. Ellis Rowan

4. *Dictyophora multicolour*.—Similar to *D. indusiata* in form, but differs considerably in colour. It has a limited distribution in Australia and Java.

Cunningham excludes *Dictyophora merulina* Berk. (*Phallus merulinus* of Lloyd's paper), recorded in error by Cooke from Australia. The plant figured by Cooke under this name is identical with *D. indusiata*, as was suggested by Lloyd. He also excludes *Dictyophora callichroa* A. Moell. (*Phallus callichrous* of Lloyd's paper), which he considers to be synonymous with *D. indusiata*.

Of the five species listed in Cooke's Handbook (3), four, viz., *Dictyophora phalloidea* Desv.; *D. tahitensis* Schl.; *D. speciosa* Meyen; *D. merulina* Berk., are all listed by Cunningham as synonyms of *D. indusiata*. This leaves only two (2) species which are definitely known from Australia:—

1. *Dictyophora indusiata* (Vent. ex Pers.) Fischer.—"Egg" White up to 4 cm. diam. receptacle up to 20 x 3.5 cm. White, cap campanulate dingy-yellow when the spore mass is removed; indusium (veil) coarsely net-like white apertures large, bars of the net elliptical in section, spores elliptical, smooth, tinted 3.5 — 4.5 x 1.5 — 2 μ .

Australian records from Queensland, Daintree River; Brisbane; Endeavour River, New South Wales, Neutral Bay.

2. *Dictyophora multicolor*, Berk. and Broome.—Receptacle 16 x 3 cm. White below, pink above, cap orange, indusium (veil) hanging to 4 cm. below cap salmon pink with fine meshes; spore slime olive-brown, spores tinted, elliptical, smooth 3.5 x 1.8 μ . Australian records, Queensland, Brisbane.

New South Wales.—Ballina; National Park.¹

Cunningham states: "This is a strongly marked colour form of *D. indusiata*, the colour is not always constant for in the type specimen from Brisbane, Queensland, the stalk was stated to be cream-coloured, veil lemon-yellow, and cap orange, while Cleland and Cheel in 1923 have described a specimen from N.S.W. with the stalk white below shading from orange to pink above cap orange, veil salmon-pink, and the "egg" tinted lilac.

The six Papuan plants, so beautifully figured by Mrs. Rowan, in the light of the existing knowledge of the genus *Dictyophora*

1. Species description adapted from Cunningham.

are, then, exceedingly interesting. One unpublished figure shows a form with Lilac to Plum coloured "egg" case, cap Green (probably still covered with the spore slime so that the true colour of the cap is not discernible), White stalk and a White veil. This form would probably be correctly identified as *D. indusiata* (Vent. ex Pers.) Fischer, and the record contributes another country to the distribution of this species. Another unpublished figure shows a plant with White stalk, cap Purple-black (again probably still covered with spore slime) and a Pinkish-red "veil." This form might possibly be placed as *D. multicolor*.

The four published figures seem to represent unknown or undescribed species of the genus. In the absence of actual specimens, it is not possible to describe them in detail and to place them more accurately, but the opportunity of figuring these in colour in this journal, for future reference, suggested by Mr. Barrett, and approved by Mr. J. A. Kershaw, President of the Field Naturalists' Club of Victoria, seemed to me to be too excellent to neglect.

When specimens of the fungi figured in Plate I are again found and further described the writer suggests that the name *Dictyophora Rowanii* should be given to one, so that Mrs. Rowan's contribution to our knowledge of this genus might be duly recognised.

In conclusion, I should like to emphasise again the value of such colour drawings of fungi, and to appeal to any members of the Field Naturalists' Club who possess talent of this type to consider the fungus group as pre-eminently worth their attention and skill.

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- (1) Lloyd, L. G.: *The Phalloids of Australasia*, Cincinnati, 1907.
- (2) Cunningham, G. H.: *The Gasteromyxetes of Australasia X. The Phallales*, Part I, *Proc. Linn. Soc., N.S.W.*, vol. lvi., 1931.
- (3) Cooke, M. C.: *Handbook of Australian Fungi*, London, 1892.

EXCURSION TO CAMPBELLFIELD NORTH.

A party of about 20 members and friends attended. It was rainy in the morning, but the weather improved before the outing began. The rain caused the flooding of the Merri Creek, which was difficult to cross. The leader pointed out various flows of basalt from Mt. Aitken and showed the different flows along the creek. The Silurian outcrops were visited and the fossil beds pointed out. We then viewed some older basalt resting on tertiary clay and sand. Leaf fossils, secured elsewhere from the same series, were described. A hare, a water-rat, and a few birds were seen. One member fell into the creek when chasing the rat. Mr. Hart kindly named the plants found.

W. HANKS.

THE STINGLESS BEES OF AUSTRALIA.

By TARTON RAYMENT.

4. FOOD OF THE LARVAL BEE.

"The rapid and extraordinary development of the queen of the bee-hive, *Apis mellifera*, is due solely to an increased supply of the rich predigested white 'pap' supplied to her by the nurse-bees; the growth of the undeveloped female, the worker-bee, is retarded by the limited feeding of the 'pap' or 'royal jelly,' resulting in 'food-castration,' since the functions of the ovaries are in abeyance."

That argument involves the acceptance of the theory that the regurgitated milky secretion is the normal sustenance, and the withholding of it suppresses or delays growth.

The hive-queen deposits her eggs in empty cells, where they are attached to the cell-wall by an agglutinative secretion of the queen. Just so soon as the chorion of the egg breaks, but never before, the young of the three "castes" are supplied with the milky, slightly acid food which is secreted by the youngest worker-bees, the hypopharyngeal glands of which atrophy with age. After three days the drone-larvae are "weaned," and a mixture of honey and pollen replaces the "pap"; the imago emerges in about twenty-five days. The worker-larvae are "weaned" at about the fifth day, and the imago emerges about twenty-one days later. The larvae destined to be "sovereigns" are supplied with more food than can be consumed, for a large yellow pellet of dried "pap" is left in the natal cell when the princess emerges on the sixteenth day.

As I have already said, the argument put forward above is not correct, because my experiments in feeding hundreds of solitary wild-bees in the genera *Halictus*, *Euryglossa* and *Paracolletes* demonstrate that perfect males and females are reared on pollen containing more or less honey. The *Halicti* using an almost dry pollen-pudding moistened only on the outside with honey; these larvae receiving the least honey of any wild-bees, and the egg is deposited, "end on," the spherical firm mass. The other two genera use equal parts which, forming a thin batter, is placed in a silvery skin covering, the egg resting on the surface of the mixture.

It has been contended over and over again by authors that the larvae of *Trigona* are supplied solely with honey and pollen, the cell being sealed immediately. My observations of colonies of *T. cassiae* and *T. carbonaria* show that while the brood-cell is half-full of food before the egg is deposited—which is in sharp contrast to the practice of the hive-bee—the cells are not sealed at once, and I have many times recorded larvae, up to three days old, feeding in open cradles. Some "after feeding" does take place, and the food fur-

nished to the larvae is not exclusively honey and pollen, but has some other biological substance added to it by the worker-bees.

While the food remains in the hive, it is a thin, dull, buff-coloured mixture of rather smooth texture; much finer than the pollen-batter of *Paracollates*. On removal from the hive the food changes quickly to a firm condition resembling white wax. Indeed, under the microscope, one may see the white globules slowly forming in the mass. On the contrary, the thin batter of *Paracollates*, *Euryglossa*, and numerous other wildbees, when exposed to the air, becomes so many dry pollen-granules. Under the microscope, the food of *Trigona* reveals pollen-grains from many plants, chiefly *Eucalyptus*, though none is in the growing condition, and exhibiting tubules such as one often finds in the food of the hive-bee. The granules appear paler, as though having been bleached and softened.

In certain circumstances, such as obtains when the colony has been imprisoned for transport, the unusual condition disorganises the feeding of the larvae, and when the hive is reopened after a long journey, the worker-bees at once begin to carry out the dead larvae and globules of the firm, white food substance. This rejected material, in all probability, is due to the demoralised worker-bees neglecting to maintain the larval food at its proper consistency, thereby permitting some drastic chemical change to take place.

The egg of *T. cassiae* is nearly oval, with slightly flattened sides, and differs from the bowed, elongate egg of the hive-bee, which, of course, is much larger, though both have hexagonal sculpturing. The two ends of the *Trigona* egg rest in the batter, the bulk of the egg standing up convexly above. Just before the egg hatches, the embryo shows through the shell as a wide silvery band.

On emerging from the egg, the wingless, eyeless, legless "grub" begins to feed, and lies on its side. The segments maintain a continuous, undulatory, wave-like movement, beginning at the head and travelling in consecutive order as though to pass the food along the digestive tract. In addition to the action described above, all the spiracles form the centres of small circular areas which continually rise and fall, though not in any observable order. The larva being on its side, assists me to observe the upper row of spiracles in action. There is no contraction of the aperture itself.

When the larva has consumed all its supply of nourishment, it is plump, white, shiny, and when coiled almost into a circle, it fills the brood-cell very compactly indeed, and is comparable to the full-grown larvae of the hive-bee. The larval excreta is voided at the base of the cell, and ten or so dark-amber, waxy pellets adhere to the bottom of the cell, but are not covered with cast larval skins, as is the case with the hive-bee.

The time taken to reach maturity varies considerably, ranging between fifty and seventy days. Hockings, a Queensland resident, in a letter to Dr. Cockerell, mentions seventy. The pupa has an exceedingly large thorax, the abdomen being very small. The subsequent development is somewhat similar to that of the hive-bee. The antennae appear as one bead growing on another, and the pigmentation of these organs is not complete when the abdomen is finally coloured. Like many other larvae, the eyes are the first to colour with a pale pink. Larvae of advanced age were removed from the colony, placed under a glass cover, in moist conditions, in a room temperature of 22°C. for three weeks, and apparently suffered no injury. Hive-bee larvae were much more delicate, and succumbed after twenty-four hours. Full-grown larvae of *Paracolletes* were dug up in New Zealand, enclosed between two strips of flannel, sealed up in a tobacco tin, and posted to me in Sandringham, where I reared them to maturity. The hardness of *Trigona* then is between *Paracolletes* and *Apis*.

I have used the term abeyance, in referring to the ovaries of the hive-worker, because when a colony is hopelessly queenless, certain of the workers seem to develop the true function, and deposit eggs which, however, produce only drones. It is asserted that such anomalous creatures had accidentally received an additional supply of "royal jelly," causing them to function as "queens," but since they are only in evidence in "queen-less" colonies, it seems that the feeding occurred later in life, when the dread emergency arose. Colonies possessing "laying workers" often refuse to accept true queens, and this action suggests the improbability of such depositing workers being over-fed during the larval stages.

Summary:—The "royal jelly" of the hive is not the normal diet of bees, but is a superfood which hastens, and assists, the full development of female sexual characters. I am now able to say that the Australian stingless bees are not reared exclusively on a diet of honey and pollen, for the nurse bees add to it some other biological product. While the substance is much more potent than the simple mixture of the furrow-bee, *Halicictus*, it is not so "rich" as the "pap" of the bee-hive. By depriving hive-bee larvae of the "pap," at various periods, I am able to obtain bees exhibiting all stages of development, from almost perfect queens to stunted sterile worker-bees.

In the entire absence of honey and pollen from natural sources, both stingless- and hive-bees will build comb, and the queens deposit eggs in a normal manner, when fed with a soft "candy" composed of cane-sugar and the white of hen-eggs. This warrants further experiments in connection with the "pollen shortage" problem now being investigated.

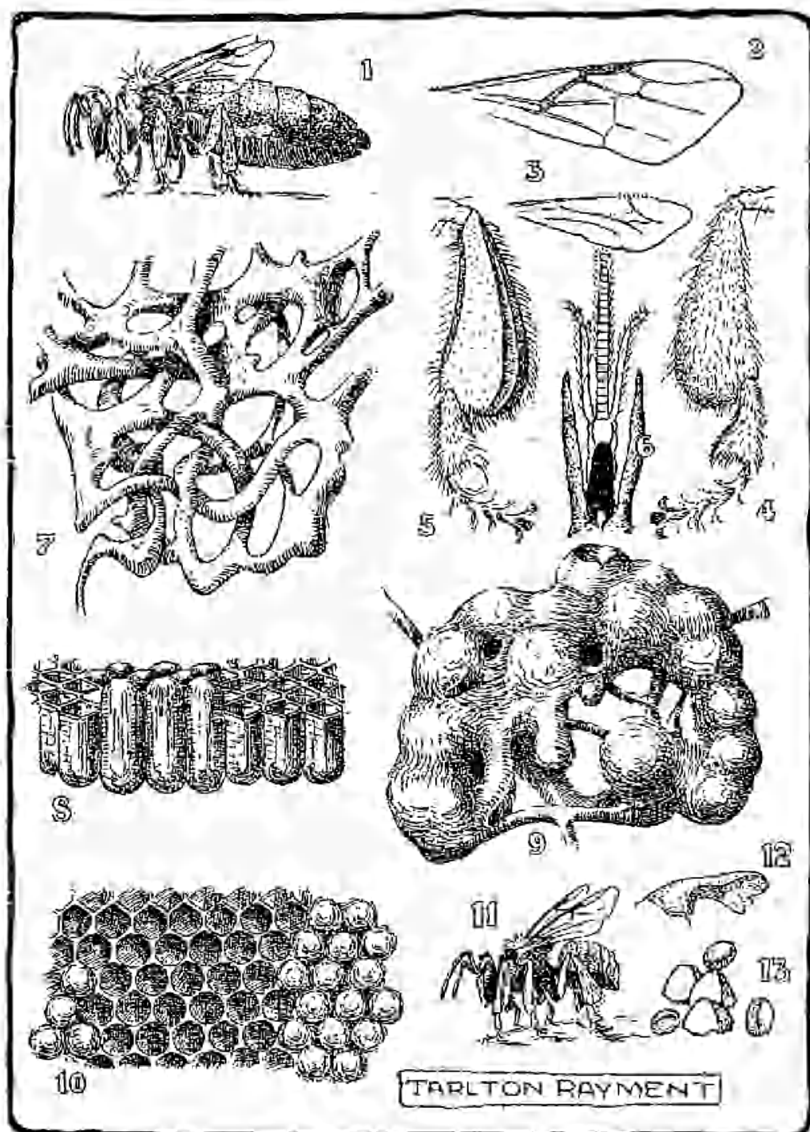


Fig. 1.

THE RULE OF THUMB AND SOME EXACT SCIENCE.

The wax used for the struts and the honey-cells is hard, brittle, and of the colour of chocolate; that in the more or less hexagonal brood-cells is somewhat lighter in tint, and more ductile. It burns as freely as ordinary bees-wax, but the odour is similar to that of

meat being roasted. The melted wax resets quickly, though when cold it has a slightly "gluey" consistency that makes it very difficult to remove from any article.

Having an inquiring type of mind, I boiled some of the dark, chocolate-coloured struts in 90% alcohol. The ebullition was punctuated by spasmodic explosions, as though some gaseous substance was being liberated. On taking off the alcohol—which was not highly discoloured—and evaporating it, I obtained a small quantity of minute white crystals, which I take to be cerotic acid. The proportion I secured was much less than that obtained from honey-bee wax, the acid content of which is 15%.

The dark residue had the appearance of finely granulated wax, and conformed to the test for myricine, plus the dark colouring matter. On reboiling this in an alkaline (carb. soda) watery solution, tiny granules of an ochreous colour were formed, and floated on the surface; later on, these were filtered out. Dry heat of 178° F. did not alter the substance; perhaps it is palmitic acid.

I then had the colouring matter dissolved in the soda water, which I acidulated with acetic acid until I obtained a red reaction with litmus paper. Reboiling produced much frothing, but the addition of a small quantity of the white of an egg resulted in the precipitation of the brown colouring. The supernatant liquid was taken off with a pipette, and the dark residue evaporated to dryness. Result: A vandyke-brown substance, soluble in both water and alcohol, but insoluble in spirits of turpentine and commercial petrol.

The odour and taste of the pigment is strongly reminiscent of a vegetable extract sold in the form of a dark paste. Of course, that is not remarkable, since the wax, too, is of plant origin, though in an indirect way. The strut wax is not readily dissolved in turpentine, as a vigorous shaking after three days' soaking is necessary to break it up into small particles; even then, should the combination be allowed to stand undisturbed for a day or two, the turpentine will rise to the top practically uncoloured, while a brown paste settles to the bottom of the vessel.

The myricine fuses at about 128°, and then has the characteristic odour of melting honey-combs. I append some exact science on the composition of the products of the *Trigona*:

ANALYSES OF THE PRODUCTS.

I am indebted to the courtesy of Professor Hartung, Acting Professor Heber-Green, and Mr. G. Ampt, M.Sc., of the Melbourne University, for the analyses of the products of the indigenous bees, *T. cassiae* and *T. carbonaria*, and which have been carried out by Miss I. H. Robertson, M.Sc.

HONEY.

Moisture	24.5	per cent.
Reducing sugars (dextrose, laevulose, etc.) ..	64.1	" "
Sucrose	7.5	" "
Ash	0.06	" "
Protein	0.26	} 0.31
Wax	0.05	
Free acid	0.15	

WAX.

A sample from the hive of *T. carbonaria* was very dark in colour. The usual bleaching agents did not result in any appreciable improvement, and this interfered with the determination of certain of the "constants."

Typical values for beeswax are given in parentheses:—

	<i>Trigona</i> Wax.	Wax of <i>Apis</i> , Hive-bee species.
Melting point, °C. ...	62.5-64.5	(63-66, Australian 64)
Saponification value, about	70	(about 100)
Iodine value	31.7	(7-13, Australian 9.5)

Hooper (*Agricultural Ledger*, 1904, 11, 73) quotes the limiting values of eight specimens of wax from a small stingless bee known as the "Damar" bee. *Melipona* or *Trigona* species:

Colour, blackish; consistency, sticky.

Melting Point, 66-76°C.

Saponification value, 73.7-150.

Iodine value, 30.2-49.6.

It will be seen that the specimen examined here conforms in the main to those investigated by Hooper. The great difference between the iodine values of *Trigona* and *Apis* waxes would have been difficult to explain in the absence of Hooper's results. Obviously, the species of bee is the controlling factor.

POLLEN.

The sample labelled "Stored Pollen—*T. cassiae*" was found to contain 3.17 per cent. nitrogen,* equivalent to 19.8 per cent. protein.

The presence of little more than one per cent. of such pollen in *Trigona* honey would account for the protein figure (0.26) found.

*For comparison I give the following figures:—

Yellow Box (<i>Eucalyptus melliodora</i>) ..	3.70	per cent. nitrogen
Messmate (<i>E. obliqua</i>) ..	3.55	" "
European Hazel (by Planta) ..	30.21	" "

EXPLANATION OF FIGURE 1.

1. Adult fecund female (queen) *T. carbonaria* Smith.
- 2 and 3. Posterior and anterior wings of the queen.
4. Outer surface of the tibiae and tarsi of worker-bee.
5. Inner surface of the tibiae and tarsi of worker-bee.

6. Glossa and palpi of the mouth.
7. An extraordinary maze of wax struts surrounds the cells.
8. The brood-cells have a conical "cap," but the opening is always at the bottom. Only the drone-cells of the hive-bee have a similar convex cap.
9. The large honey-storage cells are embedded in wax; note the "pop-holes" affording a "short-cut" to the other side of the cells.
10. Small groups of cells are often very regularly constructed.
11. Adult worker-bee, *T carbonaria*.
12. The notched mandible of the worker.
13. Pollen-grains removed from the cells; these are probably *Eucalyptus* and *Hardenbergia*.

ARTHUR MILLS LEA.

On February 29 died Arthur Mills Lea, of Adelaide, by far the greatest of Australian-born entomologists. He was born at Chelsea Street, Redfern, a suburb of Sydney, N.S.W., on August 10, 1868.

Those of us who knew him well, loved him; his nature was such that to know him and not to love him was unthinkable. He was intensely sympathetic and generous-hearted; he delighted in doing things for others, and would go to endless trouble to assist those even whom he did not greatly like. He loved little children particularly, and the writer, who enjoyed many a bush ramble with him, never knew him to pass a child without some kindly word of greeting.

It is doubtful whether there is any student of Australian coleoptera, either here or abroad, who has not benefited by his advice, or received some help from Arthur Lea. His enthusiasm for his hobby, for entomology was his hobby as well as his calling, was unbounded, and he seemed to instil enthusiasm into all who either met him or corresponded with him. Many long and weary hours must he have spent in determining material for others. Almost all Australian entomologists sent their coleoptera to him to be named, while he also received numerous parcels from overseas institutions and private collectors for the same purpose. The work he did in this direction alone was a man-sized job, yet he contrived to do an amount of taxonomic work that no man living or dead has ever equalled. Canon Blackburn, when he died, had achieved a world's record in having described some 3000 species of coleoptera. A. M. Lea's record reads as follows:—Passed 2000 mark, 13/12/1912; 3000, 27/12/1917; 4000, 16/10 1923; 5000, somewhere between 1928 and 1929; and when he left us, the number of species standing to his credit had reached the total of 5432. There are still some MS. descriptions awaiting publication. He had also written redescriptions of 221 species and produced 2160 drawings illustrating his articles.

One might think that no man could encompass more than this, yet Arthur Lea's writings on economic entomology were also considerable, some 130 papers being devoted to this branch of the

science. He contributed also numerous articles to Tasmanian and Western Australian newspapers. His papers on taxonomic entomology, about 120, appeared in Australian publications devoted to science and in several English and European scientific journals.

His first start in life was with a firm of chartered accountants in Sydney, but he very soon began to exhibit a talent for entomo-



ARTHUR M. LEA.

logy. When still quite a youth, he won first prize at a big Sydney exhibition for a collection of insects, and at the same time carried off first prize for the best set of insect drawings. Entomology appealed so much to him that he early forsook accountancy and, in 1891, joined the Department of Agriculture of New South Wales as assistant to the then Government Entomologist, Sidney Olliff.

Owing to a period of financial depression, a few years later, the Government of the day retired many of its servants, Lea among them. Very soon he secured the appointment of Government Entomologist of Western Australia, a position which he held until 1899. In that year the Tasmanian Government obtained his services in a similar capacity, and in Tasmania he remained for twelve years.

During all these years he was officially an economic entomologist, and a perusal of his writings shows that very valuable services were rendered by him to the various departments with which he was associated. Letters and testimonials also testify to this. At heart, however, he was a taxonomic entomologist, and when the chance came, in 1911, to join the staff of the South Australian Museum as entomologist, he was quick to seize it, and that position he filled to the end. About this time he was also appointed consulting entomologist to the Department of Agriculture of South Australia, and later as lecturer in entomology at the University.

When Mr. Lea joined the Museum the entomological collection was a comparatively small one, and at his death it contained the finest collection of Australian beetles extant, besides a very rich collection of insects of all other orders. Towards the latter period of his office he also built up a very extensive collection of coleoptera from the Polynesian, Papuan, and Indo-Malasian regions. When at Adelaide he undertook the examination of no fewer than 1200 stomachs of birds, a labour of great economic importance, in which his wonderful knowledge of the external anatomy of insects stood him in good stead. His memory was remarkable; it was almost impossible to show him any named Australian species of beetle without his being able, almost instantly, to give its scientific name.

In 1924 the Fijian Government obtained a loan of his services for twelve months to endeavour to find a means of dealing with the Coconut Moth, *Levuana iridescens*, which was then threatening the extinction of the copra industry. In connection with this work, he visited parts of Queensland, Torres Straits, Java, Borneo, and the Malay Peninsula in search of parasites that might be of service. He eventually discovered a Tachinid fly which attacked an allied Zigaenid Moth, *Brachartona cato.vanilla*, and immediately set about trying to arrange for direct transport by aeroplane in an endeavour to land his new discovery alive in Fiji. The Government, however, was unable to assist him in this direction, so he had to rely on shipping services. As there was no direct route to Fiji, the problem was one of difficulty. He succeeded in getting live specimens as far as Sydney, but soon after arrival they all perished. As the twelve month period had now expired, he

had to return to the South Australian Museum, and leave to others the task of successfully introducing his discovery into Fiji.

The writer was recently shown a newspaper article in which the whole of the credit for the discovery of the parasite, which has since been most successfully introduced into Fiji, is given to others, who came after him. I have before me, however, a letter signed by the then Superintendent of Agriculture in Fiji, which proves that the credit for the discovery belongs to A. M. Lea.

During the War period, when huge stacks of wheat accumulated at the seaboard, they became very badly infested with grain weevils and other insect pests. A. M. Lea was one of the original appointees to the South Australian Weevil Commission, and travelled extensively in South Australia, Victoria, and New South Wales, reporting upon the conditions of the stacks. He was the first to suggest covering the stacks with malthoid, and using poisonous gases, and at the time it was estimated by competent authorities that £1,500,000 worth of wheat was saved by this means.

He personally collected a very great number of the insects which he described, having visited most parts of Australia and Tasmania, besides Lord Howe and Norfolk Islands, in search of them. He was a Fellow of the Entomological Society of London and the Linnean Society of New South Wales, and a member of the Royal Society of Victoria, the Entomological Society of Belgium, and the American Association of Economic Entomologists.

Arthur Lea sleeps in the pretty little West Terrace Cemetery in Adelaide, a resting place not far removed from where his old colleague, Canon Blackburn, also sleeps. It is a coincidence that these two men, who were such giants in the entomological field, should have both passed the final years of their lives in the same city.

He has gone; but so long as there are votaries at the Shrine of Entomological Science, so long will the name of Lea be honoured.

F. ERASMUS WILSON.

BEECHWORTH EXCURSION, EASTER, 1932.

Eighteen members and two friends took part in the Easter excursion to Beechworth, where the whole party was accommodated at one hotel. Rising early on Friday, we were pleasantly impressed by the picturesque and hilly surroundings of the town. The morning was devoted to a four mile walk along the "Gorge," the road for the greater part being carved out of the solid granite, with a deep ravine and a shallow stream below.

This road follows a winding course, in places between huge granite boulders, to a spot overlooking the falls, where a fine view of the "Woolshed" valley and diggings, 850 feet below, was obtained. Drop-

ping down to the foot of the falls, we did some prospecting for gold and precious stones, with negative results. In the afternoon we visited Baarnutha Park, a pleasant and interesting walk of about one mile along an avenue of conifers. The Eucalypts in the park are particularly fine specimens of their kind, and a tendency to the growth of twin trunks was noted in the district.

Heavy rain falling during Friday night and Saturday morning, a projected motor excursion to Mt. Stanley was postponed; the weather, however, cleared sufficiently to allow of a visit to the Burke Memorial Museum, where numerous geological, ornithological, and documentary exhibits were inspected. The Town Hall gardens, near by, were also visited. They contain perhaps some of the finest specimens in the State of the Californian Redwood (*Wellingtonia gigantea*), also very fine examples of *Arbutus* and *Araucaria Bidwilli*. These gardens are a delight to all tree lovers, and we here pay a tribute to the Beechworth pioneers, who planted with so much foresight and wisdom.

The remainder of the morning was occupied in an excursion to "Ingram's Rock," which is a flat granite outcrop about two acres in extent and two miles from the town. Here an extensive view of the Reid's Creek valley was much admired, and members collected specimens of *Rock Isotoma* and *Stypandra glauca*. The afternoon saw us walking down this valley, via the "Gorge" road. A kangaroo was started among the Murray pines which clothe the hillside. The entomologists found good collecting ground near the "Sphinx" rock, and many specimens of insects and arthropoda were collected, also several Fat-tailed Lizards (*Diplodactylus vittatus*).

On Sunday morning it rained heavily, but, the weather clearing, towards noon we were able to visit Lake Kerford, the town's water supply, a 60 acre sheet of water 2000 ft. above sea level. Arriving at the lake after a delightful three mile walk along a natural avenue of eucalypts, blackwood, wattles, etc., charming views of low wooded hills were obtained. Monday morning breaking fine, the postponed excursion to Mt. Stanley was undertaken. Leaving Beechworth in three cars and passing through the prettily situated town of Stanley, a rise of about 600 feet, once a mining town but now devoted to apple-growing, we reached the foot of Mt. Stanley (3444 feet), this being as far as the cars could safely go. A walk of four miles to the summit proved most enjoyable, magnificent views being obtained on the way. The ground dropping rapidly into a broad valley, in the east and distant 80 miles, appears the faint outline of Mt. Kosciusko, Australia's highest peak; in the middle distance Mt. Bogong is seen, flanked on the right by the rugged outline of Mt. Buffalo, with a magnificent view of the Ovens valley in the foreground. Looking to the south, Mt. Buller and the Strathbogie ranges are seen, and to the west Glenrowan Gap, Morgan's Lookout, and Mt. Macedon.

On Tuesday morning we visited the Asylum grounds, which are very extensive, well planted and well kept. The walk through the grounds disclosed a quaint old sundial, a very nice rock fountain clothed with rock-ferns, etc., and many magnificent trees, among which were *Araucaria Bidwilli*, *Cedrus Atlantica*, *Cupressus Lambertiana*, *Cupressus Lawsoniana*, and an exceptionally fine *Thuja gigantea* rising about 70 feet, a perfect cone from the ground to the apex, but disclosing from underneath thirteen trunks close packed and springing from the one hole. After leaving these interesting grounds, we rambled over the old alluvial "Two Mile" gold diggings. All but six of the party left for Melbourne by the afternoon train.

W. H. INGRAM.

GEOLOGY.

The country about Beechworth is composed of ordovician slates and sandstones and a biotite granite usually considered to be Devonian. A few miles from Beechworth are glacial conglomerates of Permo-carboniferous age. The valleys are covered with tin, gold, and jewel bearing wash from the surrounding rocks laid down from tertiary to recent times. The tin is derived from the granite and the gold from the Ordovician. Some of the jewels are considered to be the remnants of glacial action, others are of local origin. The weather and shortness of time prevented much being done. But great interest was taken in the gorge on Muddy Creek, which appeared to be cut back along a joint plane by the Beechworth falls. Some fine examples of weathering in the granite country were noted, and a metamorphosed area at the junction of the granite and Ordovician was examined. The old diggings were inspected and inspired thoughts of nuggets in some of the party; however, by the last day hopes had waned, and they were anxious to find a speck to show they had found something. The prospectors were disappointed. But some fine jewels were shown to us in the Town Museum and by local jewellers.

W. HANKS.

ENTOMOLOGY.

Representatives of most of the orders of insects were found by the several members of the party, who showed keen interest in this side of the Club's activities.

Of the order Orthoptera, the Yellow-winged Grasshoppers were numerous, and, though very active on the wing, a few specimens were captured by members running them down. Cockroaches of varied forms were found beneath bark, etc.; the green egg-case of the larger Mantis was collected, and both field and mole crickets were seen. A fine specimen of a long-horned green grasshopper (*Tettigoniidae*), and a pale green phasmid were found clinging to the damp bark of a Eucalypt on the summit of Mt. Stanley.

Some remarkably flat bugs (Hemiptera) were found under bark and fallen trees, along with the flat bark-beetles or Cucujidae. These bugs are reddish-brown, and have short beaks, and are almost as thin as paper. They are known as flat bark bugs or fungus bugs, and belong to the family *Aradidae*. Other Hemiptera met with were the common froghoppers (*Jassidae*) on Eucalypts and tree-hoppers (*Membracidae*) on *Acacia*, both of these forms being more or less gregarious and accompanied by ants.

Of Coleoptera (beetles), numerous forms were collected, such as carabs, click-beetles, and Tenebrionids, these being found mostly under wood, etc.; two specimens of *Psephenidae* were secured. Weevils were scarce, though the beautiful greenish Diamond Weevil (*Chrysolophus spectabilis*) was found. Pretty little green and orange beetles belonging to the family Melyridae, were very plentiful on the coloured foliage in garden beds near the town.

Hymenoptera were markedly scarce, owing, no doubt, to the absence of flowering shrubs and trees. Two large winged ants were found crawling up a tree trunk, and one or two digger-wasps were seen. Paper-wasps were observed and "experienced," but no capture was made. Ants were numerous, their large gravelly mounds being very common in this granite country. A few saw-fly larvae were collected, some of which have now, in captivity, entered the soil for pupation.

The commonest Eucalypt galls were those of *Aspidomorpha pilenta* and *A. phoratrata*, both these being of fair size, and produced by

coccids or scale insects. Smaller more succulent galls were found on leaves, inhabited by the orange-red Cecidomyiid fly larvæ. Lerp "scales" of several kinds were noted, many of the Eucalypts being very heavily infested with these, and consequently were much visited by ants. A very fine "clump" of the hairy Processionary Caterpillars was found, and these have been "processing" round a small cage, in the characteristic "head-to-tail" fashion, since placing them in captivity. Among other interesting forms were termites or white ants, belonging to the genus *Extermes*. The soldiers of this genus are of the *nasute* type.

J. W. RAFF.

FRESH-WATER "MUSSELS."

The marine shells of Victoria have, in the past, received much attention from our naturalists, but the same cannot be said of the fresh-water forms, which show, to a very great extent, an undoubted neglect. This is much to be regretted and it is hoped that, in the near future, our fluviatile forms may be studied and brought up to date on the lines of Pritchard and Galliff's marine shell catalogue.

Not the least interesting are the "mussels" which inhabit most of our fresh waters and are the largest of the group. They are closely allied to the marine "mussels," differing chiefly in the structure of the foot of the animal which, in the former, is much more developed in dimensions. The shells are equivalve and covered with an epidermis often more or less of a brilliant colour, a feature perhaps more marked on the surfaces of the insides of the valves. Several species have been recognised in Victoria, the largest of which is *angasi* Reeve, from the Murray River. Perhaps the most remarkable of our forms is *glenelegensis*, described by Dennant, from the Glenelg River, a species characterised by its beautiful corrugated surface.

The fresh-water mussels are poorly represented in Australia. Tasmania possess one well-defined species where it is entirely confined to rivers flowing into Bass Strait. In other parts of the world these mussels have been frequently used by painters for containing their colours, and some of the species furnish pearls. In Southern Europe, it is said, the animals are cooked for food.

C. J. G.

PLAGUE OF CRICKETS.

Writing from Mulka, via Marree, in March, Mr. George Aiston described a plague of crickets in the far north of South Australia:—

"Most of our rats have gone and we are now invaded by crickets—they are everywhere. To lie in bed at night and hear them jumping about, one would think that the house was full of people. I wonder if anyone has studied the life history of a cricket. The stages I have watched are the development from a grub to the perfect insect. The larva is round and fleshy, and we find it curled up in the damp ground; it develops into a fat-bodied creature that burrows along just under the ground. The signs of the burrows criss-cross every bit of wet ground. Burrows are up to ten yards in length. At this time, the body of the larva is about twice the length and bulk of the head portion; next the body thins and a tail is developed. Soon there is another cricket to carry on the good work of killing off mosquitoes and other small pests. It is interesting to watch them hunting mosquitoes; we have seen them jump two feet and catch a mosquito on the wing. There are usually a dozen or so on the dining-room table at night, to catch the insects attracted by the lamps."

OUR RARER ORCHIDS.

By W. H. NICHOLLS.

(4) *Diuris fastidiosa* Rogers.

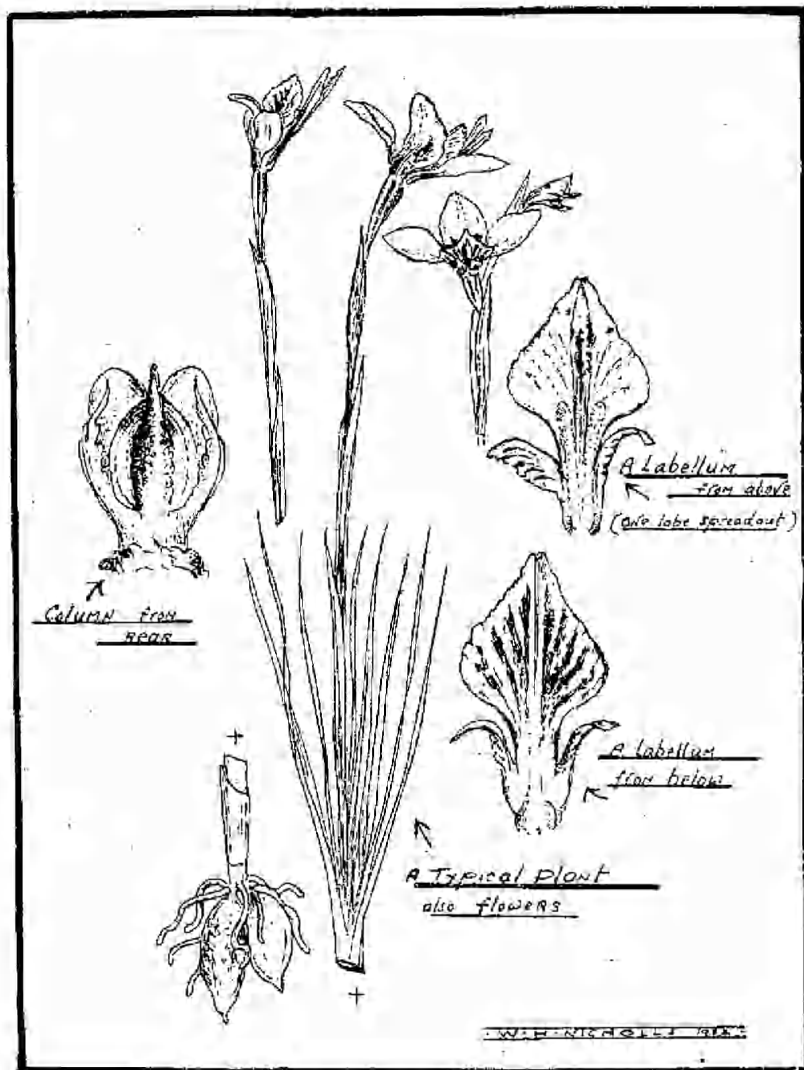
The spring of 1925, and that of 1927, are well remembered for the remarkable growth of vegetation. On the Keilor plains, as in more favoured localities, wild flowers were very plentiful. It was under such conditions that *Diuris fastidiosa*, the "Proud *Diuris*," made itself known to science, and—so it would appear—in such seasons only, does it show itself.

On a glorious day late in August, I rambled over the plains, visiting those few spots as yet untouched by settlement. The yellow, moth-like flowers of *Diuris podunculata* R.Br., and the wallflower-hued blooms of *Diuris palustris* Ldl., were surprisingly plentiful. When first I saw the little flowers of *fastidiosa* wavering in the wind, I imagined them to be those of a pale-coloured form of Lindley's plant; but the "something strange" invited closer scrutiny.

The proud, erect bearing of *D. fastidiosa* is noticeable, because all the other forms so far described have the twin sepals, to a greater or lesser extent, pendant. Here we have flowers with the sepals directed, more or less, skywards, so suggesting the specific name given to the form by Dr. R. S. Rogers, to whom the first-found specimens were forwarded. His description (adapted here) is as follows:—

Diuris fastidiosa, from *Proc. Roy. Soc. Sth. Aust.*, vol. li, 1927):—A small, very slender species, 5.5-20 cm. high; leaves 7 or 8, setaceous; flowers racemose, 1-3, on long, very slender pedicels, yellow, with dark brown markings; bracts loose, subulate, exceeding the pedicels; dorsal sepal more or less oval, erect, subacute, apex recurved, brown markings on the lower half, same length as labellum, lateral sepals greenish, linear, parallel, spreading, channelled, greatly exceeding the other segments, no tendency to cross; petals markedly stipitate, shorter than the lateral sepals; lamina yellow, elliptical, stipes dark brown; labellum vertical or subvertical, with irregular brown blotches or markings, 3-lobed, the division well above the base; lateral lobes oblong, blunt, slightly dentate on outer margins; midlobe obtuse, spatulate, narrowing posteriorly between the lateral lobes into a claw, margins entire; lamina with two well-separated pubescent raised parallel lines on the claw of the middle lobe, succeeded by a single keel to the apex; anther blunt; lateral appendages membranous, with a long subulate apex.

My records show that this species was first collected in August, 1923 (but one specimen being found). The specimens forwarded to Dr. Rogers were collected during the months of August and September, in 1925-26-27. In 1925 there were five small, compact



Details of *Diuris fastidiosa* Rogers.

tufts growing in an area of approximately 10 sq. ft. During the season of 1926, specimens were again difficult to find, two only being seen. In 1927 the five original tufts were once again in evidence, but since that favoured season the species has not re-appeared. Though the locality has been diligently searched each season, no sign of any growth in connection with this orchid has been detected. Flowers, August, September,

Tottenham, Victoria.

LYRE-BIRDS AND BUSH FIRES.

By MERVYN E. BILL.

Forests Commission Surveyor.

While any reference to the fires in the upper reaches of the Thomson River on February 5, 1932, immediately recalls to mind the tragic loss of human life which occurred on that fateful morning, and also the immense economic forest waste which is the inevitable result, one cannot help thinking also of the animals and birds which during such fires, perish, literally, by the thousand. Such thoughts, naturally, occupied my mind during the five hours' ride from Erica to my newly-erected survey camp at Talbot Creek, amid the charred ruins of what had been, only two weeks before, a magnificent area of 40,000 acres of virgin forest. And yet, this vast expanse of ruin was not entirely devoid of life, as would be imagined. One can readily understand how wombats, rabbits, and foxes are able to escape the fire—they can easily escape underground. Strangely enough, the music of the forest—the whistle and crack of the Whip-bird, the screech of the cockatoo, the chuckle and warble of many other birds—sounded incessantly all around. This, amid such desolate surroundings, would appear almost inexplicable; until one realised that there were apparently at least as many Lyre-birds in the charred gullies after the fire, as were there when the forest stood in all its grandeur. Furthermore, judging by the echoing sounds of their delightful mimicry, they were quite unmindful of, or at least unperturbed at, their depressing and blackened surroundings. All other bird life, except for a stray cockatoo or a jay, was lacking; and yet the Lyre-birds had obviously come unscathed through that terrific heat and those devastating flames.

Several days later Mr. M. Mitchell was relating to me the manner in which he so fortunately escaped with his life, while six of his mates were burned to death. He was working on the Thomson River on the morning of February 5, and, realising that it would be futile to venture into the timber while the smoke was becoming increasingly ominous, he stayed by the river, and was thus able to shelter in the water when the fires came upon him. But had he needed any other factor, excepting his own knowledge of the bush, to warn him of impending danger, he would have placed implicit reliance on the instinct displayed by the Lyre-birds.

"From eight o'clock in the morning, three hours before the fire reached me," said Mr. Mitchell, "the Lyre-birds began to flock from the higher country to take shelter in the river; and, moreover, they could not be made to move from the positions they had taken up immediately on reaching the water. They were either stupefied by smoke (which was extremely unlikely) or the instinct of preservation which had led them from the bush many hours before the fire would actually have reached them, overcame the usual timidity displayed toward human beings."

It is apparently obvious that the instinct of Lyre-birds, if the danger of fire is imminent, leads them as far as three or four miles from their customary haunts, to a place of almost complete safety, while the fire rages past. And then, within a few days, when the heat from burning logs has somewhat abated, they return again to rebuild their homes and be the first to do their small portion to attempt to restore the devastated forest.

[Country members, who have observed the behaviour of animals (mammals, birds, or reptiles) when menaced by a bush fire, are invited to contribute notes to *The Naturalist*.—Ed.]

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F.N.C.V. PROCEEDINGS.

The ordinary meeting was held at the Royal Society's Hall on Monday, May 9, at 8 p.m. About 100 members and friends were present, with Mr. J. A. Kershaw, C.M.Z.S., President, in the chair.

DEATH OF FORMER MEMBER.

The President voiced the regret of members at the death of Mr. Gustav Weindorfer, late of Cradle Mountain, Tasmania. Several members spoke of his work and the esteem in which he was held by all who knew him.

CORRESPONDENCE.

Mr. Robert Fitzgerald wrote in appreciation of Mrs. Messmer's article in the April *Naturalist*.

EXCURSION REPORT.

The President reported on the excursion to the Zoological Gardens on April 30. On Mr. Pitcher's suggestion, a letter of thanks was authorised. Members expressed keen appreciation of Mr. Wilkie's entertaining and informative remarks.

GIFT TO LIBRARY.

The President announced the gift of 28 volumes of *The Naturalist* by Miss E. F. Barnard.

ELECTION OF MEMBERS.

The following members were duly elected.—Miss E. Moore, and Mr. C. B. Scott.

NOMINATIONS FOR OFFICE-BEARERS, 1932-1933.

The following nominations were received:—President, Mr. J. A. Kershaw, C.M.Z.S.; Vice-Presidents, Messrs. G. N. Hyatt, V. H. Miller, A. S. Mitchell, J. W. Audas; Hon. Librarian, Dr. C. S. Sutton; Hon. Assistant Librarian, Mr. W. H. Ingram; Hon. Editor, Mr. Chas. Barrett, C.M.Z.S.; Hon. Sec., Mr. A. J. Swaby; Hon. Assistant Secretary, Mr. F. S. Colliver; Committee, Miss J. W. Raff, M.Sc., F.E.S., Mr. C. Daley, B.A., Mr. P. R. H. St. John, Mr. A. S. Kenyon, Mr. G. Coghill, Mr. T. Rayment.

ELECTION OF AUDITORS.

Messrs. A. G. Hooke and A. S. Chalk were duly elected auditors.

GENERAL BUSINESS.

The Report of the Victorian Advisory Council for Fauna and Flora was made available to members.

Mr. V. H. Miller, Vice-President, mentioned the action taken by the Victorian Horticultural Society for protection of Spinebills. It was decided to convey the approval of members.

Mr. Proulffoot stated that White-eyes were being sold in the markets as ruge birds.

EXHIBITS.

Exhibits were staged in the Library of the Royal Society, by special courtesy. The following members exhibited—

Mr. F. Pitcher.—*Stenocarpus sinuatus* (Fire-wheel Tree), a branch with 15 inflorescences of varied form, grown by the exhibitor.

Mr. C. Barrett.—*Clavaria* sp. (Coral Fungus), from Upwey.

Mr. C. J. Gabriel.—Australian fresh-water mussels, including *Hydriddella australis* Lam.; *H. ambigua* Phil.; *H. angasi* Reeve; *H. wilsoni* Lea; *Propchydrella nepeanensis* Conrad; *P. eudelli-formis* Conrad; *P. narracanensis* Cotton and Gabriel; *Protolhyridella glenclgynsis* Demant; *Cucumeria novae hollandiae* Gray.

Mr. H. Whitmore.—Calcite.

Mr. F. Chapman.—Casts and moulds of shells in ironstone of the Permocarboriferous:—*Deltapecten subquinguelineatus* McCoy; *Spirifer marcani* Waagen; from Wooramil River, W.A.

Mr. C. Daley.—Minerals in association with gold (12), gold deposited on charcoal in chlorination. Hammer stone and anvil stone from Point Cook. Burnett River Salmon or Mudfish. *Ceratodus forsteri*.

Mr. J. A. Kershaw.—Tooth of Sperm Whale (*Physcter macrocephalus*) and ear bone of Blue Whale (*Balaenoptera sibbaldi*), from Ross Sea, Antarctica. Case of Australian wood borer moths (*Xylorichthos*), about 50 species.

Mr. T. S. Hart.—*Billardiera*, probably *scandens*, ordinary and hairy fruits, the latter collected by Mr. F. H. Salau, at Beechworth. *Hakea nodosa* fruits with varying degrees of roughness, from Clarinda. Various pebbles from Bairnsdale Torrent Gravels, including old schistose rocks, sedimentary and igneous rocks from Devonian series; porphyry, agate from Devonian and silicified wood from older Tertiary.

Miss J. W. Raff.—Pond animals, including large water beetle, back-swimmers, water leech, damsel-fly larva, dragon-fly larva, caddis-fly larva.

Miss E. Raff.—*Abrus precatorius* in pods, cotton boll and vegetable ivory, from New Hebrides.

Master P. Flecker.—Nest of paper wasp, from Cairns.

Mr. F. S. Colliver.—Plant remains, including bark, branchlets, etc. from beneath basalt, Clifton Hill, Pleistocene; *Banksia*, *Eucalyptus*, etc., from tuff beds, Mount Gambier, Pleistocene; *Pteris hunceri*, *Cinnamomum* sp., from Bogong High Plains, Miocene; *Laurus werriboensis*, *Cinnamomum polymorphoides*, *Fagus* sp.,

from Bacchus Marsh, Miocene; *Gangamopteris spatula* from Bald Hill, Bacchus Marsh, Carboniferous; ferns and wood from Wonthaggi and Newtown (Tasmania), Jurassic; wood from bed of Yarra, Spencer Street, Pleistocene.

Mr. H. P. McColl.—*Hakea laurina*, *Stenocarpus sinuatus*.

Mr. S. R. Mitchell's exhibit at April meeting included minerals from Mt. Widderin Caves, Supton, Victoria, viz.:—Anhydrous phosphate of magnesia, showing variations in crystallisation from single solid crystals to groups of skeleton crystals made up of tabular plates. Struvite (hydrated phosphate of ammonia).

NATIVE ANIMALS AND BUSH FIRES.

We have always noticed, in a lifetime's study of native life in Gippsland forest country, where my father and brothers are pioneers, that native mammals, birds and insects could "move out" in front of fire on the first warning—the smell of smoke; also, that introduced species rush into the flames.

On the way to our assistance on that fateful February 5, at 9 o'clock in the morning, our neighbours saw in our green millet paddock, about 20 Wallabies, which were quite safe from the coming fire. The floor of our beautiful bush was burnt clean—not a leaf was left of the undergrowth that sheltered the ground animals; and even the tall gums are now leafless. Birds escape; the Bell-birds have gone to our neighbours' bush (the south wind turned the fire just at our house, and, of course, there is nothing yet to bring the birds back). We have often seen a flight of small birds escape from a less serious fire and return immediately the danger passed.

We found dozens of rabbits, a few Blackbirds, and, occasionally, a Starling. There was no trace of Wallaby, Koala or Opossum, but they must have suffered, although there are three Opossums still coming to the house. When my brothers had to light fires to burn their cut scrub, long ago, I always went to the other side to see the animals and beetles move away unharmed.

The fire of February 5 came overhead for many miles before it descended upon various parts of the district. Pieces of bark, 10 or 12 feet in length, and up to 6 inches in width, have been found all over the district; unmistakably black butt bark (*Euc. regnans*), which must have been carried over on a terrific windstorm some time earlier in the morning. There is no black butt this side of the Ranges.

(Miss) C. C. CURRIE.

In a letter to the Hon. Secretary, Mr. W. Bickerton, Curator, Wattle Park, writes:—

"As an overseas man, I have often been asked, what impressed me most when I came to this country, twenty years ago. My answer has always been: 'It was and still is, the beautiful native flora, and how little the native-born appreciate it.' Any knowledge that I possess of Australian plants is due mainly to the helpful assistance of the Field Naturalists' Club, particularly two members, Mr. F. G. A. Barnard and Mr. F. E. Pescott. I am a great advocate for the use of native species for parks and street plantations, wherever possible. More use should be made of Australian trees along our great highways. May I say how much I appreciate the work done by your Club in fostering a love for native flora."

NOTES ON AUSTRALIAN CORAL FUNGI—*CLAVARIA*
L. spp.

By E. McLENNAN, D.Sc.

As the Field Naturalists' Club has decided to issue another coloured plate of some of the late Mrs. Ellis Rowan's paintings of fungi, the writer was asked to choose, from among the collection, those most suitable for publication. Since the "coral fungi" are so distinctive and easily recognised as such in the field, and as so little is known about the Australian species, two paintings of this genus were chosen for illustration, with the hope that some members of the Club might be encouraged to study these forms.

The plants included in the genus *Clavaria*—the coral fungi—exhibit great variety in form and size, ranging from small simple clubs to large coral-like masses which may weigh several pounds. The name *Clavaria* is derived from the Latin word, *clava*, meaning a club, and some of the older workers confined the name to the simple club-shaped species, which are sometimes referred to as "fairy clubs"; the branched forms were included in another genus, *Ramaria*. At the present time, however, unbranched and branched forms are placed together in the genus *Clavaria*. It is a genus of the family Clavariaceae, belonging to the group of Basidiomycetes. All members of this group produce spores on a special cell called a basidium, which, typically, has at its free end four processes—sterigmata. At the end of each a spore is finally constructed off, and when discharged from the basidium serves to reproduce its kind. These special reproductive cells or basidia are arranged to form a layer over the surface, or part of the surface, of the fruit body, this layer is called the hymenium.

The form of the fruit body, and hence the position of the hymenium, is used as a basis for the division of the large group of Basidiomycetes into smaller families. If the hymenium is smooth and covers the surface of erect club-like or coralloid branches, the plants so characterised are placed in the family Clavariaceae.

Clavaria is the largest, most common, as well as the most attractive member of the family, far exceeding its allies in the variety and beauty of its species. The plants included in the genus grow on the ground or on wood; they are fleshy or subcoriaceous, erect, simple or branched, with the hymenium spread over the surface of the clubs or branches. The stem of a *Clavaria* plant is not, as a rule, sharply marked off from the spore-bearing part, but it is sterile, and under a lens its surface is seen to be different from the more waxy hymenium above. The variation in the genus is expressed in extreme differences in size, in texture, in type of branching and in the color of the mature plant. In, perhaps, no other genus of the fungi is an accurate record of the characters

of fresh specimens so necessary, for some of the most distinctive features are not retained in the herbarium.

The colour of the fresh specimen is most important and should be noted, preferably by means of accurately-coloured sketches or in terms of a colour standard. Such colour standards (1) may not be available to all workers, but form, as well as colour, can be registered for future reference in a coloured sketch by any interested observer. Notes on the odour and taste of the specimens should also be included at gathering; the majority of the species are edible fungi and, since none has been proved definitely toxic, this can be done without any fear.

Apart from such differences of size of plant, colour, etc., the spores of the various species of *Clavaria* afford the most reliable characters in their classification, so that spore collections from fresh specimens are also necessary for accurate identification. When the spores are mature they are shot away from their sterigmata, and if the specimen is placed on a piece of glass the falling spores adhere to the glass and a spore print may be obtained, which should be preserved free from dust in paper envelopes. The colour of the spore deposit should be noted on the outside of the envelope, for the colour may fade on keeping. When spores are obtained in this way, one may be reasonably sure that the spore collection consists of mature spores of normal size and shape.

Such a collection of dried plants, coloured sketches and spore prints, made locally, would be very valuable for showing the distribution of the various species to any one preparing a monograph on the Australian forms. There can be no doubt that such a monograph is badly needed. Cooke (2) records forty-two (42) species for Australia; of these, nineteen (19) (Nos. 1-5, 9-11, 15, 16, 18-21, 23-26 of key) are known in the Northern Hemisphere. Intensive study of the European and American forms by various workers has resulted, after re-examination of type specimens and much experience in the field, in the publication of adequate descriptions and figures of the old previously incompletely described forms. As eighteen (18) of Cooke's records occur also in Great Britain (3) it is now possible to obtain accurate data of these plants, and so identification can be attempted with some degree of certainty.

No. 5 of the key, *Clavaria pyridata* Pers., was excluded by Cotton and Wakefield from the list of the British species, as it was suggested that it was possibly only an abnormal form of *Clavaria stricta* Fr., for it occurred on wood. The American workers, Burt (4) and Coker (5), recognise it as distinct from *C. stricta*, and since the writer has gathered this form consistently in the field, it has been included among the Australian species.

No. 17 of the key, *Clavaria tasmanica* Berk., is a Tasmanian species. The description given by Berkeley includes spore mea-

measurements and is not quite so sparse as the majority of the others cited by Cooke, so this form has also been retained.

The remaining twenty-three (23) species recorded by Cooke have been excluded. The following are regarded as synonymous with included forms.¹

C. aurea Fr. = *C. flava* Fr.

C. coralloides Linn. = *C. cristata* Fr.

C. fastigiata Linn. = *C. corniculata* Fr., var. *pratensis*, Cott and Wkfd.

C. grisea Pers. = *C. cinerea* Fr.

C. Krombholzii Fr. may be *C. Kunzei* Fr., or *C. rugosa* Fr.

C. millina Berk. (Australian record) = *C. corallino-rosacea* Clel.

C. muscoides Linn. = *C. corniculata* Fr.

C. rufa Pers. = *C. inaequalis* Fr.

The remainder—fifteen (15) in all—have been excluded from the key. Of these, some have definitely been declared indeterminate by the British workers; others, not included in the American and European lists, are so poorly described (6) that it would be impossible to fit the descriptions to any specimen.

Recently, Cleland (7) has described six (6) new species (Nos. 7, 8, 12, 13, 14 and 22 of key). No. 22, *Clavaria corallino-rosacea*, was submitted to Miss E. M. Wakefield for examination, and she reported "probably the same as the Brisbane specimen on which the Australian record of *C. millina* was founded. The true *C. millina*, from South America, is stouter and has no distinct stem. Unfortunately, the type shows no spores, but it seems unlikely that the Australian species would be the same."

The paintings represented in Plate II were submitted to Dr. Cleland by the writer, and he has been good enough to comment upon them. "It has been a great pleasure to see Mrs. Ellis Rowan's exquisite paintings of *Clavarias*. Without dried specimens for spore measurements and shapes, it is difficult to be certain of the species. However, I have attached names which are probably correct":—

1. *Clavaria ochraceo-salmonicolor* Clel.

2. *Clavaria sinapicolor* Clel.

3. *Clavaria vinaceo-cervina* Clel.

Although these three (3) species were described in 1931 by Dr. Cleland, no figure accompanied the descriptions, and it is very pleasing to be able to add to our knowledge of them by the inclusion of Mrs. Rowan's work. As these were painted at Macedon,

1. The writer follows Cotton and Wakefield for synonymy and excluded species. Carleton Rea—British Basidiomycetes, Cambridge, 1922, includes in his list some species which the former workers have omitted.



Australian Coral Fungi (*Clavaria*)

Clavaria ochraceo-salmonicolor Clel.

Left foreground: *Clavaria sinapicolor* Clel.

Clavaria vinaceo-cervina Clel.

From paintings by the late Mrs. Ellis Rowan

Victoria, it suggests, moreover, that this state should be included in the record of their distribution.

The following key is offered to encourage field observations and collections of this genus in Victoria. A *Clavaria* may be recognised in the field at sight, but owing to inadequate presentation of the Australian forms in Cooke's Handbook, it has been impossible for the collector to name specifically any of the forms he may gather. It is certain that a number, even of our more common types, will still be difficult to place; however, if that be the case, careful collections of such a form can then be submitted to an authority on the genus and notes published from time to time on such forms will place the Australian species of *Clavaria* on a good systematic basis.^{2, 3}

KEY TO THE AUSTRALIAN SPECIES OF *CLAVARIA*.

A.—PLANTS BRANCHED.

1. Plants when mature more or less yellowish, spore ochraceous.
 - (a) Plants large up to 10 or 15 cms. high, spores 9-20 μ long, ochraceous.

Plant fragile, pale when dry, spores pale ochraceous, minutely granular, 11-14 x 4.5 μ

Plants white to ochraceous, tips of branches rosy, spores striate or reticulate, 12-16 x 4.5 μ

Plant buff-pink, tips of branches yellow, spores minutely granular, spores 9-11 x 5 μ
 - (b) Plants medium sized, up to 5 cms. high, spores 6-10 μ long.

Growing on wood, vinous to brownish yellow, taste bitter, spores 8-9 x 4 μ
1. *C. FLAVA*
Vic.; N.S.W.; Qld.
2. *C. BOTRYTIS*
(*C. botrytis*, Cooke's Handbook).
Vic.; N.S.W.; Qld.; S.A.; W.A.
3. *C. FORMOSA*
Vic.; N.S.W.; Qld.
4. *C. STRICTA*
N.S.W.; Qld.

2. It is not possible to include descriptions of the twenty-six (26) spp. listed, but the writer will be pleased to make these accessible to any interested member.

3. Other species of *Clavaria* have been recorded for Australia by Lloyd, but owing to meagre information, they have not been considered in the key.

- Growing on wood, branches ending in expanded cups, from the margins of which other branches arise, yellow to brownish, taste peppery, spores $2.2 \times 4\mu$ 5. *C. PYXIDATA*
Vic.; N.S.W.
- Growing on ground.
Plant turning green when bruised, spores finely rough, $7-10 \times 3-5\mu$ 6. *C. ABIETINA*
Vic.
- Plant not turning green when bruised
- Plant mustard yellow to light orange yellow, or in age, chamois colour, spores $5.5-8 \times 3.8-4.5\mu$ 7. *C. SINAPI-COLOR*
S.A.; N.S.W.; ?Vic.
- Plant cauliflower-like, light ochraceous salmon, tips a warm buff. Spores with an oblique apiculus av. $9-10 \times 4\mu$ 8. *C. OCHRACEO-SALMONICOLOR*
S.A.; ?Vic.
2. Plants variously coloured, spores hyaline.
- (a) Plants white.
Branches cristate, spores large sub-globose, $9-12 \times 6-8\mu$ 9. *C. CRISTATA*
Vic.; Qld.; Tas.
- Branches not cristate, spores small globose, $3-5\mu$ 10. *C. KUNZEI*
Qld.
- (b) Plant greyish, spores sub-globose, $7-10 \times 6-8\mu$ 11. *C. CINEREA*.
Vic.; N.S.W.; S.A.
- (c) Plants vinaceous.
Spores sub-globose, $7.5-9\mu$ 12. *C. VINACEO-CERVINA*
S.A.; ?Vic.
- Spores elongated, $13-16 \times 4.5-5.5\mu$ 13. *C. AUSTRALIANA*
S.A.
- (d) Plant pinkish, later brownish salmon, spores sub-globose, $5.2-7\mu$ 14. *C. COMPLANA*
N.S.W.
- (e) Plants clear yellow, spores sub-globose, $6-7\mu$ 15. *C. CORNICULATA*
Vic.; N.S.W.

B.—PLANTS SIMPLE (occasionally branched in 19 and 22).

1. Plants tufted.

Plant white, spores sub-globose, 3.5 x 3.4 μ . 16. *C. VERMICULARIS*
Vic.

Plant sooty or smoky, growing on wood, spores sub-globose, 8 μ . . . 17. *C. TASMANICA*
Tas.

Plant yellow, spores globose, 5-7 μ . . . 18. *C. FUSIFORMIS*
Qld.

2. Plants solitary or in small groups.

(a) Plants white.

Plant stout, rugose, sometimes branched spores sub-globose, 9-11 x 8-9 μ . . . 19. *C. RUGOSA*
N.S.W.; Qld.

Plant minute, 4-9 mm. high, growing in association with the Alga *Chlorococcus*, spores av. 2-7 μ . . . 20. *C. MUCIDATA*
N.S.W.

(b) Plants reddish.

Plant bright rose-pink, spores elliptical, 7-10 x 5-6 μ . . . 21. *C. ROSEA*
Vic.; Tas.; N.S.W.

Plant coral red or rosy pink, sometimes, slightly branched, spores, pear-shaped, 6 x 3.4-4 μ . . . 22. *C. CORALLINO-ROSACEA*
N.S.W.

(c) Plants yellow.

Spores sharply warty, 5-6 μ (occ. 5-8 μ) . . . 23. *C. INAEQUALIS*
Vic.; N.S.W.; Tas.

Spores smooth, 10-11 x 5-6 μ . . . 24. *C. ARGILLACEA*
Vic.; N.S.W.; Qld.

(d) Plants ochraceous to brownish.

Plant very large and stout, clavate, dingy yellow to brown, spores 12-16 x 7-8 μ . . . 25. *C. PISTILLARIS*
Vic.

Plant filiform, on dead fallen leaves, etc., spores 8-11 x 4-5 μ . . . 26. *C. JUNCEA*
Vic.; Tas.

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GUSTAV WEINDORFER.

Gustav Weindorfer was a valued member of this Club for many years and a very dear friend of many of us, so that the news of his sudden and tragic death came as a great shock. His dead body was found, by a casual prospector, lying near his motor cycle only a few hundred yards from the chalet, on May 6.

From what he wrote in letters received since his death, he had purposed cycling to the coast on the fifth, and the strenuous effort required to push the cycle and side-car over a very rough half-mile between the chalet and the track, where it was possible for him to drive it, would seem to have over-taxed a heart already, in the past, unduly strained on numberless occasions. Death was certified to as from heart failure.

Gustav Weindorfer was born in Carinthia, in 1873. His father, who was in the diplomatic service, played some part in securing for Germany that part of Africa afterwards known as German East Africa, and subsequently was Governor of the portion of Poland then included in Austria-Hungary. Gustav was educated at the Vienna University for the same service as his father, and studied, in particular, languages, and also the science of agriculture.

In 1899 he came to this country to take the position of Chancellor in the Melbourne Austro-Hungarian Consulate, under Herr Pinschof. He was then aged 26, and had left his native land hoping to find abroad, and more particularly in Australia, a freer atmos-

phere, where his sensibilities would not be offended by clerical and military arrogance. In appearance he was blonde-bearded, blue-eyed, tall and athletic, and his manner vivacious and attractive. A good linguist, he already spoke our tongue fairly well, but further to improve it, he regularly attended the Wesley Church, where he listened to the Rev. Edgar, whose diction was notably excellent, with much benefit.

Being a born naturalist, Gustav lost little time in joining our Club, becoming a member, with Messrs. Hardy and Pescott, at the December meeting in 1901, but previously taking part in the Gembrook Camp-out. His chief interest was botanical and he



GUSTAV WEINDORFER.

specialised in the flora of high places, his previous collecting having been done mostly in the Carnic Alps, bordering his home-country, and Northern Italy. Very quickly he became one of our most active members, furnishing reports on excursions, joining in visits to Shoreham, the Buffalo, Bogong, the Grampians and the Baw Baw Mountains, exhibiting specimens. He contributed papers "On the Fertilisation of Phanerogams," "Some Comparison of the Alpine Flora in Australia and Europe," and "Some Considerations of the Origin of Our Alpine Flora."

In 1907 he resigned his appointment at the Consulate, went to Tasmania, married a fellow-member of the Club, Miss Kate Cowle, whose father was a police magistrate there, and commenced farming at Kindred. Some time later, having heard a glowing account

of the Cradle Mountain, the highest land in the island, he suggested to the writer that we might very well pay it a visit, and accordingly, in January, 1909, the visit was duly paid.

The romantic beauty of the locality, its lovely lakes at various levels, each with its special appeal—ranging from the idyllic charm of the Dove Lake to the awe-inspiring Crater Lake—its picturesque crags, deep gorges and crystal cascades; the wealth, variety, beauty and novelty of its flora, notably the curious cushion plants of the plateau, whose counterparts in growth-form are met with elsewhere only in New Zealand and southern South America; all far exceeded our expectations, and surpassed anything we had experienced on the other side of the Strait.

A second visit, in which Mrs. Weindorfer took part, was made



THE CHALET, CRADLE MOUNTAIN.

in the following summer. Previously, we had humped our swags from Middlesex Plains, but on this occasion, packhorses were taken and our camp was set up on the spot where, later, the chalet was built. This example of our old friend's versatility was commenced in 1912 and, with the exception of help in splitting the timber of the King Billy pines in the forest at the back, the whole of the work, including the making of the necessary furniture, was done by himself. Such articles as a stove and, later, a bath, which

were beyond his ingenuity, were carried by him over a matter of about ten miles from the Plains. At first, of course, the accommodation was limited, but ultimately there was accommodation, it was said, for as many as 24 visitors.

In 1916, Mr. Weindorfer had the misfortune to lose his wife. Up till this they had spent their time partly at the farm and partly at the chalet. Now, however, bereft of her companionship, he sold the farm and permanently established himself in the chalet where, in the winters, he spent many solitary months and became known to many as the Hermit of the Cradle Mountain.

Although he was the last man in the world to seek solitude, he yet bore these lonely winters better than most people, for he had a world of interests. He was ever adding to and improving the interior of his home. He was a great reader and an enthusiastic photographer. He made a close study of the physiography and geology of his surroundings and of its flora. In addition he established a meteorological station, having to rely at first on such instruments as he then possessed or was able to contrive, and commenced to keep records. These were so appreciated by the Commonwealth Meteorological Bureau that he was supplied with other instruments by it and was thus enabled to take thirty different readings each morning and the mean of these at intervals of five days.

Denied human companionship during those long winter months, our friend sought it in the wild life of the forest so close at hand. Unlike the great majority of us, he seemed easily to acquire and secure the confidence of animals. As he once told us, "When the ground is all covered with snow, I do build a big fire, open my door, seat myself very, very quietly in front of the blazing logs, and, presently, one by one, in they would come, without their usual fear of man or of one another, and share with me in stillness the grateful warmth."

As I had ample opportunity of knowing, both here in Victoria, during my half-dozen visits to the Cradle Mountain and during the long motor trip he took with me around the coast to Brisbane, thence to Roma and back by Bourke and Cobar to Melbourne, Gustav Weindorfer was an ideal companion. He was always enthusiastic, invariably good tempered, had a keen sense of humour and the gaiety of his salutation was a very tonic. His adaptability and versatility were truly remarkable. He seemed to be able to turn his hand to anything, from bathing the baby of the wife of a visiting American Professor, while the lady was deep in the examination of the plants she had that day collected on the Plateau, to cooking a meal for a score of visitors to Waldheim. One cannot help thinking what an excellent plan it would be, in furtherance of the brotherhood of man and of nations, for these to pick out from among their people as many as possible like Gustav

Weindorfer and send them to other countries as propagandists of international goodwill.

For the last two years our friend had been staying away from Waldheim during the winters, and this season had hoped to again visit Melbourne, but, as he said in his letter to me dated May 4, he was obliged to give up the idea on account of the expense. Further, he says that for three days he had been endeavouring to bring his machine to life so that he might go down to the coast; that he succeeded on the 3rd and, in his own words, "full of spirits I prepared to bring the thing out this afternoon (the 4th) as far as the Dove Valley, into which, from here, I made a track five feet wide to connect with the road. Now just you imagine, go it did with the first kick, but it absolutely refuses to move when put into low gear. I presume one cylinder is not working, and it got dark, so I have to find the trouble and clear out before the rain starts." He tells also in the letter of a fall from his cycle in February, when, he thinks, he fractured a lower rib. After reading this last letter from him one can imagine the end. He will be always remembered and greatly regretted. He was buried near the edge of the forest, close to "Waldheim," on May 10, Archdeacon Atkinson, an old friend, conducting the service, just twelve other friends being present. Of his family, only two sisters are living, one of whom is the wife of an Austrian judge. His parents, who visited him in Melbourne, and whom some of us were charmed to meet, are long since dead. Two brothers, one a medical man and the other a captain in the army, were both killed during the late war.

It is stated that a work dealing with the plant geography of the Tasmanian mountains by the late Gustav Weindorfer was to have been published in the coming spring. It is very much to be hoped that such a work was actually completed by him and that it will eventually be available, both as a souvenir of the author and also on account of the fascinating nature of the subject.

According to Mr. Smithies, of Launceston, the people there intend to do their best to see that Waldheim is carried on by someone worthy to continue the work so well begun.

C. S. S.

It is with the deepest regret that the death of Mr. F. G. A. Barnard is recorded, in the journal which he edited for so many years. An appreciation and biography of our late member will appear in the July *Naturalist*.

THE STINGLESS BEES OF AUSTRALIA.

By TARBTON RAYMENT.

5. IS THERE A SYMBIOTIC ASSOCIATION?

A number of other insects are tolerated in the colony, and *T. carbonaria* appears to harbour the most. The one very conspicuously in evidence is a small grey fly, about 2 mm. in length. It is hunch-backed, belongs to the family BIBIONIDAE, and is close to the genus *Scatopse*. Dr. Cockerell received some fly larvae and adults, taken from *Trigona* "nests" by Hockings, and dated "Jan., 1888," and he identified the flies as a species of *Ceroides* related to the Indian *C. ornatifrons* (Brunetti), but much larger. "They are not really parasites," he concluded. However, no other details are given, and he did not know from which species of *Trigona* they had been taken.

A careful examination of the interior of the hive-wall revealed hundreds of the adult flies, and many thousands of minute white ova adhering to the wood. The egg has a peculiar sculpture, measures about 0.7 mm. in length, and a dozen or more were found to the square cm. The fly larvae are about 3 mm. in length. The eggs hatch quickly, and the young, spiny larvae appear to feed on the pollen and debris of the colony. When fully grown, they turn brown while changing to pupal form. At this stage, and while they are helpless, the *Trigona* workers seal down many hundreds with a covering of resin and wax.

This wise and sanitary action may not be a defensive one, and perhaps is due merely to the bees' desire to have everything fast. On the other hand, remembering that the *Trigona* have all the "elements of greatness," the hermetical coating may be due to the same perspicacity that directs the honey-bee to intomb the too-adventurous snail in a resinous sarcophagus; an intelligent and not uncommon method of preserving the health of the colony.

The huge number of fly larvae carried out when the hives were first opened was due to the disorganisation attending such a long journey; the bees could not remove their normal daily quota, and the pests accumulated. The natural surroundings of the combs are such that innumerable chinks and crevices make convenient "dust-bins" for the debris of the colony, and the flies frequent such "feeding grounds" rather than the actual structures of wax. I provided a false ceiling to the hives, leaving plenty of room at the sides for insects to ascend to the top, and the overhead shelter

1. It has been reported that the earth-burrowing bee, *Andrena aterrima*, harbours a dipterous parasite, and microscopical investigation demonstrated that two of the bee's tracheae had actually grown into the parasite's body, and were functioning, so that air was conveyed in, permitting the intruder to "breathe." Surely, in all the world, there is a no more remarkable method of robbing a host.

so provided was used by the bees as a kind of "refuse tip," and there the flies congregated, as I surmised they would.

Three species of beetles, about 5 mm. in length, were obtained from the colonies, the most numerous being the small black *Brachypeplus planus* Er., which left the interior, during transport, to cluster on the outside of the boxes in any available chinks. On re-opening the entrances the beetles took up their former positions on the actual combs. This species of beetle is found in groups of five or so with the bees working all about them, and apparently paying no heed to their presence; but I noticed that the beetles remained very quiet when the bees were near. I doubt the ability of the bees to eject them, though I have never observed

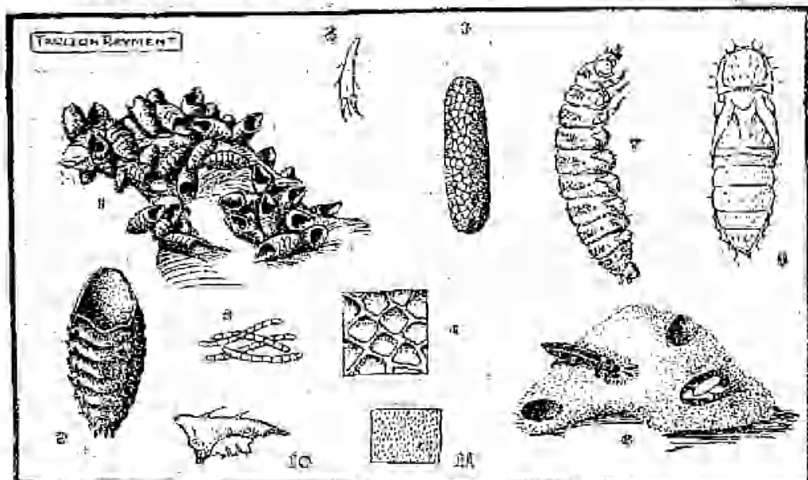


Fig. 1.

the bees attempt to carry one out. Beetles placed on the combs of hive-bees were immediately carried off by the workers.

The larvae of the beetles bore into the cells of pollen, and hidden in such propitious quarters they feed in comparative safety. On breaking open the cells of pollen one or more beetle larvae may be found without difficulty. *B. meyrueki* Blkb., a smaller yellow and black species, is not so prevalent. A reddish beetle, about 4 mm. in length, *Tribolium myrmecophilum* Lea, also resides on the combs in groups, rearing its larvae on the pollen-stores of the bees. Mr. Clark, of the National Museum, and who has identified these inquilines, says he is unable to distinguish my specimens from some which he found in ants' nests; Mr. F. E. Wilson has observed *B. planus* breeding in boxes of raisins and currants.

In addition to the fly and the beetles, I have noticed a pale microscopic moth, 1 mm. or so in length, running over the hive-wall, and occasionally, flitting past the entrances, but so far I have not

been able to secure a specimen. Of course, the hive-bee, when weak, or otherwise discouraged, is often pestered with two species of wax-moths, the larvae of which feed on the pollen and tunnel galleries through the combs.

Among the gregarious *Haliets*, another greyish-pink fly, *Ephyt-droselinus raymenti*² Curran, haunts the entrances in an endeavour to have its eggs taken to the rich pollen-stores below. It has been shown that a "sympathetic agreement" often exists between the owners of a home and the various foreign insects frequently found in residence. Where the association is proved to be one of "mutual aid," then symbiosis is admitted, but where the intruders have all the advantages, to the detriment of the real proprietors, who endeavour to eject them, then the term should not apply. In the case of the *Trigona*, while they have the strength and ability, they seek to overcome the raiders whose presence they recognise as being inimical to the race. When unable to overcome the enemy the bees maintain a passive resistance, but should the active foreigner pass later into a quiescent state, then it will be dragged forth from the colony with no hesitation and without regret.

Mr. J. Clark's observation tends to show that *T. myrmecophilum* will establish itself in any nest that offers food and shelter for its young.

Later on I was able to secure further details of the life history of *B. planus*. The adult beetles excavate small galleries, about 8 mm. in length, in the pollen-mass, and they appear to copulate in these narrow quarters. On ejecting the amorous pairs I was able to find two or three eggs deposited in the extreme end of the chamber; these were often criss-crossed, lack any agglutinative coating, and are not attached to the chamber-wall like the eggs of bees. The ova were shining white, opaque, about 0.8 mm. in length, and as the embryo developed, one end became much darker. The egg-shell splits open in from three to five days, and the rather spiny larva begins to eat almost at once, the larval jaws being adapted for crushing the pollen-granules. Some of these small larvae hatched about the 10th of October, 1930, but did not reach maturity until the 1st of January, 1931. I could not find any eggs until twenty-four days later, though some may have been hidden in the rough mass and escaped my search.

The sculpturing on the chorion of the egg is dissimilar to that on the fly's egg; the raised angular pattern being more like that on the bees'.

There were plenty of adult beetles, of the three species, in October, and the next generation was numerous enough on January 10th; the third generation being in evidence during March and April, so in Victoria, during the cool summer of 1930-31, three

2. *Neoborborus speculabundus* Raym. is a synonym, being only the other sex of the above.

generations were bred without difficulty in the rather warm, but equable temperature, of my kitchen. The beetles did not appear to be disturbed by my frequent and intimate observations; indeed, the red species, *T. myrmecophilum*, went on unconcernedly with its burrowing.

I transferred a number of the beetles to combs of pollen taken from the hive-bee, and they developed in a normal manner. The sole sustenance of the beetles in the breeding-cages was the stored pollen which, of course, contained a small percentage of honey. I have not the slightest doubt that the beetles frequent the *Trigona* nests only because of the easily-obtained and abundant nitrogenous food, which the real owners cannot adequately defend. On the other hand, the beetles do not visit the great population of the honey-bee because it is strong enough to eject the intruders; otherwise, the beetles would frequent the "nest" and thrive equally well on the pollen of *Apis*.

I obtained a quantity of pure pollen by brushing the ripe anthers of sunflowers with a camel-hair brush. In this jar I imprisoned several adult beetles and, later on, eggs were deposited and larvae emerged. But growth was so seriously retarded that many did not reach half the normal size. Another group was bred on pure sunflower pollen which had been made into a firm mass with honey from *Eucalyptus melliodora*; this is singularly free from pollen-granules. The larvae certainly grew larger, but still did not reach their normal stature. I then bred a group on pollen stored in the combs of the honey-bee, and every larva developed into a fine large insect. This pollen was of mixed origin, being gathered from *Cryptostemma*, *Hypochaeris*, *Eucalyptus calophylla*, *Trifolium* and *Leptospermum*.

The experiments demonstrated that the granular meal, after being gathered and stored by these social bees, does not consist merely of pollen and honey but, in addition, contains a minute proportion of some other substance that has a very decided influence on the growth of the insects. On watching the bee-harvesters storing the meal, I saw the granules frequently being moistened by the proboscis, and now suggest that it is during the storing of the grains that some biological product is added.

Although hundreds of *Trigona* cells, and the juices of many larval bees, were microscopically examined for the great plague of the bee-hive, "foul brood" (*Bacillus larvae*), I did not obtain positive results in a single instance. Since these bees often harvest their supplies from blossoms in company with honey-bees from diseased hives, it would appear that the danger of infection by spores remaining on the flowers is negligible. I did not find the blind parasite, *Branla caeca*, nor any of the Acarid mites so common on the solitary bees.

EXPLANATION OF FIGURE 1.

1. The empty puparia or cradles of the fly.
2. The empty puparium enlarged.
3. The egg of the beetle enlarged.
4. The sculpturing of the egg.
5. The submoniliform threads of beetle excrement.
6. Beetle burrowing into the pollen-mass. The few eggs visible in a cavity are not drawn to the scale of the insect.
7. The larva when fully fed.
8. Tarsal claw of the bee.
9. The pupal form.
10. The mandible of the larva has a dentate process for crushing the cases of the granules.
11. Hairs on the wing of the adult beetle.

A NEW VICTORIAN SAWFLY.

By F. E. WILSON, F.E.S.

Perga nemoralis n. sp.

♀—Length, 18 mm.; alar spread, 28 mm.

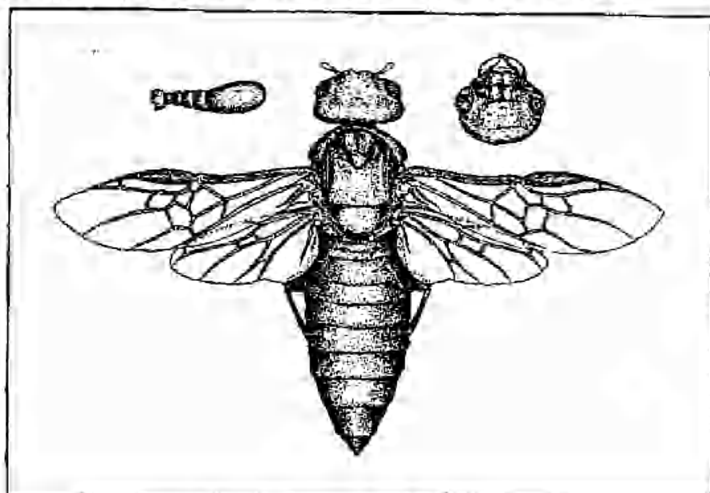
Head above dull brown, its undersurface and occipital area paler, with two inwardly arcuate deeply infuscated areas immediately behind eyes; mandibles dark reddish testaceous, tipped with black; palpi pale; ocelli and four apical segments of antennae black; mesonotum as uppersurface of head, except along parapsidal furrows, where it is deeply infuscated; lobes of prothorax somewhat darker; scutellum paler; metanotum, with front margins infuscated; abdomen bright reddish-brown above, paler beneath, its lateral margins mottled; anterior and intermediate legs flavous but with two apical segments of their tarsi lightly infuscated; posterior, with femora, dark reddish testaceous, their tibial blackened on their apical halves and their tarsi almost wholly black; forewings suffused with brown, with pterostigma dark reddish-brown, and veins somewhat paler.

Head moderately long and broad, narrower than prothorax, its vertex lightly convex and hind angles widely rounded, not or scarcely dilated behind eyes, densely reticulate punctate, except on lateral orbits, where it is almost smooth and highly nitid; postocellar furrow and lateral furrows lightly impressed; lateral ocelli bisected by supraorbital line; ocelloccipital line about twice ocellocular line; frons with strongly impressed furrow reaching from anterior ocellus to clypeal margin, with a distinct furrow on either side between it and the antennal grooves, the intervals strongly rounded; clypeus with a shallow median impression and with its front margin only lightly impressed in middle; labrum broadly rounded, with a small, rounded fovea at middle of base and a few scattered punctures, mostly at sides; antennae of six segments, not much longer than the distance between their points of insertion, scape longer and broader than pedicel, apical segment one third longer than the three preceding segments; eyes oval, moderate; mandibles robust, truncated; with a sparse vestiture consisting of pale, bristly hairs, mostly confined to clypeus, labrum and base of mandibles; lobes of prothorax densely reticulate punctate, with a wide median impression in front; mesonotum lightly convex, with puncturation as on lobes of prothorax and a small nitid elevation on disc, in front of which is a shallow median impression; scutellum flattened on disc, its posterior margin

with about middle third lightly advanced, hind angles sharp, but not very pronounced, and with a few moderately-large scattered punctures; mesoepisternum densely punctured, except along its lower margin; abdomen highly nitid, microscopically reticulate, basal segment clothed with a fairly dense fringe of pale hairs, the rest with a few scattered decumbent hairs towards their apices, the three apical segments markedly carinate; sheath viewed from beneath gradually dilated towards base, from the side strongly bent apically and fringed throughout.

♂—Length, 16 mm.; alar spread, 26 mm.

Head, with labrum, clypeus, palpi, a spot around the base of each antenna, and about two-thirds of the ocular orbits, yellowish, the rest black; prothorax, with a streak on either side in front directed downwards, and lobes, yellowish, the rest black, the blackened area, however, angularly encroaches on to the lobes in the middle; mesonotum



Perga nemoralis Wilson. ♀

Upper Left—Antenna, enlarged. Upper Right—Head, front view.

black; scutellum yellowish, with apical margin and a broad longitudinal median band black; with an oblique, yellowish streak above points of attachment of wings; abdomen metallic blue, but with segments yellowish at lateral margins, beneath ferruginous more or less mottled; mesoepisternum, with upper margin, narrowly tipped with white, and with a broad white longitudinal median marking; mesoepimeron black, margined with white posteriorly; metapleuron mostly white; all coxae pale, but posterior with two black markings at base; front and middle legs flavous, hind with femora having their apical halves black, tibiae with a little less than their apical halves, and tarsi almost wholly black.

Head short and broad, sides behind eyes evenly rounded; eyes large; lateral ocelli well below supraorbital line; ocelloccipital line about two and a half times ocellular line; frontal furrows much less marked than in female; postocellar furrow wanting, lateral furrows only faintly indicated; abdomen, with two basal segments densely clothed all over with a fine pubescence, giving them an opaque appearance

in certain lights, segments 3, 4, 5 glabrous on their basal halves, pubescent apically, other segments more or less pubescent throughout; wings tinged with brown but hind less so than in female.

Habitat, Victoria—Wonga Park, Miss J. Raff. ♂ and ♀ bred from same hatch of larvae.

This species, in general facies, approaches most closely to *P. lewisi* Westw., but may be easily distinguished from that species by its very different antennae. In *lewisi* the antennae are pale, longer, and the club is about twice as long as the three preceding segments. In *memoralis* the antennae are black and the club is only one-third longer than the three preceding segments. The frontal sculpture is also very different, *memoralis* having a distinct groove on either side of the frontal groove, between it and the antennal groove, whilst *lewisi* lacks this character.

Another closely allied species is *guerini* Westw., which, like *memoralis*, has black antennae. Its antennae, however, of seven segments, are much longer, its club longer in proportion to the three preceding segments, its frontal sculpture very different, the apex of its abdomen is always infuscate and its general build much more slender. The saws of the three species are very similar, but the following distinctions have been noted:—

<i>guerini</i> .	<i>lewisi</i> .	<i>memoralis</i> .
Line inclined towards saw tooth straight, almost reaching summit of tooth. Tooth at apex more or less truncated. Four serrations on each side of tooth.	Line inclined towards saw tooth arched, apex of tooth bifurcate, lateral serrations not so marked as in <i>guerini</i> .	Line inclined towards saw tooth more strongly arched, tooth bifurcate at apex, with only three well defined serrations on each side of tooth.

I am much indebted to my friend, Mr. J. Clark, for the drawing accompanying the above description.

NOTES ON *PERGA GUERINI* WESTW. AND *PERGA LEWISI* WESTW.

These two species have been frequently confused in Australian collections. The Rev. F. D. Morice, in his *Notes on Australian Sawflies* (*Trans. Ent. Soc. London*, 1918, pp. 273, 274) states that they are very similar and gives some characters by means of which they can be separated. Boiled down, the only character of any importance he gives is that in *lewisi* the antennae are luteous, whilst in *guerini* they are black, and he also gives the measurements of *guerini* as 14 mm., and of *lewisi* as 19 mm. Regarding length, this, whilst useful, is not a firm character as in my experience I find great variation in a given species. For example, a *guerini* of 14 mm. is a small one, specimens having frequently been taken up to 17 mm. in length.

Dr. Runar Forsius, writing in *Notulae Entomologicae* (IX, 1929), suggests that the two species were evidently conspecific, probably relying mainly on the notes as given by Morice. It is, however, easy to pick out at the merest glance, examples of *lewisi* from a mass of specimens of *guerini* without taking any note whatever of the colour of the antennae. *Lewisii* is a generally

more robust species of more or less uniform colour, whilst *guerini* has its abdomen always markedly piceous, besides being much more slender in build. Other characters of assistance in distinguishing the species are as follows:—In *levisi* the lateral furrows on head converge backwards much more than in *guerini* and the disc of head is generally less convex. The prothoracic lobes are much more strongly margined, and at the sides, noticeably recurved. The mesoepisternum is more closely and more rugosely punctate also than in *guerini*. In the latter species, I find that the sculpture of the clypeus is rather a variable character.

Male examples of *guerini* have been taken in copula by my friend, Mr. A. Burns, at Mt. St. Bernard, Victoria, at an altitude of 4000 feet. It is very doubtful if definitely associated males of *levisi* have so far been taken or bred. Morice says of the male of *guerini* than its scutellum is black, with apex yellow, but in Mr. Burns' mated examples the scutellum is black, with its lateral margins yellow. These examples might be easily confused with males of *memoralis*, except for the fact of their having seven jointed antennae. *Guerini* is a very common insect in Eastern Victoria and *levisi* is, in my experience, rare. The former may be seen tending its eggs or young larvae on sapling growth about March and April, but I once took an example similarly occupied, at Ringwood, Victoria, in the middle of November.

F. E. W.

THE STUDY OF AUSTRALIAN MOSSES.

By G. O. K. SAINSBURY.

(Continued from "Victorian Naturalist," April, 1932.)

5. *Campylopus clavatus* (R. Br.) H.f. and W.

This species is common to both countries, and very widely spread, at any rate, in New Zealand. The specimens distributed are probably referable to *Campylopus appressifolius* Mitt., having the sterile shoots with appressed leaves. I am satisfied, however, that only one species is involved. If the New Zealand habitat is any guide, this moss should be looked for on clay banks and road-cuttings. Its yellow-bronze colour is quite distinctive, and as *clavatus* usually grows in large dense patches it is easy to find. The leaves are lanceolate-subulate, and are nearly always tipped with a hyaline hair-point which is somewhat denticulate. The nerve is strong, wide and excurrent. The seta is strongly arched when young, and even later on in life is always curved or waved to some extent. Species of this genus usually have a strongly furrowed capsule, but not so here, where it is practically smooth. The peristome consists of a single row of 16 filiform teeth, divided almost to the base into two papillose limbs. The operculum is long-beaked, and the calyptra cucullate.

6. *Bryum truncorum* Brid.

The genus *Bryum* is one of the most difficult to deal with; so much so that it is an accepted principle that a bryologist must not be accused of cowardice if he refuses to offer an opinion on barren or imperfect material. The number of described species easily exceeds 1000, and includes some very widely distributed mosses. Plants of the genus can usually be placed, when fruiting, by the horizontal or inclined capsule, combined with a nerved leaf and cells which are more or less lax and hexagonal or rhomboid. *B. truncorum* has been reported from Australia, and is very widely distributed and extremely variable in New Zealand. In order to give some idea of the latter character, I have enclosed in the packets material from two habitats, one of which is swampy land and the other loamy forest floor. It does not grow on bark, but may be found on rotting logs as well as the more usual terrestrial habitat. The leaves are of varying shape, but usually somewhat widened above. They have a *strong white* border of narrow cells, and are *denticulate* above. The nerve is shortly excurrent in a cuspidate point. The leaves are usually *comose* (i.e., tufted at the end of the stem), but this character is ill-defined in one of the distributed specimens. The capsule is more or less inclined and quite smooth, as is always the case in *Bryum*. The peristome is double; the outer of 16 yellow-brown teeth which are lamellate (i.e., furnished with projecting plates) on the inner (ventral) surface; the inner peristome of 16 hyaline processes, widely split down the middle and with interposed cilia. The cilia are *appendiculate*, i.e., furnished with lateral projections. Operculum shortly conical and apiculate. Calyptra cucullate, but in this genus it is very small and falls so early that it is seldom found except in very young specimens.

7. *Breutelia pendula* (Hook.) Mitt.

Common to both countries, and very widely spread in New Zealand. It should be sought for on damp, grassy banks, and is recognisable by the markedly *plicate* leaves and the strongly *ribbed* capsule which is short and rather wide and set pretty well horizontally on the seta. This is a dioicous moss and I have distributed some male plants also in the packets, for purposes of comparison. They will be recognised by the discoid heads containing the antheridia. The stems of this species are usually divided above into several branches, and matted with red-brown tomentum. The leaves are lanceolate and denticulate above. Nerve excurrent. Cells shortly and irregularly oblong above, and narrow and elongated towards the base. A *marginal band* below of several rows of much wider cells should be noted, as well as the distinct plication of the leaves. Peristome double. Outer of 16 rather short red teeth, lamellate on ventral surface; inner of same number of yellow papillose processes. Operculum shortly conical.

8. *Macromitrium longipes* (Hook.) Schwaegr.

Found in Tasmania, so perhaps it may appear in Australia. Although this moss has an elongated and creeping stem it will be noticed that it is acrocarpous, the setae being produced at the ends of the branches. In this connection it is worth mentioning that sometimes a fruit stalk appears to be lateral, i.e., borne in the side of a branch, when it is really terminal. What happens in such a case is that a shoot (innovation shoot) develops just below the female flower and appears to carry on the growth of the stem, though the latter has actually ended with the fruit stalk. The position of the leaves when dry is important in *Macromitrium*. In the present case they will be seen to be spirally twisted, with incurved points. Being very hygroscopic, i.e., having the capacity to absorb water quickly and alter their shape, they soon straighten out when wet. This rapid absorption of water, when consequent alteration of the form of the leaf, is especially marked in the family (*Orthotrichaceae*) to which the genus belongs. Leaves linear-lanceolate; nerve ending at or just below the apex. Cells above more or less rounded and small, strongly incrassate, and quite smooth; elongated towards the base. Dixon has pointed out the peculiar and characteristic structure of these lower cells. The lumen, or cavity of the cell, does not run parallel to the straight longitudinal wall, but is very narrow and *S-shaped*. Seta long, and somewhat flexuose. Capsule oval, constricted and plicate at the mouth. Peristome single, of 16 white blunt teeth, inserted well below the orifice, and papillose. Operculum with a long fine beak. Calyptra smooth, mitriform and fringed. Species of *Macromitrium* live on bark, and *M. longipes* is of vigorous growth, sometimes covering the trunk of a tree for several feet in length.

9. *Thuidium furfurosum* (H.f. and W.) Jeag.

Found in both countries, and, if it is as common in Australia as it is in New Zealand, it will probably be one of the first mosses to be collected by anyone interested. In New Zealand it is found mostly on grassy ground, but often also on bark of trees. Its variability is extreme, forms sometimes being met with of such slender habit that it seems hard to believe that another species is not involved. However, there appears to be good ground for holding the various forms to be but disguises—very effective ones certainly—of this species. It will be noted that the stem leaves are often much larger than those of the branches, and of different shape. This diamorphism, as it is called, is pronounced in many mosses and is especially noticeable here. The stem is thickly beset with multicellular papillose rods or leaf-like appendages (paraphyllia). These outgrowths no doubt help the plant to absorb water, and are often of systematic importance. The branch leaves are papillose, and the nerve is pale and vanishes well below the

apex. *T. furfurosum* is not a very common fruiter, and the specimens distributed are barren. The seta is reddish and about half an inch or more long. The capsule is curved, and the operculum has a long fine beak. Peristome double, there being 16 teeth, the same number of processes, and three interposed cilia between each of the latter. The calyptra is cucullate and smooth. This is a pleurocarpous moss, as would be expected from its general appearance.

10. *Drepanocladus fluitans* (L.) Warnst.

A pleurocarpous water or swamp moss, which is found in all cold or temperate regions. It is reported as being common in Tasmania, but I do not know whether it has ever been found in Australia. It is often difficult to separate from allies which resemble it in general habit and in the curved falcate leaves. The cells are long and narrow throughout, except the alars, which form a *distinct group* of quadrate or oblong cells, which are usually more or less incassate. The leaves are often slightly *denticulate* at the extreme apex (always so in the New Zealand plant, I think), and are very long and narrow, gradually tapering off to a fine point. These characters are usually sufficient to identify the New Zealand form. The nerve is of varying length, but is never so long as in the English plant, where it may even reach the apex. The seta is long, and the capsule short and strongly curved. The operculum is conical, and the calyptra cucullate and smooth. The two latter are not present in these specimens. Peristome double, with two cilia between the processes. This species is *autoicous*, and the male flowers will be found on the main stems. Species of *Drepanocladus* are terrestrial, and always found in or near water.

On a fine colour plate in the April issue of the *Agricultural Magazine*, the splendid Grass-Parrakeet, *Neophema splendida*, is figured. A pair of these rare and beautiful birds formed a gift made to the King recently. The history of the species, in captivity, is interesting. The first examples brought alive to England were "received from a vessel coming from Adelaide." For the pair £7 was paid to a London dealer by the Zoological Society. But another splendid Grass Parrakeet was secured for the London Zoo at a cost of only £1. The present day value of a pair of these *Neophemas* is estimated at about £100!

The Scarlet-chested Parrot, as this species also is termed, has been recorded, at least in recent times, only as isolated pairs, met with in dry inland localities. The range of the species is New South Wales, Victoria, South Australia, and Western Australia. All members of the genus are noted for grace and beauty, while some are so rare as to be in danger of extinction in a wild state.

OUR RARER ORCHIDS.

By W. H. NICHOLLS.

(5) *Caladenia pumila* Rogers.

This low-growing *Caladenia* is, apparently, very localised in its distribution, having been definitely recorded* only from one district in Victoria. It was discovered over 10 years ago at Bannockburn, by Miss B. Pilloud, a resident school teacher. In a letter she indicates that it was abundant. "I wish you could pay a visit to our district, and see for yourself the hillsides whereon this white spider grows. I am sure you would be delighted with the sight."

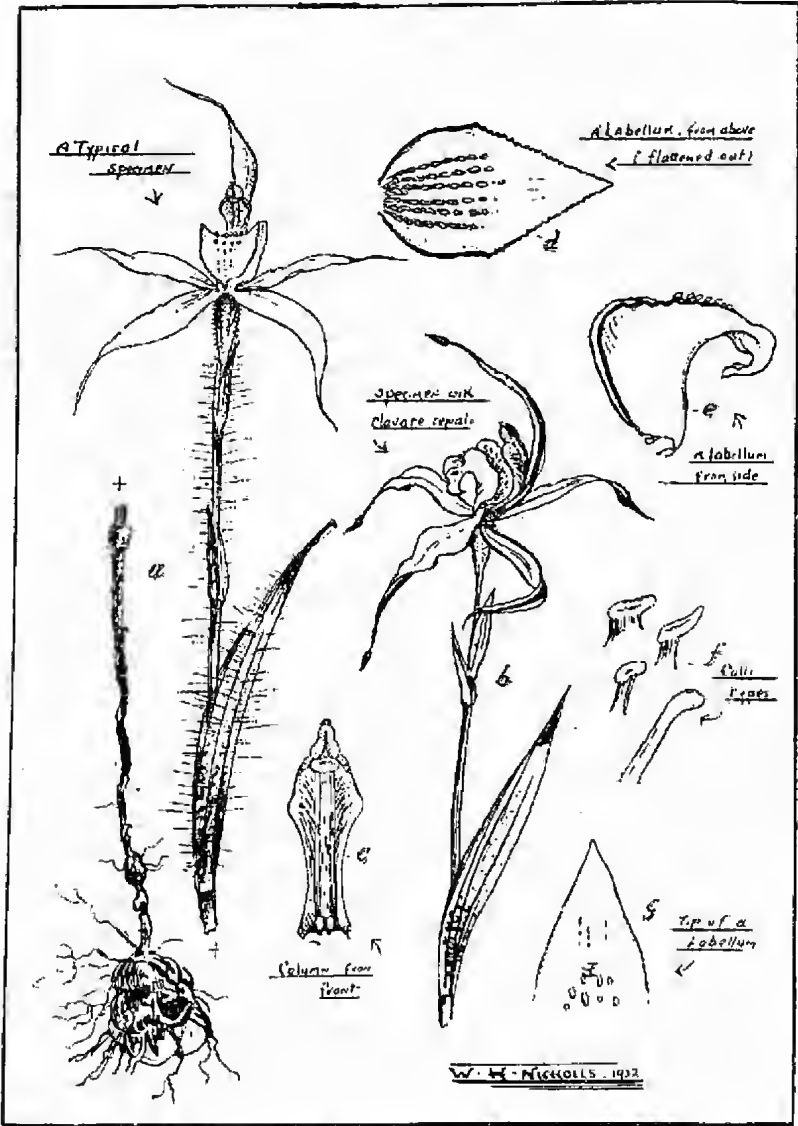
This *Caladenia* is easily distinguished from other somewhat similar forms. The pinkish-white spider-like flower seems rather large, owing to the shortness of the stem, and the segments of the perianth are not produced into caudæ, being merely acuminate (in the majority of the specimens). Sometimes the tips of the sepals are minutely, occasionally distinctly clavate, while the margins of the labellum, in at least a few specimens, are definitely entire, *i.e.*, without any suggestion of the fine serrulations characteristic of the many; the tubers, comparatively small in *C. pumila*, are naked, above them are often numerous remains of withered tubers, interwoven through these are the fine rootlets of shrubs or grasses growing in the vicinity. The description is as follows:—

C. pumila Rogers.—"A very hairy species of low stature; leaf relatively large, linear or oblong-lanceolate; stem rather stout; flower solitary, white, large; perianth-segments white, usually without markings, but sometimes with a faint pink stripe on the outside, nearly equal in length, not contracted into caudæ, finely acuminate, non-clavate points, rarely glandular; dorsal sepal erect, incurved, lateral sepals and petals spreading, lanceolate; labellum white with narrow pink margins, a few pink splashes on the lateral lobes, obscurely 3-lobed ovate, blunt at the apex, lower half erect, with entire margins, thereafter recurved with serrulated or crenulate margins, the lamina flattened transversely; the calli pink, narrowly linear in 4-6 rows, ending near the middle; column incurved, speckled with pink, widely winged in its upper half." (Adapted). Bannockburn, Victoria. Fl. September-October. (Dr. R. S. Rogers in *Trans. Roy. Soc. S.A.*, Vol. XLVI, 1922).

*The Rev. H. M. R. Bupp, B.A., of Weston, N.S.W., writes in reference to *C. pumila*:—"I remember well this white *Caladenia* growing at the foot of the "Dog Rocks," near Geelong (Vic.) many years ago."

In my notebook are recorded further facts relating to this very rare "spider":—

"The segments of the perianth have (in an occasional specimen) a rather broad, deep pink stripe on the reverse; one or two rows



Caladenia pumila Rogers.

of calli immediately at the base of the labellum-lamina are wholly white and taller than those forward; situated in the depression at the base of the column are two sessile yellow glands, or calli. Sometimes the large bract, usually situated near the middle of the stem is immediately below and alternate to the one subtending the flower pedicel. This last was noted in four specimens. (See Fig. "b.")

The writer was informed recently that this particular *Caladenia* was collected near Yarram, in South Gippsland, a few seasons ago, but, so far, "S" is the only letter placed alternate to the species' name in "The Census." It would be interesting to know whether it does really occur in the abovenamed localities.

Note.—In Figure "b" the hairy character of stem, leaf, etc., has been inadvertently omitted.—W. H. N.

BLUE WREN IN SPIDER'S WEB.

Among the many native birds which visit my garden at Windsor, that delightful little warbler, the superb Blue Wren, *Malurus cyaneus*, is one of the most constant, and, at the same time, most welcome. Usually making their appearance in small companies of from six to ten, they spread themselves throughout the garden, industriously examining each tree and shrub for scale and other insects.

During one of their recent visits my attention was drawn to them by an unusual commotion, and on making an investigation, was astonished to find that one of the birds had become entangled in the strands of a spider's web, which extended between the branches of two shrubs.

The bird was suspended, head downwards, in mid-air, and fluttering its wings violently, while its cries of distress attracted its companions, who manifested decided symptoms of alarm.

On realising the cause of the trouble, I called to my son, and we stood watching the struggling bird for fully a minute, expecting every moment it would break loose. I then took the bird in my hand, and found that the web had become so closely wrapped around both feet, the flight feathers and the tail, that the poor creature was rendered practically helpless.

It took some time to remove the spider's web, as it was of a particularly viscid nature, but it was finally accomplished with the aid of the water tap, and the bird liberated, little the worse for its rather unique experience.

Although a careful search was made at the time and on subsequent occasions, we failed to locate the spider. It did not appear to be one of the orb-building species, the web consisting of a series of long, straight strands, exceedingly strong to the touch, and so viscid that it was difficult to remove from the fingers.

Although I have seen the remains of small birds entangled in the huge mesh webs of a large spider, probably a species of *Nephila*, in northern Queensland, I have never before seen or heard of such an occurrence in Victoria.

It would be interesting to learn if any of our members have had a similar experience.

JAS. A. KERSHAW.

The Victorian Naturalist

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July 5, 1932.

No. 583

THE FIELD NATURALISTS' CLUB OF VICTORIA.

The annual meeting of the Club was held in the Royal Society's Hall on Monday, June 13, 1932, at 8 p.m. About 100 members and friends attended, and the President, Mr. J. A. Kershaw, occupied the chair.

DEATHS OF MEMBERS.

The President expressed the deep sorrow of the Club in the loss of Mr. F. G. A. Barnard, a foundation member. He also announced, with regret, the passing of Mrs. L. L. Hodgson, widow of a former secretary. Messrs. E. E. Pescott, F. Pitcher, G. Coghill, C. Daley, and C. Barrett supplemented the President's remarks. Members paid the usual tribute of remembrance. Mrs. Barnard, who was present, responded to the expressed sympathy in a very beautiful appreciation.

CORRESPONDENCE.

The Assistant Chief Inspector of Primary State Schools, Mr. J. T. Saxton, M.A., asked for special excursions for teachers.

Malvern Nature Observers' Club desired lecturers for its monthly meetings.

The Chief Inspector for Fisheries and Game, Mr. F. Lewis, had inquired into the sale of White-eyes. He had found that it was not extensive, or likely to extend. He would, however, keep the matter in mind.

Mr. A. MacCaskill, of Coleraine, asked for the favour of specimens of *Selaginella uliginosa*, *S. Praissiana*, *Tmesipteris tannensis*, and *Lycopodium densum*.

The management of *The Argus* announced the publication of a series of articles in *The Australasian* on "The Truth About Snakes."

The Secretary, Victorian Horticultural Society, offered sympathy in the loss of Mr. Barnard.

The Exhibition Trustees thanked members for assistance and announced extensive improvements.

REPORTS.

Excursions were reported as follows:—St. Kilda Gardens, Mr. V. H. Miller; Mornington, Mr. F. S. Colliver, National Museum (leader, Mr. J. Clark).

ELECTION OF MEMBERS.

The following were duly elected:—As ordinary members: Miss Logan, Mr. T. Adams. As country member: Miss E. I. Green. As associate members: Miss Alice and Master Pat. Flecker, Master Kenneth Robertson.

ANNUAL REPORT AND BALANCE SHEET.

The annual report was read, received, and adopted. In the discussion of the report, Mr. F. Pitcher suggested that mention of the index to *The Naturalist* might be made. The President informed members that it had been the intention of the committee to wait for the completion of Volume L.

In moving the receipt and adoption of the financial statement, Mr. A. G. Hooke, auditor, expressed pleasure in the satisfactory condition of Club affairs. Mr. Pescott deprecated the holding of a large balance, and suggested the purchase of an epidiascope. Mr. W. H. Ingram, hon. assistant librarian, explained that, by direction of the committee, he was making inquiries. Approval of the inclusion of coloured plates was expressed by several members. The question of expense was raised, and the general feeling appeared to favour the advance—with due caution. The balance sheet was adopted.

ELECTION OF OFFICE-BEARERS.

The following officers were declared elected unopposed:—President, Mr. J. A. Kershaw, C.M.Z.S.; Hon. Librarian, Dr. C. S. Sutton; Hon. Assistant Librarian, Mr. W. H. Ingram; Hon. Treasurer, Mr. J. Ingram; Hon. Editor, Mr. C. Barrett, C.M.Z.S.; Hon. Secretary, Mr. A. J. Swaby; Hon. Assistant Secretary, Mr. F. S. Colliver. A ballot for the offices of Vice-Presidents resulted in the re-election of Messrs. V. H. Miller and G. N. Hyam. As members of committee the following were duly elected:—Miss J. W. Raff, M.Sc., F.E.S., Messrs. G. Coghill, C. Daley, B.A., F.J.S., A. S. Kenyon, M.I.E., Aust., and J. W. Audas.

SUGGESTIONS BY PRESIDENT.

Members were urged by the President to furnish notes and reports of observations, not necessarily for publication. If a member found anything of interest, it was certain to be interesting to others. While all members should take a general view of natural science, there was an immense field untouched and waiting for people who would take special interests.

EXHIBITS.

The following exhibits were displayed:—

Mr. S. R. Mitchell.—Jasperised wood, from Arizona, U.S.A. Silicified wood, Clover Ck., Idaho, U.S.A., and various Australian

sources. Agates, series showing the formation by infilling cavities in rocks with silica from solution. - Australian aboriginal flint implements, Bridgewater Lake, Victoria. Bone implements, Warrnambool, Victoria.

Mr. A. S. Kenyon.—*Eucalyptus tetraptera*. Series of natural history illustrations in colour, 1796-1828.

Miss Haynes.—*Banksia collina*, Yarra Junction.

Mr. G. Coghill.—*Acacia podalyriacifolia* (Queensland Silver Wattle), *Gravillea rosmarinifolia*.

Mr. C. J. Gabriel.—Marine shells. *Hinnites giganteus*, Gray, California. *Hinnites sinuosus*, Gmel, Ireland. A curious bivalve, free and like a "fan shell" when young; but later fixed and distorted.

Mr. E. E. Pescott.—*Thryptomena calycina*, *Viola hederacea*, *Adiantum formosum*.

Mr. F. Pitcher.—*Stenocarpus sinuatus* (Queensland Firewheel Tree), for the third successive month. *Davallia pyxidata*, Cav. (Hare's-foot Fern), pot and herbarium specimens, *Eugenia Smithii* (Lilly-pilly), variegated, also seedlings for distribution.

FIFTY-SECOND ANNUAL REPORT, JUNE, 1932.

To the Members of the Field Naturalists' Club of Victoria,
Ladies and Gentlemen,

Your Committee has pleasure in submitting the 52nd Annual Report. The membership is as follows:—Honorary members, 3; life members, 7; ordinary members, 266; country members, 68; associate members, 29. Total, 373.

We record, with great sorrow, the loss by death of several valued members. Mr. A. E. Rodda was a member from November, 1921, served on the committee from June, 1928, and held with credit the office of secretary from February, 1929, to August last. Mr. L. L. Hodgson joined in September, 1921, became secretary in June, 1926, and was forced by continued ill-health to retire in February, 1929. His great interest and mastery of detail were given in committee until May of last year. These two secretaries leave an ever-green memory of loyal, efficient and encouraging service. Mrs. L. L. Hodgson was elected at the same meeting as her husband, and, in spite of failing strength, retained interest in the Club till her death, last month. Mrs. E. Bage was a member from September, 1884, to June, 1931. She became a life member by subscription. Having many interests in public life, Mrs. Bage was unable in recent years to attend Club meetings regularly. Mr. D. H. Orchard was well known to members who visited Kinglake. He was always available to show visitors around. His death occurred a few days before an excursion he had been appointed to lead. His great regret, in his illness, was that the excursion might

be spoiled. Mr. T. S. Savige, of Thorpdale (1918 to 1931); Mr. W. J. Morgan (1899 to 1931), and Mr. Joseph Hill, of Stawell (1901 to 1931), were all active members throughout their long association with the Club.

Attendance at meetings has been remarkably even; the seating accommodation has been fully taxed on almost every occasion. Your committee has arranged for the display of exhibits in the adjoining room, thus allowing more space in the main hall. The number, variety, and scientific value of exhibits have been well sustained. Lectures and papers, all well illustrated by specimens, lantern slides, maps and other aids, have been contributed by Dr. Ethel McLennan, Miss J. W. Raff, Professor A. T. Ewart, Drs. S. Penn, C. S. Sutton, and C. Kellaway, Messrs. R. A. Keble, A. S. Kenyon, J. A. Kershaw, F. E. Wilson, and C. Barrett.

Through various causes six outings were cancelled. All others were well attended. There is a fairly general feeling among members that excursions could be made more helpful to beginners. One excursion announced for beginners was so well received that it will be worth while to include more in the next syllabus.

Volume XLVIII of *The Victorian Naturalist* compares well with its fore-runners. Favourable comments have been many. The committee regards the journal as one of the outstanding features of the Club's activities, and hopes, as circumstances permit, to increase its interest to members generally.

The Club has continued its activity in preserving the wild life of Australia. Through our members a vigilant eye is kept on the sellers of plants and animals in the markets. The following matters have been inquired into, and reported to the proper authorities:—Commercialisation of lizard skins, the shooting of Australian Bustards, sale of ferns, Boronia, and White-eyes. Both State and Federal authorities have shown appreciation of our efforts. Several finches have been added to the protected list.

Increased co-operation with kindred societies has been secured. The assistance of members has been sought for keeping the children's room at the National Museum supplied with specimens. The Foreshore Advisory Committee has continued its work at Sandringham. The Council, however, has been too much occupied with finance to give much attention to development. The Victorian Advisory Council for the Protection of Fauna and Flora, with our Mr. C. Daley as secretary, is active and alert. The committee again voted £4/4/- towards expenses. Several of our members have been instrumental in reviving public interest in the Aquarium. Co-operation has been assured to the Victorian Apiarists' Association in its efforts to prevent destruction of trees on the roads. The combined Progress Associations of the Shire of Fern Tree Gully

have been supported in the movement towards establishing a sanctuary for Australian animals in the Monbulk State Forest.

Our cordial relations with similar organisations have been shown in the combined outings, notably at You Yaug's, Wyperfeld, the Black Rock Excursion, and the planting days at Sandringham and St. Kilda.

The *Census of Victorian Plants* has been again revised and brought into line with international nomenclature. The thanks of the Club has been accorded to the Revision Committee, Messrs. J. W. Audas, P. F. Morris, and P. R. H. St. John.

The Wild Nature Show, in October, was very successful, and fully justified the extension to a second day. The work of organising was in the hands of Messrs. C. Barrett, G. Coghill, and V. H. Miller, with Mr. E. E. Pescott as director, and Mr. W. H. Ingram as secretary. The nett proceeds exceeded £200. The educational value of these shows is widely recognised. All leaders of sections realised this and set out their exhibits to show, as far as possible, the relationships on which classification is based. A very pleasing feature of this, and other recent shows, is the organisation of helpers, so that continuous explanation of exhibits is available for visitors.

Grateful acknowledgment is tendered to the following benefactors:—Cash donations: Mr. J. E. Dixon, Mr. A. E. Keep. Gifts of books: Mrs. W. J. Morgan, Mr. H. Brew, Miss J. W. Raff, Mr. H. Whitmore, Dr. Grout, U.S.A., Mr. A. S. Blake, Miss Barnard, and the Government of Victoria. Other donations: The late Mr. L. L. Hodgson, lantern slides; Mr. Harvey, enlarged photographs of the late Mr. H. B. Williamson; Mr. W. H. Ferguson, a case of birds, since handed to the R.A.O.U., as we have no museum.

Your committee very heartily appreciates the continued free use of Mr. Coghill's office for committee meetings. Thanks is also due to the Melbourne daily press, and the Railways Betterment and Publicity Board, for generous assistance in bringing the club's activities before the public. A comprehensive expression of thanks is part of the reward for all those members and friends, speakers, leaders of excursions, contributors to *The Naturalist*, exhibitors, lanternists, helpers in show work, and all who have cheerfully given their time and energy to advancement of the interests of the Club. The major part of their reward lies in the knowledge that the efforts have been useful.

Committee meetings numbered 12, and attendances of officers were as follows:—Messrs. Miller and Hyam, 12; Dr. Sutton, Messrs. Daley and Swaby, 11; Messrs. Kershaw and W. Ingram, 10; Miss Raff, Messrs. J. Ingram and Barrett, 9; Messrs. Coghill and Colliver, 8; Messrs. Kenyon and St. John, 4.

FUTURE POLICY.

The following points of general policy are offered for the consideration of members:—

Your committee considers the time is opportune for extending the sphere of influence of the Club. This might take two main courses.

(1) Increased membership, with special attention to country membership.

(2) Increased junior membership.

As means to this end, the following suggestions are put forward:—

That *The Naturalist* be considerably enlarged and notes by observers encouraged.

That, among metropolitan members, corresponding committees be formed to deal with inquiries by country members.

That, wherever possible, corresponding groups be formed in country centres. These could collect and distribute correspondence, increase local interest, keep the Club in touch with country members, and act as local information bureaux for the assistance of visiting members.

That excursions be more frequent, and that several each year be devoted specially to instruction of beginners. Also that all leaders make a point of collecting the party towards the end of the day for a survey of the work.

That formal business be still further reduced and the time given to conversation and inspection of exhibits.

AN OPPORTUNITY.

The Club has been approached, tentatively, by a senior officer of the Education Department with a view to infusing more life into the nature study of the schools. Informal conversations have taken place; but no proposal is ready to go before members. Your committee believes that, with the ready co-operation of members, and in conjunction with matters already foreshadowed, a rare opportunity is open for definite community service, better protection of native plants and animals, and extensive increase of the influence of the Club, and its value to members and to science.

JAS. A. KERSHAW, President.

A. J. SWABY, Hon. Secretary.

Visiting our little country shack, I went into the scrub with a saw to get some firewood. I selected a large log with both ends lying on the ground, but the centre arched considerably above it. This centre piece I sawed off, a section about two feet in length, which fell to the ground. It was hollow, but full of old decayed wood. I carried it in my arms to an outcrop of rock close by and banged one end on the rock. Imagine my surprise when not only the decayed wood came tumbling out at my feet, but also seven young snakes, each about 18 inches in length. I killed the lot.

N. H. SEWARD.

FIELD NATURALISTS' CLUB OF VICTORIA.
STATEMENT OF RECEIPTS AND EXPENDITURE FOR THE
TWELVE MONTHS ENDED 30th APRIL, 1932.

RECEIPTS.

To Balance at Banks on 1st May, 1931—				
English, Scottish and Aus- tralian Bank		£72	19	3
State Savings Bank		55	17	9
				£128 17 0
„ Subscriptions—Arrears	£32	4	6	
Current	220	3	0	
In Advance	11	11	0	
				263 18 6
„ Wild Nature Exhibition Re- ceipts		302	3	8
„ Cash Sales of—				
<i>Victorian Naturalist</i>	6	2	3	
Badges	2	7	6	
Plant Census	1	4	0	
				9 13 9
„ Donations		1	0	0
„ Advertisements in <i>Victorian</i> <i>Naturalist</i>		2	17	0
„ Interest—				
Best Fund	2	11	5	
Savings Bank Debentures . .	10	13	0	
Savings Bank, Current Ac- count	4	17	1	
Commonwealth Loan	21	3	10	
				39 5 4
				618 18 3
				<u>£747 15 3</u>

EXPENDITURE.

By <i>Victorian Naturalist</i> —				
Printing	£166	7	2	
Illustrating	23	3	0	
Wrapping and Despatching .	28	3	10	
				£217 14 0
„ Wild Nature Exhibition Ex- penses		97	1	3
„ Library		12	5	10
„ General Printing and Sta- tionery		10	3	8
„ Rent and Carctaker		14	0	0
„ Reprints (<i>Naturalist</i> and <i>Census</i>)		11	18	7
„ Postage, Petty Cash and Bank Charges		13	6	8

„ Donations to Advisory Council for Fauna and Flora	4 4 0		
Alice Springs' Mission : ..	5 5 0		
		<u>9 9 0</u>	
			£385 19 0
„ Balance at Banks, 30th April, 1932—			
English, Scottish and Aus- tralian Bank		19 4 7	
State Savings Bank		342 11 8	
		<u>361 16 3</u>	
			<u>£747 15 3</u>

SPECIAL TRUST ACCOUNT.

To Balance on 1st May, 1931.....			£19 6 3
			<u>£19 6 3</u>
By Expenditure			£6 11 0
„ Balance on 30th April, 1932			12 15 3
			<u>£19 6 3</u>

STATEMENT OF ASSETS AND LIABILITIES ON
30th APRIL, 1932.

ASSETS.

Arrears of Subscriptions, £111/9/-. esti- mated to realise, say			£50 0 0
Bank Current Accounts—			
E., S. and A. Bank	£19 4 7		
State Savings Bank	342 11 8		
		<u>361 16 3</u>	
Savings Bank, Special Trust Account ..			12 15 3
Investments—			
E., S. and A. Bank, Fixed Deposit	50 0 0		
State Savings Bank Debentures	200 0 0		
Commonwealth Bonds	350 0 0		
			<u>600 0 0</u>
Library and Furniture, Insurance Value ..			400 0 0
Stock on hand of—			
Plant Census, at valuation	23 16 0		
Club Badges, at valuation	3 14 5		
		<u>27 10 5</u>	
			<u>£1452 1 11</u>

LIABILITIES.

Endowment Fund		£350 0 0
Late Mr. Dudley Best Fund		50 0 0
Char-a-banc Fund		2 15 0

Special Trust Account		12	15	3
Subscriptions Paid in Advance		11	11	0
Outstanding Accounts—				
Rent and Caretaker	£13	10	0	
Ben Jordan Ltd.	5	9	0	
				18 19 0
				<u>£446 0 3</u>

Examined and found correct on 13th June, 1932.

A. S. CHALK, } Hon. Auditors.
A. G. HOOKE, }
JOHN INGRAM, Hon. Treasurer.

CAVES AND MINERALS OF MOUNT WIDDERIN.

By S. R. MITCHELL.

The caves of Mount Widderin, near Skipton, are of interest, both on account of their peculiar origin and the fact that several species of rare minerals are to be found in them.

Their formation was probably due to the covering of large masses of loose volcanic scoria and ash by basaltic lava. Decomposition of the underlying material, with a consequent reduction in volume has allowed considerable settlement, and an extensive series of irregular-shaped cavities, roofed by basalt, has resulted. In places the basalt has collapsed, forming a type of "sink," and it is from one of the largest of these that access is to be had to the caves. A low passageway opens out into a wide, spacious chamber with several extensions, and for several chains these chambers can be traversed. In past times bats inhabited the caves nearest the entrance, and guano was deposited—layers of a varying thickness on the irregular floors. Much of this guano has since been removed for use as a fertiliser.

The most important minerals found are Newberyite and Struvite. In addition, Hannayite is recorded, besides two other doubtful species—"Dittmarite" and "Mullerite."

Newberyite, named after the late Cosmo Newbery, is a hydrous phosphate of magnesia, crystallising in the Rhombic System. It occurs sparsely as well-formed simple crystals and plentifully as tabular pieces and skeleton crystals made up of partly separated plates, ranging in size from minute particles up to 1½ inches across. The most usual habit is in groups of imperfect crystals and tabular pieces. Penetration twins, and fairly large crystals showing the rough form are also common.

The simple crystals usually have four prism faces and the corresponding pyramid faces, two well-developed brachy pinacoids and very small basal planes. The abnormal development

parallel to the brachy pinacoids gives rise to the tabular skeleton crystals, made up of partly separated plates. This may be due to the incomplete crystallization in the first place, or subsequent solution of portion of the crystals. Thin plates are clear and colourless, whilst the colour of the larger specimens ranges from a cinnamon brown when damp to grey. The brown colour is largely due to the enclosing of finely divided organic matter between these plates. Newberyite has resulted from the combination of phosphoric acid derived from the guano and magnesia from the decomposed volcanic ash.

Struvite is a hydrous phosphate of ammonia, both compounds being derived from the guano. It occurs as small clear crystals rarely more than half an inch long, belonging to the Rhombic system and of hemimorphic habit. One basal pinacoid is abnormally developed, together with two brachy dome faces, with four small prism faces and two larger macropyrarnid faces usually present. The crystal in cross section is triangular and in appearance can be likened to the hip roof of a long barn.

Hannayite is a somewhat rare species occurring as very small clear prismatic crystals of a yellow colour. It is hydrous phosphate of ammonia and magnesia, but is rare.

EXCURSION TO MORNINGTON.

Approximately a dozen members and friends arrived by train at Mornington on June 6, and were met by the Rev. G. Cox, who, unfortunately, was unable to take part in the excursion. A group of Girl Guides accompanied us (later they made fires and boiled our bilbies). At Fossil Beach the party was increased to about fifty, the newcomers having travelled from Melbourne in motor cars. A short account of the area's history was given; then the search began. Many of the typical minerals and fossils were found. Mr. Hanks searched for and found fossil leaves. Lack of time prevented the party from visiting these beds. Some of the members observed bird life; several searched for orchids.

F. S. COLLIVER.

LYREBIRD SONG RECORD.

The Lyrebird record, available shortly, will be the first made of a wild creature in Australia, and will contain about four minutes of the song, selected from about 24 minutes actually obtained. The two birds used are probably the best singers in the Sherbrooke Forest, and the recordings were made possible by long investigation of the characteristics of the individual birds. In each case their actions were anticipated, so that they sang for long periods within a few feet of the hidden microphone. The record will be 10 inches. One side will have the song, and the other side a description of the habits, etc., of the species. Some will be sold in souvenir form, all ready for posting overseas. The new recording made this year is particularly fine, being free from a few faults which were present in last year's.

THE RARE DASYURES (NATIVE CATS).

By DAVID FLEAY, B.Sc.

It is a unique experience at the present day to find oneself in the haunts of the uncommon Dasyure. Within the last twelve months I have enjoyed first-hand acquaintance with the two better-known species, the Viverrine Dasyure (*Dasyurus viverrinus*), at Corangamite, and the splendid spotted-tailed giant of the tribe (*Dasyurus maculatus*), in the heavy forest near Cape Otway.

From accounts supplied by people of these localities, the animals were not affected by the mysterious disease which annihilated many marsupials in other parts of the country in the first years of this century. Though still well known, however, they are becoming scarce, with the continuous work of rabbiters' dogs and traps, and the increase in settlement. It is thus very interesting to note adjoining areas in the southern part of western Victoria, where the two largest carnivorous marsupials of the mainland still roam at large.

In the May vacation of 1931 I journeyed to the basalt country of Lake Corangamite, armed with a number of crude, but serviceable, box-traps, and spent a week of continuous work along the stone walls and natural outcrops of the area. Under heaped-up boulders were found occasional "dining lairs," which contained piles of old sheep and rabbit bones. Some of these were surprisingly large to be dragged to the lairs by Viverrine Dasyures, but experience of the little animals in captivity has shown me that such feats are of usual occurrence. The sheep bones are brought from slaughter places, some distance from the lair.

On still, frosty evenings trails were laid by means of rabbit carcasses, dragged from trap to trap on the end of a string. A motor-cycle battery, carried in a haversack, provided a great advantage in hunting the Native Cat at night by the searching beam of a spot-light. One beautiful specimen was run down on top of a wall, and seized. The seizure was mutual, with lasting effects for both of us. The beam of light occasionally caught the glowing yellow "lamps" of a native cat, and proved the commencement of an exciting chase.

The greatest piece of fortune entailed very hard work, for a specimen of the rare black type was seen through a chink at the base of a solid, well-built wall, and subsequent action required the complete removal of a section some yards to the left of the animal, and, similarly, that several yards to the right. Thus was left standing an island column of great, heavy stones, with the escape of the Dasyure along the wall cut off completely.



1. The feeding lair of a Native Cat. Locality, Lake Corangamite.



2. "Booty" stored in a rock cavity by a Native Cat (*Dasyurus viverrinus*). Bones removed from the original site.



3. Sharp-nosed Natter Gal, (found) in its native haunts, by Cooching and Co.

Stone after stone was now lifted away until, under the very last one, a lucky grab made this unusually large and beautiful animal a captive. Severe lacerations from the captive's teeth, and the rebuilding of the wall, was the price paid for success. The traps captured six of the normal yellow-grey animals, and at the end of the week I returned to Melbourne with eight Native Cats, including the prized black specimen. Strange to say, all belonged to the male sex.

A resident of the district had promised to maintain a search for others, and in the following August he succeeded in catching a female, which carried eight young ones (maximum number) in the pouch. The females usually are smaller and slighter in build than the males; and this little animal was discovered in a grass nest beneath a large boulder.

Apparently, these Dasyures do possess a nest-building habit, for some of them, living in a cage, have been seen to pull pieces of hessian into their roomy hollow logs. I have caught others in small "dens" in stone walls where the place, though thick with faeces, was without the least sign of a nest. As regards this female Dasyure, the notable feature was the proportion of males to females in her pouch; their subsequent growth and development provided great interest. When they arrived, in August, they had gained a covering of short fur, and were the size of mice. Their age was probably in the vicinity of fifteen weeks, and the proportion of the sexes was five females to three males. Five of the blind, little spotted animals became separated from the parent on the journey to Melbourne, and soon died from the effects of exposure. The remaining three consisted of two females and one male. These grew slowly, and the male animal very soon became the largest and most robust. The sisters were small and slight, and one of them made no headway at all. In the end, the mother killed the weakling and devoured it, leaving only the two youngsters, which were able to fend for themselves at the age of, approximately, six months. At the present time (June) the pouch of the young female is developing in rather an interesting manner. The whole area has become more conspicuous and reddish hairs are prominent.

Though only one case has been noted, it seems quite probable that there is a higher mortality in the female line, and this may also apply to both the larger Spotted-tailed Dasyure and the Phascogales, where males are also more commonly found.

The two young Viverrine Dasyures were handled a great deal, and, naturally, became very tame. They are the most dainty, delightful and vivacious pets that one can imagine. Adult animals rarely, if ever, drop their furtive ways, but these marsupials of mine are quite different, and at night play about in a fascinating

way, with tails held high in the air. They are of a most enquiring turn of mind, and, when younger, took a special delight in climbing on to people's shoulders and poking a wet cold nose into their ears.

The adult male animals supported a host of parasites, and, when first brought to Melbourne, before being treated, they possessed



4. The Spotted-tailed Dasyure or Tiger Cat (male). The yawn is characteristic. Note enormous canine teeth.

numerous large ticks, sores infested with fly larvae, and the peculiar flea (*Stephanocircus dasyuri*); while investigations on Dasyures which had been caught in rabbit traps showed numerous nematode worms internally.

In captivity, the animals relish rabbit carcasses, birds and frogs; they are also extremely fond of fish. One has only to place several flathead in the doorway of the cage to see the young Dasyures sneak forward, scenting the air, and then dart away behind a log,



5. Female Native Cat, with young, aged approximately three months, hanging from the pouch area.

bearing a fish apiece. Though squabbles are frequent during the busy chewing which follows, the sharp, hissing cries of disagreement are seldom accompanied by damaging fights.

The large Spotted-tailed Dasyure, or Tiger Cat, is rarer than the Viverrine species, and odd ones still occur in the Otway Forest. Several years ago a large male specimen issued from the northern limits of this area and was caught on the plains near Winchelsea. I was fortunate in obtaining this animal. Though very old and blind in one eye, he is extremely tame, and remains content provided he is given a continuous supply of food. He is even tolerant of dogs, and "sniffs noses" in quite a friendly fashion; but woe betide the canine visitor that adopts the offensive!

Occasional damaged specimens have arrived, over a period of years, at the Melbourne Zoological Gardens, from the Otway Ranges, and in every case of which I have a record the animals were of the male sex.

Having looked forward for a very long time to a camping trip in the Otways, it was pleasing to spend five or six days near the Cape in May of this year. Inquiries revealed a spot between Laver's Hill and Princetown where Tiger Cats had been caught and destroyed twelve months previously, following a poultry raid, but the box-traps and "scent" trails failed to bring any results in this locality. Then sheer accident caused a meeting on the roadside with an old lady, who had seen a living Tiger Cat only a week previously; and within a mile of this place, three weeks before our arrival, a large and very old Dasyure had been destroyed the night following its raid on a hen-roost. The animal killed five fowls, and others died subsequently from the effects of tooth-wounds in the neck.

To make a long interesting series of events short, a beautiful young Tiger Cat, once again a male, and only half-grown in size, was caught in one of the large box-traps on the last night of the stay. I had never heard a sound uttered by the tame Tiger Cat, or by any of those in the Zoological Gardens. Thus it was a surprise to hear this splendid young animal, at bay in the trap, uttering deep, ominous, hissing sounds, exactly like those of the Viverrine species, while it displayed a gleaming array of keen white teeth with long conspicuous canines. Later it was noticed that when this animal was placed near the tame Spotted-tailed Dasyure it again acted in the identical manner of the smaller species, namely, the same threatening long-drawn hiss followed by a series of sharp sniffing sounds, which seem to heroken uncertainty and guarded curiosity in both species.

Both Tiger Cats exhibit another characteristic of their kind, and that is, the very oily nature of the fur. After touching them

one's hands are covered in a greasy substance, and perhaps in the heavy rainfall areas (Otway, 60 inches), where the animals are so much at home, this fact may serve a useful purpose.

The same Spotted-tailed Dasyure has revealed many interesting habits in the course of the few years of his presence, and his utter disregard of everything with the exception of food, sleep and a ramble is notable. All food is held in the fore-paws. The natural mode of progression is a bounding gait, during which the tail is held more or less in the air. He has been noticed to pick up the cross trail of a rabbit, and killing is brought about by a powerful bite at the base of the skull, or in the neck after leaping on the victim.

The Tiger Cat is, in reality, rather a clumsy animal, and not by any means fast in its movements. The captive specimen shows very little inclination to climb. It is fond of fish. Evidently dead fish cast up on the sea-coast would be relished by wandering Dasyures. I have noticed that the tame animal is fond of diurnal rambles, and many bushmen have remarked on Tiger Cats bounding along a "pad" during daylight.

It is not an easy matter to handle a large Dasyure with impunity, and viewing the dentition and massive heads of these crouching, spotted hunters, one can imagine the bush of the old days when bandicoots and rat-kangaroos and small wallabies had to beware of these terrors in their midst. However, the old days have gone, and with the advent of settlement, disease, dogs, guns, traps, and last, but not least, the fox, which exterminates the simple marsupial game of the Dasyure, we have come to the time, in Victoria, of the almost complete disappearance of these primitive carnivorous hunters.

On Sunday, June 19, after sending in the above article, great excitement was caused by the discovery of six new-born embryos in the pouch of the original mother native cat. A week beforehand the pouch area was noted to have developed very rapidly from its resting stage, and, by repeated licking with her tongue, the animal kept the spot very moist. A longitudinal fold appears in the mid-line of the pouch, and four embryos (each 5 mms. in length) are to be seen attached to the four mammae on the right side. The remaining two embryos are supported on the posterior mammae of the animal's left side. Additional interest centres round this event in view of the fact that the male parent is probably the uncommon black Dasyure, the unusual capture of which has already been described.



6. A Tiger Cat. Note the low, powerful build and massive jaws.

FRANCIS G. A. BARNARD, J.P.

It is given to few men to establish such a record as that held by our late friend, F. G. A. Barnard. To have been one who worked for the initiation of the Field Naturalists' Club of Victoria, and to have joined as an original member; to have seen that Club carried to its successful fruition right to the jubilee celebration, at which he acted as chairman; to have been continuously in office for over forty years, and to have been Editor of the Club's publications for thirty-two years—this surely constitutes a record among workers in natural history science.

Francis George Allman Barnard was born in Kew, Victoria, in 1857, at his father's pharmacy, which was situated where the Kew post office now stands. His father, Mr. Francis Barnard, who died in 1912 at the ripe age of eighty-nine years, was probably the oldest pharmacist in Victoria. For some years he occupied the premises now occupied by our member, Mr. C. J. Gabriel, at Abbotsford.

Removing to Kew, he established the business, where F. G. A. Barnard was born. He was a Councillor of the Municipality of Kew, and was three times its Mayor. He was also one of the foundation members of our Club, devoting his attention to microscopy. One species, *Phragmidium Barnardi*, a fungus which he found on *Rubus parvifolius*, was named after him. His obituary notice appears in the 1912 volume of the *Naturalist*.

In company with his father, our late member became a foundation member of the Club. At its first meeting he exhibited a number of insects, which he collected at Kew. For some years his interests in entomology increased, and he specialised largely in local insects, exhibiting regularly at the meetings of the Club. Later he became interested in Physiography and Botany; but he retained his collection of Kew insects to the end.

Our late member loved the Club wholeheartedly. He treasured many little memos, and items relating to the Club. One of these was a letter which our first Secretary, the late Dudley Best, wrote to Charles French, senr., making an appointment to complete arrangements for the first meeting. He had that letter framed, and his widow has since presented it to the Club.

In 1883 Mr. Barnard was elected a member of committee, and in 1884 he became Hon. Secretary; at the end of six years he retired from that position and became Hon. Librarian. In 1892 he became Editor of the *Naturalist*, a position he held, carrying out his duties with great faithfulness and devotion until 1925, a period of from thirty-two to thirty-three years. From 1903 to 1905, in addition to his Editorship, he became Vice-President, and from 1905 to 1907 he was President. In 1908 he again became Secre-

tary for a period of two years. Thus for forty-two years, our friend was continuously in office, working hard for the Club he loved. Just a few years ago he wrote to me on Club business, and referred to the Club as "my first love." He edited nearly eight thousand pages of the *Naturalist*, and in keeping up a very high standard of natural history journalism, it can be said that very few errors crept into its pages.



FRANCIS G. A. BARNARD.

Mr. Barnard originated the scheme of excursions, one of the most valuable and useful features of the Club's work. He was leader at many hundreds of these, always making the gatherings attractive by his general simplicity of explanation as well as his catholic breadth of knowledge in natural history.

BIBLIOGRAPHY.

In addition to editing, Mr. Barnard contributed very largely to the *Naturalist*, and it is quite impossible to record here all the notes and brief articles he contributed. His first paper, "Notes of a Day's Outing in the Dandenongs" appears in Vol. I, p. 19, March, 1884.

In Vol. XXIII, page 136, November, 1906, appears an article, "Are Popular Names of Native Plants Desirable?" This article resulted in the formation of the "Plant Names Committee", of which Mr. Barnard was a member during the whole eleven years of its work. The fruition of this committee was our *Vernacular List*, which is a valuable contribution to botanical work.

Other articles were "Notes of a Holiday Tour in Riverina" (with C. French, F.L.S.), Vol. III, p. 120, April, 1887; "Note on the Butterfly, *Ialmenus evagorus*", Vol. V, p. 168, March, 1889; "Notes on the Butterflies of Victoria", Vol. VI, p. 83, September, 1889; "Among the Alpine Flowers" (with C. S. Sutton), Vol. XX, p. 4, May, 1903; "Some Early Botanical Explorations in Victoria", Vol. XXI, p. 17, June, 1904; "Presidential Address" (a Retrospect), Vol. XXIII, p. 65, July, 1906; "In the Valley of the Upper Yarra", Vol. XXIII, p. 244, April, 1907; "Over the Dividing Range", Vol. XXIV, p. 111, November, 1907; "A Day on Mount Disappointment", Vol. XXVII, p. 228, April, 1911; "Some Account of Journeys of Dr. George Neumeyer, Victoria, 1859-1864", Vol. XXXIV, p. 185, April, 1918; "Notes of a Visit to West Australia", Vol. XXXVI, p. 24, June, 1919; "The Field Naturalists' Club of Victoria, a Retrospect," Vol. XXXVII, p. 71, October, 1920; "The Stranger Rock at Derrinal," Vol. XLII, p. 101, August, 1925; "The Story of a Meadow Moonwort"; Vol. XLIV, p. 197, November, 1927; "The Late Mr. Dudley Best", Vol. XLV, p. 195, August, 1928.

"The Story of a Meadow Moonwort" reveals a wonderful and painstaking interest in an uncommon and usually an unattractive plant. In 1887 a Club excursion was held at Oakleigh, during which some plants of the fern *Botrychium ternatum* were seen. Mr. Barnard removed one plant for growing. It was potted in a five-inch pot, where it continued to grow. On rare occasions, probably only twice or three times, it was reported, otherwise being occasionally top-dressed.

This plant is deciduous, usually drying down at the end of the year. During the second week in February "the new fronds appear, as regular as clockwork," which continue to grow again until December. Mr. Barnard kept his pet growing in the pot for nearly forty-five years, keeping it in an open bush-house. I can only hope that my old friend's fern will be as successful with me as it was with him.

On his retirement from the position of Editor, Mr. Barnard at once commenced an Index of the *Naturalist*. To this monumental work he devoted many weary, if interesting hours. On many occasions he would visit my home, carrying the Index with him, to discuss its phases and its progress. Fortunately, and only a few months ago, he completed the work, and it is hoped that it will be published as a memorial volume to our friend.

In 1923, along with the remaining other six original members of the club, Mr. Barnard was elected a life member, an honour he greatly appreciated. He was a keen collector, and it is recorded that on one occasion he was delighted to have found what he considered to be a new orchid. He took it to Baron von Mueller, only to find that Mr. George French had collected it on the same day near the Dandenong Ranges, and had delivered it to the Baron two hours previously. Thus it became *Prasophyllum Frenchii*. "It might have been *Prasophyllum Barnardi*," said the Baron.

In the early days of the Club, Mr. H. Waits was a leading member and the first librarian. He was interested in Microscopy and Seaweeds. It was only natural that family friendship should be engendered as a result of excursions and other associations. At any rate, in 1889 our late member was married to the daughter of the librarian. This event was made the occasion of a presentation to the young couple of a marble clock, an address, and a purse of forty sovereigns. In a letter to Mr. C. French, senr., the secretary, Baron von Mueller, writes: "Pray convey also my best felicitations to him and to his future lady, at this happy and auspicious event. To me it is particularly significant, because Mr. Barnard is a scion of the family on which Sir Edwin Smith, who just 100 years ago founded the Linnean Society, shed such a lustre.

The bridegroom whom we wish to honour on this great occasion has evidently inherited the Smithian spirit, of which, by his zealous services to the Club, he has given such ample proof."

Reference is here made to the fact that, through his mother, Mr. Barnard was a descendant of the famous botanist, Sir James Edwin Smith, founder of the Linnean Society of London. A few years ago, Mr. Barnard presented to our National Herbarium a small lens that had belonged to Sir J. E. Smith.

The Barnard family can trace its descent back to the time of Edward III (1380), and the line of descent is also traced through one of the descendants of Shakespeare.

Mr. Barnard loved the Dandenong Ranges; he knew every peak and hill, and the trees and plants were his familiars.

I well remember standing with him on the balcony of his home at East Kew one Sunday afternoon, viewing the wonderful panorama of the Plenty, Healesville, and Dandenong Ranges. Every point and valley were pointed out, the courses of the streams were noted, and his interest and love of the panorama were very keen.

It was given to our late friend in many ways to render splendid service, both in the pharmaceutical world and in municipal office. He matriculated at the Melbourne University in 1873, and became a registered pharmacist in 1879. He was president of the Metropolitan Chemists' Association in 1915. About 1920 he further became president of the Eastern Suburbs Chemists' Association.

In 1915 he secured municipal honours, being elected to the Kew Council. He became mayor in 1920, and it was during his mayoralty that Kew was proclaimed a city.

It was a great sorrow to him and his wife that their only son was killed in action near Ypres in 1917. Their daughter was a nurse during the war; so that both members of the family responded to the Call of Empire.

In 1910 Mr. Barnard wrote a History of Kew, which was considered by literary critics as a model of what a local history should be.

He was engaged in writing a history of Croydon at the time of his death, and a number of notes has been left for some future historian to take up this work.

As a member of the Historical Society of Victoria, Mr. Barnard was elected a member of the Council in 1913, and remained as such until his death. In June, 1912, he gave a most interesting paper entitled "Gleanings from the *Richmond Australian*," a newspaper published in 1859-61. Later, considerable interest was aroused in a paper read on "Some Early Victorian Maps." Just a few weeks before his death he read, before a crowded meeting of the Society, a valuable paper, "With Bonwick in Western Victoria in 1857," this being a résumé of of Bonwick's well-known book on the Western District.

It is not generally known that he was an enthusiast in cricket, having been a keen cricketer in the Kew team for many years. He followed local and international cricket very keenly right to the end.

There was one phenomenon of nature that had a peculiar attraction for Mr. Barnard—the sunrise. Often in the Club, when describing a week-end excursion or a camp-out, he would tell of the beautiful sunrises that had been noted in the ranges. On the last morning of his life Mrs. Barnard called him to see a very beautiful sunrise. And it was a beautiful one—many of us also noted it. Then he went to work at Croydon, in the foothills of the ranges. At the end of the day he visited a friend who was ill, and cheered him for a few hours. Then, with the thoughts of his beloved hills, the glorious sunrise, and the joys of friendship, he was quickly taken from us, in the train, to leave behind a memory fragrant with nature, friendship and service.

E.E.P.

NOTES ON *CHILOGLOTTIS REFLEXA* (Lab.)
Checl.

By (MRS.) C. A. MESSMER, Lindfield, N.S.W.

This diminutive but interesting terrestrial orchid is one of the most widely-distributed Australian species of the genus, ranging from South Queensland to Tasmania.

Although generally regarded as an autumn flower, I have seen it as early as January on the highlands, while on the lower levels every successive month, up to July, sees it flowering. Found usually in large colonies, it appears to be a shy bloomer, but possibly this may be explained by the fact that many of the leaves belong to immature offshoots, due to the vegetative method of reproduction referred to below. Notes on the following features of its character may be of interest to orchid-lovers generally:—

- (i) Variability of flowers.
- (ii) Variability of foliage.
- (iii) Self-fertilization and vegetative reproduction.
- (iv) Elongation of stem after fertilization.

(i) *Variability of Flowers.*

This is particularly noticeable in regard to the labellum, the shape of which is inconstant. FitzGerald depicts the typical labellum with a narrow base, broadening into a somewhat obovate lamina, mucronate, or even blunt, at the apex. Forms have been seen, however, with the lamina almost as rhomboidal as that of *C. trapeziformis*. The grouping and character of the glandular calli—a feature constituting one of the main guides to determination of species in this genus—are by no means consistent in *C. reflexa*.

In some flowers the calli are almost wholly dark, stout and shortly stalked, very few being filamentose. In others pale gland-tipped filaments are strikingly developed, chiefly on the margins of the mass of robust calli. Both the number and arrangement of the calli are subject to variation. They are sometimes grouped in a relatively small, compact mass near the centre of the lamina (cf. *C. trapeziformis*), or they may extend in far greater numbers in a gradually narrowing formation almost to the apex. Two calli along the central line are invariably much larger than any others. The anterior of these, oblong or roundish in shape, firm, shining, and almost sessile, is in some flowers nearly concealed by the gland-tipped filaments. In other cases it is bare, forming a prominent boss. The large posterior callus is erect, then reflexed into a flattened, more or less bifid apex facing the column of the flower.

The texture of the lamina is sometimes delicate, and (apart from calli) smooth, but in some specimens it is firm, leathery and more or less glandular-rough. In colour, it ranges from pale green with an almost transparent tip, to dull or deep red brown. The calli are usually reddish purple, often very dark. The whole flower varies in colour from pale green-tinted with pink to deep red brown. This may depend on conditions of soil, shelter and climate. The lateral sepals are sometimes threadlike, and extended forward, sometimes broader and sharply deflexed. The petals are normally deflexed against the ovary, but in flowers from one locality they were almost horizontal. The dorsal sepal may be shortly acute, or quite long, the broad central portion tapering almost into a filament.

(ii) *Variability in Foliation.*

Leaves sessile and resting on the ground or petiolate and more or less erect. In the former case the margins are often crisped. The sessile leaves may perhaps be those of the first season, as they are seldom accompanied by flowers. Their tuber is globular and directly beneath them. They may be seedlings, since young plants produced by the negative method have the erect petiolate leaves of the parent. Plants with these leaves have a broadly elliptical tuber at the end of a 3-4 inch rhizome, or on a branch thereof.

The leaves are always two in number; hence Robert Brown, who probably knew of no other species, named this *C. diphylla*, to mark a characteristic which we now know belong to the genus.

(iii) *Self-Fertilization and Vegetative Reproduction.*

FitzGerald observes that in the case of failure to be fertilized by insects, when the flower has been long in bloom the labellum clasps the column and the calli adhere to the pollen masses when fertilization appears to ensue; either by contraction of the labellum and consequent extraction of the pollen masses and their contact with the stigma, or by a similar result from the flower being brushed when the labellum has adhered to the pollinia. Having had many plants under observation indoors away from interference by insects, I have come to the conclusion that self-fertilization does take place, but not in the way FitzGerald suggests; as in no case when the labellum has moved up and clasped the column with the pollinia remaining *in situ*, have the pollinia consequently been removed, or seed capsules set.

Where fertilization has not yet been accomplished, if the labellum be held up against the column, it will be found that the large anterior callus fits exactly on to the stigmatic plate. Before the boat-shaped pollinia are ripe they are not easily removed from the embrace of the clinandrium, but upon ripening they are ejected with an appreciable amount of energy, and fall always

right side up on to this large callus, whatever the disturbing agent may be.

I have watched pollination and subsequent fertilization of the ovules take place under each of the following three conditions.

1. A touch, as from some passing object, to the plant, flower stalk, or part of flower, whereupon the ripe pollinia immediately fly off, hit, and stick to the large callus.

2. At certain stages, after the ripening of the pollinia, the labellum becomes irritable if touched from below, and snaps up against the column, later moving back to the horizontal position and dragging with it the pollinia, which remain firmly affixed to the callus until the labellum moves up with age, as also in case No. 1, and brings them into contact with the stigma.

3. When in the wind, the labellum flaps up and down, as on a loose articulation, and I have watched it knock up against the column and carry away the pollinia. It is curious to note that in a room where there is no wind, this articular motion is not apparent, the joint appearing quite stable, even if jerked about by the finger.

Whatever the cause of the pollinia reaching the anterior callus on the labellum (and I have never seen them alight elsewhere), there they remain until the labellum slowly moves up and embraces the column, the loaded callus being firmly pressed against the stigma. Within a few days after pollination the ovary begins to swell, and at the end of the second week the tiny seeds may be observed through the translucent ovary walls.

In some species of orchids this swelling of the ovary takes place very rapidly after pollination. In flowers of *Dendrobium nobile*, which I hand-fertilized, it was apparent after the elapse of only eight hours.

Like other species of the genus, *C. reflexa* also increases by the vegetative method, several young plants sprouting along a rhizome. After flowering the second or third year, the parent plant dies away and is replaced by its offspring. This method accounts for the dense "colonies" so characteristic of many of our terrestrial orchids.

(iv) *Elongation of Stem After Flowering.*

This curious habit is more strikingly seen in *C. gunnii*, which is very shortly stalked, but after fertilization many elongate to nearly a foot. Southern botanists record the habit in *C. reflexa* also, but in New South Wales it does not seem to be a prominent characteristic. It is very marked in the genus *Corysanthes*, and has been discussed by Rupp and Nicholls in their review of the Australian species (*Proc. Linn. Soc., N.S.W.*, V. III, 2, 1928).

THE STUDY OF AUSTRALIAN MOSSES.

(Continued from "The Victorian Naturalist," June, 1932.)

By G. O. K. SAINSBURY.

11. *Dicranoloma dicarpum* (Hornsch.) Par.

There are more than a dozen good species of *Dicranoloma* in New Zealand, and several, including this moss, are common to both countries. The plants are usually found in dense masses on forest loam or logs and tree-trunks, and they attract attention by their large size and distinctive habit. It will be noticed that the leaves are often falcato-secund, *i.e.*, sickle-shaped and set on one side of the stem, a characteristic arrangement in this and allied genera. They are lanceolate-subulate, *plicate*, and dentate, both on the upper margins and on the back of the excurrent nerve. The structure and width of the nerve and the nature of the upper leaf-cells are the characters mostly relied on in the determination of the species of this genus. Separating the New Zealand species is often a troublesome task, but *D. dicarpum* is always easily placed by the *plication* of the leaves and the presence in the subula of several rows of strongly differentiated *shorter* cells next to the nerve. There is a distinct group of coloured alar cells (a generic mark), and the leaves are more or less *marginated* with a hyaline border. The perichaetium usually contains two or more setae, and is differentiated and sheathing. The capsule is asymmetrical, strumose and *incurved*, often strongly so when dry. The peristome has the usual dicranoid structure, *i.e.*, consisting of 16 reddish cleft teeth with fine vertical lines on the outer surface and prominently barred within. Operculum (not present) long-beaked. Calyptra (not present) cucullate. A number of species of *Dicranoloma* which have been founded on Australian material have been shown to be identical with certain New Zealand species, and it is greatly to be desired that further collections of the Australian plants should be made for the purpose of critical comparison.

12. *Ditrichum flexifolium* (Hook.) Hampe.

This species is widely spread throughout the southern hemisphere, and is very common in New Zealand. It is usually found fruiting freely in large patches on damp earth banks, and is recognisable by the slender silky leaves and the rather long asymmetrical capsule, narrowed at the mouth, and smooth. Leaves from a wide sheathing base narrowed to a long setaceous subula, *entire*, or slightly toothed at the extreme apex to which the nerve is continued. Cells linear-oblong, including the *upper* ones. Alar cells not differentiated, and this is a generic mark. Seta *red* or *yellow*. Peristome of 16 yellow-brown teeth, each divided nearly

to the base into two brown *papillose* threads. Operculum (not present) rather long, conical and slanting. Calyptra (not present) cucullate. Some other species of *Ditrichum* have also been reported from Australia. In habit there is a general resemblance to the present plant, but the elongated upper cells will serve to distinguish the latter. A good deal of variation must be expected in the length and shape of the capsule and the colour of the seta, but as a rule the determination of this species presents no difficulty.

13. *Fissidens asplenoides* (Sw.) Hedw.

Mosses of this genus have a characteristic leaf structure which merits a somewhat detailed description. The leaves are distichous and set vertically on the stem. The lower part, which is the true leaf, sheathes the stem, and consists of two conduplicate laminae. The nerve, when present, is continued up beyond the sheathing portion, and on the front of this continuation is developed a wing of leaf tissue (the superior lamina), whilst at the back is developed another such wing (the inferior lamina), which stretches from the apex of the nerve down its outer side to, or nearly to, its base. The vaginant (or sheathing) lamina may be either bordered or not, and is usually entire, though in some species it is more or less toothed. The border or denticulation, as the case may be, often extends to the upper laminae. In the present species the leaves are *unbordered* throughout, and the margins are *entire*, except that at the apex there will be found a very slight crenulation caused by the projection of the marginal cells, and visible only under high magnification. The leaves are obtuse, or at most sub-acute, and when dry they are conspicuously incurved at their tips. The cells are *small and obscure*, and the nerve, which is stout and sinuose, ends just short of the apex. Capsule oblong with a widened mouth. Peristome of 16 red teeth, strongly barred, cleft into two segments which are colourless and papillose above. Operculum (not present) conical, with a long slanting beak. Calyptra (not present) cucullate. *Fissidens* is well represented in New Zealand, there being about 15 species. They are nearly always found on earth, especially on the moist shaded sides of the miniature caves and canyons that small runnels of water form in their course through forest or grassland. Some of the mosses of this genus that grow in such places are tiny plants, and difficult to find; but they are well worth seeking, if only for the reason that unreported or new species are quite likely to be hiding amongst them.

14. *Weisia viridula* (L.) Hedw.

Widely distributed in both hemispheres, and abundant in New Zealand; probably so in Australia. The specimens distributed are a form without peristome (gynnostomous), known as var. *gynnostoma* Dixon. *W. viridula* is found on bare earth, and usually in freely fruiting dense tufts. The plant is short and green, and

the leaves much curled when dry. Leaf margin *incurved*. Nerve *excurren* in a yellowish point. Cells below hyaline and oblong, above papillose and obscure. Seta straw-coloured, variable in length, but usually very short. Capsule erect, oval or elliptic, often somewhat *furrowed* when dry, with a *red* mouth. Operculum with a slanting *subulate* beak. Calyptra cucullate. The peristome, when present in this species, is often imperfect, and consists of 16 teeth, divided or entire. When in fruit this moss is easily placed, but barren material is not safely determinable.

15. *Polytrichum juniperinum* Willd.

This moss is one of the commonest in the world, and appears in some form or other in practically every country. The rigid stems and thick, tough leaves will at once attract attention by their unusual appearance, and those interested will not be surprised to learn that in the order Polytrichaceae the highest development of the mosses is attained. The solidity of the leaves is due partly to the thick nerve occupying a great part of the subula, and partly to the numerous plates, or lamellae, which are set vertically on the inner surface of the nerve. If a leaf is softened in hot water, and the ventral surface is scraped with a needle, the lamellae will be easily detached in fragments, and it will then be seen that they consist of several rows of cells of which the apical ones are so shaped that they give the plate a crenulated appearance along the top edge. The shape of these terminal cells of the lamellae is an important character in *Polytrichum* and allied genera. They are sometimes papillose instead of being smooth, as in the present case, and this quality is also of importance. The leaf is expanded below into a sheathing portion in which the nerve is narrower and without lamellae. The margin is *incurved* and *entire* throughout. The nerve projects in a denticulate point. Capsule four-angled, and immediately below it there is a disc-shaped swelling of the seta called the apophysis. Mouth of capsule closed by a membrane (the epiphragm). Peristome of 64 short ligulate (strap-shaped) teeth. Calyptra *densely hairy*. Operculum shortly beaked. The male flowers are borne on separate plants and are discoid. There are strong family likenesses in many of the mosses of this order, and outward resemblances are so usual that species can hardly be identified without a thorough examination. The shape of the capsule, smoothness, or otherwise, of the calyptra, dentation of the subula, number of rows of lamellae and shape of their apical cells, are the main points in the systematic treatment. This species and others always grow on the ground, thinly or thickly scattered. It is worth noting that the order contains several giant mosses, and that the closely related order *Dawsoniaceae* consists of the well-known New Zealand *Dawsonia superba*, which sometimes attains a length of 30 inches!

16. *Ptychomnion aciculare* (Brid.) Mitt.

This beautiful moss is abundant throughout New Zealand, and should be quite common in Australia. It is, of course, pleurocarpous, and will be recognised at a glance by the rigid black stems, clad with pale leaves, and the black seta with strongly ribbed capsule. It is found on rotting logs or loamy forest ground. The leaves are stellately spreading, *i.e.*, rigidly at right angles to the stem, and are either nerveless or with a mere trace of double nerve. The margin is entire below and *denticulate* towards the apex, becoming *dentate* in an elongated *twisted* acumen. Cells throughout linear, somewhat elongated below, porose, and *without* differentiated alars. Perichaetium shortly sheathing, with longly-acuminate bracts. Seta *black* and *wiry*. Capsule curved, 8-ribbed (very conspicuously so when dry). Peristome double. Outer of 16 lanceolate teeth, densely horizontally striate on the dorsal face, and with well-developed ventral lamellae which project laterally. The teeth have a semi-transparent crack down the centre, and are papillose above. Inner peristome of 16 keeled colourless processes. Cilia present, well developed and appendiculate. Operculum with a very long fine beak. Calyptra (not present) cucullate, large, chestnut-brown.

THE "FAN-MUSSEL".

Fan-mussel is a term frequently applied to the *Pinidae*, a family of Marine Bivalves. These shells enjoy a wide distribution, but are more frequently met with in tropical seas, where they range from low-water to a depth of 50 feet. About twenty species exist in Australian waters, with one representative from Victoria, *P. tasmanica*, T. Wds. The genus *Pinna* is somewhat ancient, several fossil species being recorded from Australia. The shells are very oblique, wedge-shaped, equivalve, very inequilateral, fragile, and gaping posteriorly. Though not strong in texture, they are known to attain a length of two feet, and perhaps in this respect are second only to the giant-clam. Generally speaking, they live in sandy mud, with the gaping extremity uppermost, and the beaks or narrow end imbedded deeply in the ground. Some species are used for food, while the strong and silky byssus of others when mixed with silk has been utilised in southern Europe in the manufacture of gloves and other articles. Pearls of an amber colour are sometimes found in the shells. Under the name of "razor-backs," these shells have been referred to, by virtue of their sharp edges. *P. tasmanica* is the largest bivalve in Victoria, where it is at times seen in numbers washed up on the beach between Newhaven and Cape Wollamai. Some years back fine examples were trawled in Bass Strait by the Government steamer, "Lady Loch."

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F.N.C.V. PROCEEDINGS.

The monthly meeting of the Club was held in the Royal Society's Hall on Monday, July 11, 1932, at 8 p.m. About 130 members and friends attended, and the President, Mr. J. A. Kershaw, C.M.Z.S., occupied the chair.

CORRESPONDENCE.

Mr. F. Lewis, Chief Inspector of Fisheries and Game, intimated his intention to place the White-eye (*Zosterops*) on the protected list for the whole year.

REPORTS.

Excursions were reported as follows:—Zoology School, Mr. Kershaw; Wattle Park, Mr. Miller; National Museum, Mr. Kershaw.

ELECTION OF MEMBERS.

The following members were duly elected:—Mr. and Mrs. J. J. Freame, Miss A. M. Havinton, Miss J. Anderson.

GENERAL BUSINESS.

The President announced the resignation of the Secretary on account of ill-health.

A rumour having been circulated that there was a possibility, as a measure of economy, of suspension of the Fisheries and Game Department, on the motion of Mr. G. Coghill and Dr. Heber Green, the Committee was requested to take such action as might be deemed advisable.

LECTURE.

Mr. A. H. E. Mattingley, C.M.Z.S., spoke of his tour, in 1908, with members of the R.A.O.U., of the islands at the east end of Bass Strait. The nesting "rookeries" of many birds were depicted. Notable among them were mutton birds, gannets, and penguins. Mr. Mattingley entertained members with glimpses of the habits, social customs and peculiarities of the birds. Interesting sidelights on the population of the islands were given. Lantern slides gave a remarkably clear representation of the various phases of bird life.

EXHIBITS.

Mr. H. P. McColl.—*Stenocarpus sinuatus*, *Banksia collina*.

Mr. F. H. Salau.—*Grevillea alpina*, *Pterosty'is nutans*, *P. concinna*, *P. alata*. Fungi—various.

Master P. Flecker.—Sea-horse.

Mr. G. Coghill.—*Acacia podalyriacifolia*, *A. dealbata*, *Grevillea rosmarinifolia*, *Thryptomena calycina*, *Eugenia Smithii*.

Mr. E. E. Lord.—*Cassinia longifolia*, *C. aculeata* (to show the keeping qualities as cut flowers).

Mr. F. Pitcher.—Uncommon form of *Polystichum aculeatum*, and typical form for comparison.

Mr. L. Stach.—Rare Lower Pliocene fossils: From Beaumaris, above nodule bed; *Cucullaea coriocoensis praelonga* Sing.; *Myodora gabrieli* Chap. and Cresp.; *Nucula kalinnæ* Sing., new locality; *Propeleda ensicula*; *Angas* sp., new locality; *Leda acinaciformis*, Tate; *Zenatiopsis angustata*; *Ostrea* sp.; *Aturia australis*; *Natica subinfundi bulum* Tate; *Tylospira coronata* Tate, sp. From Macdonald's *Cucullaea coriocoensis praelonga* Sing.; *Leda acinaciformis* Tate; *Zenatiopsis angustata*; *Nucula kalinnæ* Sing. Two worn specimens of *Spondylus gaederopoides* McCoy; a typical Miocene species, from the nodule bed at Beaumaris, giving evidence of the fact that it is in all probability a remanié nodule bed.

Mr. C. J. Gabriel.—Fan mussels or razor-backs: *Pinna tasmanica* T. Wds., Vic., Tas., S. Aust.; *P. dolabrata* Lam., S. Aust.; *P. dulloides* Menke, Port Darwin; *P. hanleyi* Reeve, Port Darwin; *P. menkei* Reeve, Qld.; *P. nigra* Chem., N. Caledonia; *P. zelandica* Gray, N.Z.

Mr. V. H. Miller.—*Epacris impressa*, *Leucopogon ericoides*.

Mr. F. S. Colliver.—(1) Land shells from Chillagoe caves, showing four stages in their conversion to pebbles. (2) Section of whale's vertebra, Balc., Muddy Ck. Tympanic bones of whale, *Cetorolites* sp., Kal., Beaumaris. Tooth of whale, *Ziphius geelongensis* Janj., Waurin Ponds. (3) *Graphularia senescens* (square bones of quarry workers, Group, Octocorolla, first described by Prof. Tate as *Belemjité*) Janj., Torquay.

Mr. A. S. Kenyon.—*Acacia Baileyana*, *Grevillea rosmarinifolia*, *G. ilicifolia*, *G. trinervis*, *Hakea*, sp.

Tasmanian Collembola of the family Sminthuridae (the globular Springtails) are dealt with by Mr. H. Womersley, A.L.S., F.E.S., in a recent paper (*Royal Soc. of Tas. Pap. and Proceedings*, 1931). Several new species of this very primitive group of insects are described. The Springtails are completely apterous, and "have recently been shown to be the earliest fossil insects". They occur in immense numbers in the soil, and therefore are of serious economic importance. "Of the morphological characters used in the identification of these insects," Mr. Womersley writes, "the furca or spring is one of the most important. This organ is attached to the fourth or fifth abdominal segment. . . . When the insect is in repose the spring is folded under the body, being held by a catch." The feet also provide many features of specific and generic value.

NOTES ON A TAILED SPIDER.

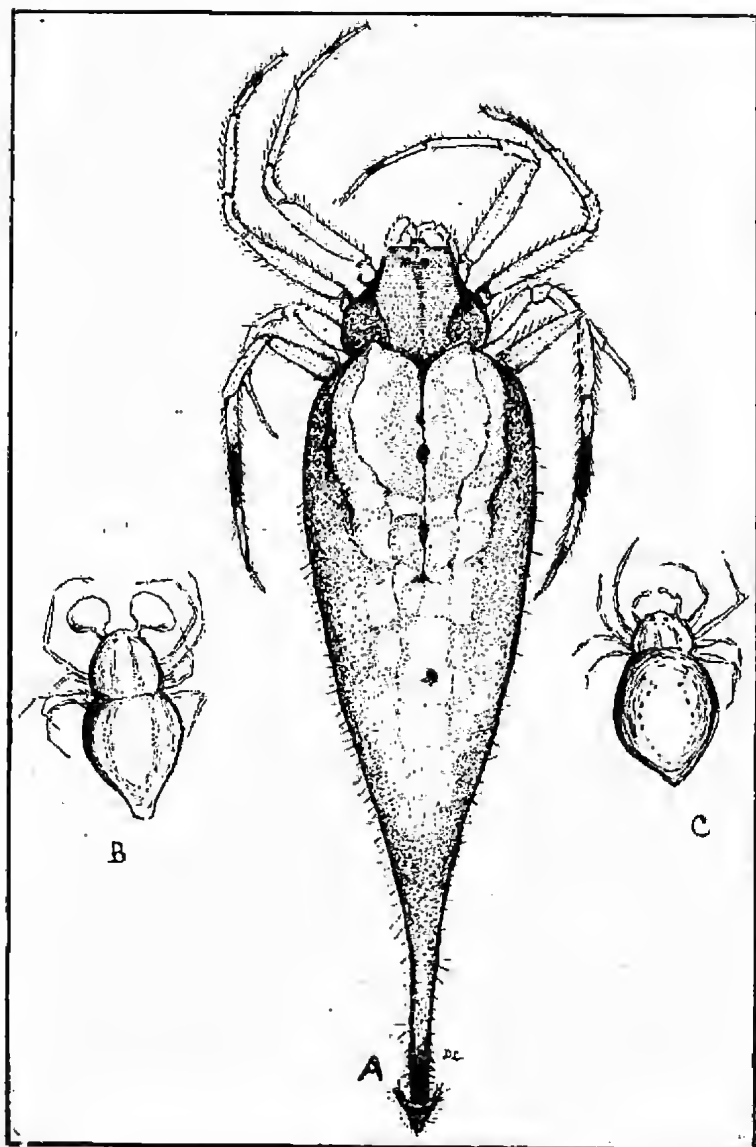
By EDITH COLEMAN.

In December, 1931, a tailed spider, *Arachnava higginsii* Koch. was sent to me by a Blackburn nature-lover. He had not noted a "web", and could tell me nothing of the spider's habits. A few days later one was found outside my door, and within a few weeks 40 more were under observation in various parts of the garden.

Of drab appearance, from $\frac{1}{2}$ inch to 1 inch only in length, harmonising perfectly with the string of dingy egg-sacs to which she clings, the spider is not readily detected, and one is not surprised to find that it has been little studied. The general shape suggests a scorpion, and this is accentuated by the habit of carrying the "tail" erect, or curved over the back. The elongated abdomen ends in three black processes, forming a "trident" of decidedly formidable appearance. The five finger-like spinnerets are arranged in a conical rosette. There are eight eyes. The dorsal surface of the abdomen is of a silvery-white or cream colour. The ventral surface, legs, and the whole of the cephalothorax are of a dull brown, like dingy cob-web. As she hangs, "head" down, behind her string of sacs, only the dull under surface is visible, and this, even when seen closely, appears to be part of the string of cocoons.

The snare, a sectoral-orb, is hung in a nearly vertical plane beneath a complicated system of foundation cables and stay-lines. These probably serve to interrupt insects which would damage the delicate snare, moths, etc., too large for the spider to deal with. The orbed snare is formed of from 20 to 30 non-viscid lines radiating from a common centre, crossed spirally by extremely viscid circular lines. The spirals do not make complete circles, but are looped, leaving a large, triangular, open space, in which the string of cocoons depends, suspended, by two thick cords, from one of the overhead foundation lines. Nine or ten non-viscid, well-spaced foundation spirals are first placed. Travelling along these, using her legs like fingers on the strings of a harp, the spider supplements them with 38 to 50 closely-spaced beaded spirals—incomplete circles looped on the two radii which form the sides of the clear, triangular space.

The open-meshed, non-adhesive hub forms the spider's parlour. Here she waits "head" down, legs gripping the radii, her long tail held vertically, occasionally curved scorpion-wise, behind the sacs. Motionless, she is practically invisible, and, with the string of from three to 15 cocoons, might be mistaken for a dingy roll of cob-web—a masterpiece of camouflage. As the line of cocoons lengthens, the hub is lowered to give the spider her central position just below the last cocoon.



A—*Arachnura higginsii*. Koch. female.

B—*A. higginsii*. Koch. male (immature).

C—Spiderling, *A. higginsii*, a few days after emergence.

The capture of prey is interesting. The prey consists mostly of tiny flies; occasionally larger game is taken. That the radii serve as telegraph wires is evident, for they convey to the spider the exact position of her prey. The instant an insect touches the snare she gives a bound. A few short, sharp tugs on the radii probably make the captive adhere more firmly to the viscid spiral. Without hesitation, she travels along the nearest radius straight to her quarry. Small flies are taken directly into the mouth. Larger ones are swathed in silk and tied to her spinnerets. Then, dropping on a thread, free of her snare, she climbs her life-line and, "head" down, enjoys her well-earned meal. In fair weather one sees scores of small flies captured, with little or no damage to the snare.

Points of anchorage and suspension cables are strengthened every day. Travelling slowly over the lines, the spider touches them with her spinnerets at half-inch intervals. Broken and sagging ropes are mended and tightened. Usually the snare is made at night, but, after rough weather, when appetites are sharp, one may watch the process during the daytime. Whether the points of anchorage necessitate the construction of the snare within the compass of a triangle, a square or any other shape, the result is perfect—a triumph in engineering.

Under a *Pittosporum* tree, beneath a netted maze of interlacing foundation and suspension cables, a community of six spiders has its snares. They pass and re-pass each other with indifference, as each one reinforces its own guy-ropes and main lines. After a frost or a Scotch mist, this community of nets is exquisite, a lacy cloud of silver snares illuminated with crystal lights.

During the heavy rains of March and April, stung by many fierce winds, all of these ardent little mothers clung tenaciously to their precious capsules. Their legs were closed, extending forward into a sharp triangle, from the apex of which drops of water gathered. Egg-laying proceeded, even in the rain. Sometimes, during windy weather, no nets could be made, yet cradles would be woven, eggs deposited, and a new snare constructed, before food could be obtained. One witnessed, without regret, the capture of that next meal. On March 14 a sadly neglected snare was noted. There was no egg-sac, but the spider was resting, motionless, below a small twirl of silk suspended by two silk threads from an overhead cable. The twist of silk was quite inadequate to conceal her. Next day a small oval cocoon appeared on the twist of silk, the ends of which formed a silky tail. The spider was hidden behind the cocoon, her legs gripping the radii, her "trident" just visible. The cocoon was obviously used as a "hide", while at the same time receiving the mother's protection.

In other instances a small leaf, attached to the suspended twist of silk, formed the first "hide", beneath which the spider rested for perhaps a week before the first egg-capsule appeared.

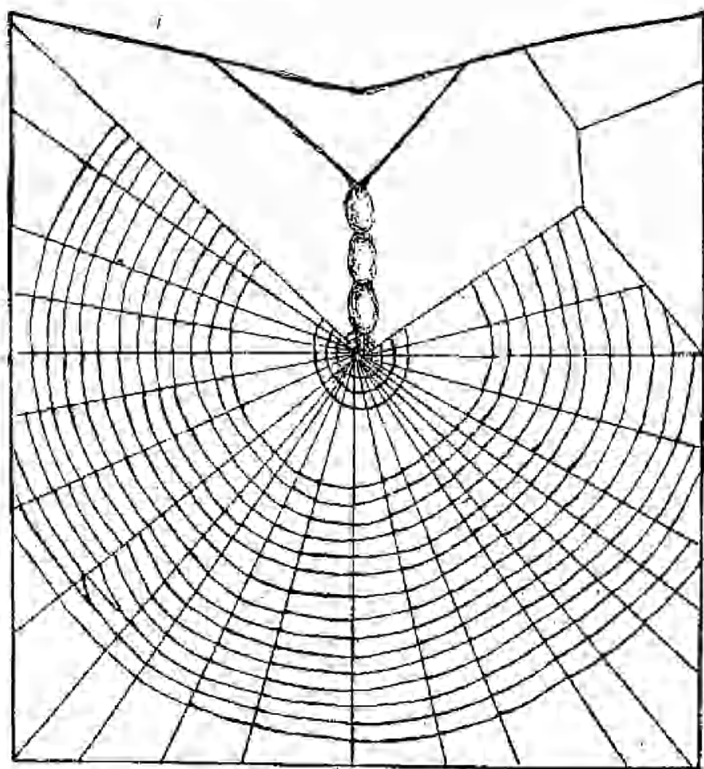
Some of the capsules are well separated, with a neck like the waist of an hour glass, or like strings of sausages; others are continuous, the silky tail of one forming the foundation for the next. Most of them are camouflaged with bits of leaf, petals, tiny twigs, etc. This decoration, in some instances, is deliberately carried out; in others it appears to be accidental, wind-blown leaves being caught and held among the silky threads. Those suspended under the apple trees are unadorned except for balls of insect debris, the remains of many feasts. Apple leaves are probably too large for the spider to manipulate. Two fine strings in a *Crataegus* are completely disguised with fruits from a nearby pampas. Those under the wattle trees are decorated with wattle-flowers and leaflets. Cocoons are made, and eggs deposited at night. I watched the process many times. It varied little. One soon learned the signs of imminent egg-laying. The spider rested quietly all day, usually away from her platform, and neglected her meals.

On the suspended swirl of silk, or on the tail of a previous capsule, she built up a narrow pad of silk. With short up-and-down movements, she touched the pad with her spinnerets, until a broad mass of flocculent silk was raised. In this the pressure of her abdomen, with up-curved tail, made a spoon-shaped hollow. She changed her position often, head up, then head down, until a boat-shaped receptacle was formed, into which her curved abdomen fitted beautifully.

On April 6, at 9 p.m., a spider had just hollowed her mass of fluffy silk into the desired shape. Wishing to photograph the cradle in this stage, I tried to remove her, but, without hurting her, could not do so. By drawing her aside with my pencil, I could see the eggs, a glistening, opal-coloured, glutinous mass. Even as I held her, the abdomen commenced its up-and-down motion. In five minutes the eggs were screened with a thin layer of silk. In fifteen minutes the covering mound of silk was oval in shape. Once she left the sac to mend her hub and tauten a rope which my pencil had disturbed. I left her at 9.45 p.m., still adding to the body of silk that formed the lid of her precious casket. At eight o'clock next morning the sac was complete, the outside firm and waterproof. There was a new snare, and the spider was enjoying a well-earned breakfast. What an expenditure of silk after her sustained fast! I regretted having, by my carelessness, added to her labour.

On March 17 one spider was missing. Her four cocoons were opened. They contained 40, 52, 35 and 26 eggs respectively. Globular in shape, they resembled minute, creamy, seed-pearls, adhering in mulberry-shaped masses, but separating readily at a touch. They lay on a bed of softest silk. Examined again on April 26, they were no longer globular, and through their trans-

lucent, covering membrane great changes could be traced. On June 11 the spiderlings had emerged, and one of my most puzzling problems was partly solved.



D.—Snare of *Arachnura higginsii* Koch. No attempt has been made to reproduce faithfully the delicacy of the spider's wonderful work, nor the complicated foundation lines. Both would be quite beyond my skill. The drawing merely indicates the position of the cocoons, with the spider beneath.

During all these months I had seen only six male spiders which appeared to be in any way associated with the busy little mothers. Each was no more than 2 mm. in length, little larger than the head of a pin when, with legs folded, it "shammed death". The clubbed palpi were evident. The nearly spherical body was not elongated into a tail. Each hung in a tiny circle of irregular radii and spirals on the outskirts of the lady's domain. The disparity in size and shape seemed incredible, though there are records of even more startling differences in size of the sexes. Though I believed that these agile nidgets were the mates of the

tailed spiders, I saw nothing to confirm my view. The diminutive males swung themselves down to within half an inch of the females, but always retreated swiftly, as if in alarm.

One evening a more daring one approached a mother many times, retreating just as often. At times he was, close enough to touch her side, but it was obvious that he dared not linger. The mouth and legs of the mother were engaged with a larger fly than usual. It is possible that he, too, was hungry. I visited the snare at intervals during the evening, and each time I found him actively making advances and retreats. Next morning he was in his accustomed place, well away from the danger zone. It seemed a strange partnership. I saw nothing to suggest that harmonious relations existed between them. By the end of March, all the males had disappeared. Subsequent observations, however, have strengthened my belief that these nudgets were the males of *Arachnura higginsii*. Most newly-emerged spiderlings closely resemble the parents, except in size. In all the hundreds of spiderlings emerging from the tailed spiders' egg-sacs, the abdomen is spherical, without any elongation. In some an obtuse point at the apex is apparent. In others there is nothing to indicate a future "tail". I assume that the latter are males, but, as the clubbed palpi are not fully developed until the last moult, I have no means of definitely distinguishing the sexes.

The resemblance to the agile dwarfs that haunt the outskirts of the snares partly confirms my view that the males of *Arachnura higginsii* are without the elongated abdomen, and that elongation in the females takes place gradually, "after emergence". In support of this latter opinion, in March I found, in a tiny curled leaf attached to one of the snares, the shed skin of a female, perfect in every detail, but with a much shorter tail, showing no "trident" on its apex. These views are again partly confirmed by the opening of a further string of five cocoons.

The lowest (last constructed) was full of perfectly-formed, but feeble, spiderlings, showing little movement. Legs and cephalothorax were translucent, milky-white. The spherical abdomen was of a deep cream, and the apex showed neither boss nor point. In the next sac the spiders were pink, older and more active. The eight gem-like eyes were prominent. In some a very rudimentary tail was indicated. In others it was not apparent. From the three upper (older) sacs the spiderlings had vanished.

Three days later the apices of many abdomens had lengthened into definite, but short, tails. Others are still spherical, or almost so. At this date, June 23, many of the mothers are emaciated, and make but feeble snares. Others hang in an almost lifeless condition below the cocoons, and are without snares. Several are already dead, and a few have disappeared. It seemed miraculous that any of these delicate spiders could survive the

severe hailstorms of June 17, yet at the end of the day fifteen were clinging to their sacs, without a trace of snare, extended legs forming a sharp triangle, from the apex of which drops of water hung. Emerging during the coldest months of winter, the chances of survival are slight. The sacs, suspended from leaves of deciduous trees, no doubt find shelter where they fall. Here the spiderlings possibly wait for propitious weather. In the garden, rose-hedges and many shrubs appear to have provided sufficient protection to ensure the survival of a greater number than is usual.

In February I received a letter from a Kenderup (W.A.) naturalist, telling me of his interest in a similar spider, which had made its home in a shade-house roofed with melaleuca twigs. The egg-sacs were camouflaged with leaves, "giving the effect of a fallen twig". In this shelter he had about fifty under observation, which certainly suggests the survival, under favourable conditions, of a big percentage of these curious spiders.

Editorial Note.—Mrs. Coleman's article should foster interest in home garden dwellers that afford a wide field for observation. Every garden contains many spiders, whose life histories are but little known, and some species with remarkable habits that perhaps have never been recorded. The tailed spider dealt with in the preceding article is a common form in our suburban gardens, though often overlooked. Nearly a score of examples of *Arachnura hugginsii* have been observed in an hour's ramble around a small garden at Elsternwick. The curious strings of cocoons frequently are found pendant from Manuka bush twigs and those of Kunzeas.

Among other spiders frequently met with in gardens, and a record of whose habits would be welcomed for publication in *The Naturalist*, are the communistic *Uloborus* species, the Leaf-curler (*Araneus wagneri*); the Wolf Spider (*Lycosa godfreyi*); the beautiful little Jumping Spiders that hunt their prey on flowers; and other kinds. An attractive by-way of nature study invites explorers.

A book on the Australian Finches by Mr. Neville W. Cayley, is announced for publication by Messrs. Angus & Robertson, Sydney. It is intended for both naturalists and aviculturists, and will contain many colour plates, together with descriptions of the different species and accounts of their habits as wild birds and in captivity. Another book, to be published by the same firm, deals with Australian Butterflies. The author is Dr. G. A. Waterhouse, co-author with Mr. George Lyell, a member of our Club, of a notable scientific work on these insects. The forthcoming book is of a popular nature. It will be illustrated by colour plates, figuring all the species painted by Mr. Cayley from specimens selected by the author.

BLANDOWSKI.

By T. IREDALE and G. P. WHITLEY.*

Just after the first gold was discovered in Victoria, money, *real* money, was available for many purposes for which it is now not easily procurable. As instance, to our astonishment and envy, we read that £2000 (two thousand pounds, gold) was voted for the investigation of the natural history of Victoria. Little in the way of results from this great expense appear on record, but search in various musea and libraries have unearthed some curious information which seems worthy of recall.

An unknown adventurer, named Williant Blandowski, was the leader of the party which was granted the £2000. His "expedition" started from Melbourne on December 6, 1856, and almost immediately, through bad leadership or other unknown difficulties, began resolving itself into its elements. In a week or two the party had travelled few miles and had been reduced man by man, so that Blandowski reported that altogether he had hired eighteen men, and only two had been with him the whole period. One of the latter was Gerard Krefft, later Curator of the Australian Museum, whose manuscript account of the journey, in the Mitchell Library, Sydney, though incomplete, is the best we have traced.

The party passed Keilor, and crossed Deep Creek by a bridge where, a few years before, Krefft had encountered obstacles on his way to and from the gold diggings. A jilbing horse caused several delays, but the little expedition persevered, crossed the Keilor Plains, and, turning to the right at the Gap Inn, went to Sunbury, Lancefield, and Mount Macedon, where a natural history collection was made. Krefft now became expert at cooking parrots, cockatoos, and 'possums. After some trying experiences, the party crossed the Dividing Range, and, often travelling over rough country in the dark, celebrated Christmas Day, a Tuesday, on the Campaspe River, which joins the Murray at Echuca, where the Murray Cod, the Platypus, and the Beaver-Rat were noted. Here bush fires were an added annoyance. Blandowski, Krefft, and Batchelor, the taxidermist, were the only members of the party, the others having refused to make the journey or resigned at an earlier stage.

The dwindled expedition was robbed of supplies by a half-caste blackfellow as it followed the course of the Campaspe, and suffered setbacks from rough country, unbridged rivers, bush fires, and general misfortunes, until the members reached Maiden's Station, where they were hospitably received. Here Krefft noted

*Contribution from the Australian Museum, Sydney.

the Blood-stained Cockatoo and the Sulphur-crested Cockatoo in swarms.

The Terrick Hills and Mount Hope were next sighted, and signs of natives seen. The party camped, on January 28, at Gardner's Station, about ten miles from the Murray River, and were soon surrounded by blackfellows, who built their *mis mis* in the vicinity. The natives collected wallabies so fast that Batchelor could not skin them all, and Blandowski set the blacks to work to skin some of them, which they did in an unsatisfactory way. Krefft did much of the hard work of the camp, and was also cook and baker; but he sketched many natural history objects. Flies were so plentiful that he could only use one hand when working, "for the other had enough to do to prevent these indefatigable tormentors from depositing their ova in my eyes". Specimens were dropped into a keg of arrack, a number, referring to a catalogue, being attached to each one. At Gunbower, as the camp was called, some reptiles and Bettongias were caught, and a young joey came to an untimely end by getting between Krefft's blanket and the ground—the next morning they found it "as flat as a pancake".

At night, Krefft acted as amanuensis to Blandowski, an arduous task with the temperature in the 'nineties and only melting tallow candles for illumination. An independent excursion was made by Krefft to Mount Hope, and collections also were secured around McDonald's station. At Pyramid Hill, he saw Emus for the first time, and also encountered two men suffering from *delirium tremens*. Almost all the marsupials and birds collected were eaten by Krefft and his blacks, because provisions ran low. One large Emu was preserved, although an aborigine cut away a large piece of skin from the breast. The bird's carcase was cooked and eaten, "the meat was well baked and juicy, though rather coarse".

On February 12, 1837, Batchelor and Krefft left with specimens, including thousands of shells, for Echuca, and then went on to Forrest Creek Pound for some of the expedition's lost horses. Batchelor was discharged and replaced by James Menson at Gunbower, and a scholarly traveller, H. Weitenan, also joined the party. "Of fishes no new forms were found at Gunbower, and except a few specimens in spirit none were preserved for the collection."

The party left Gunbower on March 1, arriving at Reedy Lake on the 5th, where Krefft and Weitenan collected some objects determined by Blandowski as freshwater sponges, then a novelty to the Australian fauna. On March 7 the party had a "holy day" at Lake Boga, where another collection was made. A snake was caught here, and Krefft remarked: "As the specimen in question was to all appearance a Death Adder, supplied with a poisonous sting on the end of the tail, I did not like to take it up"; also that

"every snake or part of a snake, however mutilated, will live until the sun goes down, and though the neck had been cut through this snake lived till evening". A description and sketches are included in Krefft's MSS., as Blandowski thought the Death Adder was a new species. At Lake Boga, a Darter or Snake Bird was shot by Mr. Tullk, another member of the expedition. Lake Boga was noted as being of a uniform depth of about eighteen feet and as communicating at times with the Murray River. A boat was sailed on the lake, but no specimens were obtained from it.

The manuscript account ends at Lake Boga, but to it Krefft has added a "List of Eggs collected on the lower Murray and Darling during the month of February at Gunbower, near Mount Hope".

A picture of Blandowski's camp on the Lower Murray River is given in the *Illustrated Melbourne News*, Feb. 6, 1858, p. 65. His party arrived there on April 6, 1857, and left for Adelaide, August 6, 1857. Sketches which were executed by Gerard Krefft are in the library of the Linnean Society of New South Wales (*Abstr. Proc. Linn. Soc. N.S. Wales*, June 14, 1920), and include etchings of aborigines and marsupials, upon which Krefft contributed a paper to the transactions of its forerunner, the Philosophical Society of New South Wales (*Transact.* 1862-1865, pp. 357-374).

The only published account of Blandowski's expedition is a short report in the *Transactions of the Philosophical Institute of Victoria*, Vol. ii, for 1857 (publ. 1858), pp. 124-137 (pp. 131-134 omitted), in which are references to huge collections made and deposited in the National Museum, Melbourne, where some still persist. In one place Blandowski mentions that he brought back 28 boxes and parcels of about 16,000 specimens, registered under 2000 different numbers, after having travelled 1300 miles. In another place he mentions that 3000 insects were delivered to the Museum, and notes about 19 different forms of fish (about which more hereafter) "living in the waters of the Murray and Billibong".

Referring back, we find in his "Personal Observations made in an Excursion towards the Central Parts of Victoria . . ." in *Trans. Philos. Soc. Vict.*, i, 1855, p. 50, the explanation, as there he tells us that the Victorian Government had conferred upon him the honour of assisting in the formation of a museum of Natural History, and of reporting upon the physical character of those parts which, in the execution of that mission, he should happen to visit. Again, we read on page 64 of his observations: "Six hundred species of birds have already been discovered in Australia, and about half of these, viz., 300, are inhabitants of Victoria. In the National Museum are about 230 species (with an equal number of duplicates), and when we consider that the

institution has been scarcely eight months in existence, we have no reason to be ashamed of the progress made when a comparison is drawn with the museums of our sister colonies". These observations of Blandowski's were read on October 21, 1854, so the museum must have been founded in February, 1854. Apparently this is the first time that now well-known institution was named the National Museum, as on p. 203 of the *Transactions* cited it is called by Brough Smyth the "Museum of Natural History, Melbourne". In Heaton's *Austr. Dict. Dates*, part 2, 1879, p. 166, we read that ten years later, on May 1, 1864, the *National Museum* was opened in the building it then occupied.

Recent writings (Dickison, *Emu*, xxxi, 1932, p. 192) state that the National Museum, Melbourne, originated in a small collection of specimens made under the direction of the Surveyor-General, Captain Andrew Clarke, and that the collection was removed to a building at the University in 1856, two years after which Professor Frederick McCoy was appointed Director. In 1862 the collection was removed to a National Museum building in the University grounds, and after the death of McCoy, in 1899, taken to a building in the Public Library block, being transferred to the present position in Russell Street in 1906.

From his short accounts, it becomes obvious that Blandowski was a man of parts, as throughout, notwithstanding a little ego, there is considerable evidence of his great ability. The number and variety of animals collected, the time occupied, and the distance travelled are sufficient to stamp him as a successful worker. Yet, through unknown influences, his labours were discounted, and he was apparently so aggrieved that he returned to his native Europe. Wonderful projects were in his brain, and these are only now the mood of speculation, as seen in a portfolio of plates labelled "Australia Terra Cognita" in the Mitchell Library, Sydney. The whole natural history and ethnography of Victoria was to be dealt with in great detail and illustrated with excellent plates, many of them fine landscapes, from drawings made by Blandowski himself.

"An Interesting Item" about Blandowski was placed on record by Gregory M. Mathews (*The Austral Avian Record*, v, 5, June 1, 1927, pp. 101-102), who wrote: "While in Berlin in October (2nd-7th), 1925, Dr. Stresemann showed me some drawings of Australian birds, done by William von Blandowski. Most of the plates were paintings, and many birds on a plate, signed in ink 'G.M., 1861'. These plates were numbered 99 to 110, of which two are printed, the remainder being originals. The two plates have 'Birds of Victoria' engraved on them, one showing Cockatoos (with movable crests) and the other eggs. The two plates were engraved by Redaway & Sons, Melbourne. The paintings signed 'G.M.' were by G. Mütsel, the famous German

painter. His plates are superior to the two done by Blandowski himself."

Mathews relates further details of Blandowski, and lists his scientific contributions, including "*Australia*, in 142 photographs, etc., 1862". What this last item is we do not understand, especially as photography was not in evidence in Blandowski's days. The plates in the Mitchell Library portfolio are practically all from engravings by Redaway & Sons, Melbourne, and bear numbers from 1 to 124. There are missing, however, Nos. 3, 5, 10-14, 17-20, 22, 25-27, 30-37, 39-40, 42-69, 72-100, 102-109, 111-115, and also apparently 125-142. Another complication then arises: the Berlin plates of birds are numbered 99-110, all being originals save two, which are, in the Australian printed set, numbered 101 and 110. The latter are by Blandowski, and it looks as if Mütsel had redrawn the other plates, making up the 99-110 from Blandowski's drawings, as the series would seem to have been mapped out in the rough to get the numbers. The "*Australia*, in 142 photographs, etc., 1862" would apparently cover all these; but where was this issued in 1862, as Blandowski was back in Germany, and the engravings are apparently mostly unpublished Melbourne prints? Those of the Mitchell Library set are all of quarto size, and sum up thus:—Nos. 1-16 (or 20) are headed Geological Views in Victoria or South Australia; 21-38 (or 40), Fossils of Victoria or South Australia; 41 (? to 60 odd), Vegetation of Victoria; 70-71, Fishes of the Murray River; (72-100) [Zoological subjects?]; 101 and 110 are of Birds of Victoria and birds' eggs, while 116-124 are of Aborigines of Australia.

The plates of birds and birds' eggs are shown in both coloured and uncoloured states, and plate 101 is headed "V. Cockatoos", so that these would begin at 97, not 99, as now shown in Berlin.

A very comprehensive account was thus projected, covering Geology, Palaeontology, Botany, Ichthyology, Ornithology, and Ethnography, and we see, from the *Transactions of the Philosophical Institute of Victoria*, Vol. ii, 1857 (1858), p. 135, that drawings of frogs, lizards, and snakes were prepared, so the quadrupeds would doubtless be included.

The two quarto fish plates are of some interest, as they comprise the four octavo plates which were to have accompanied Blandowski's article in the *Trans. Philos. Soc.* for 1857. When we turn up that volume, however, we find the plates and several pages missing, and an inserted slip explains: "NOTE. Pages 131 to 134, inclusive, with four Plates, are omitted from this volume of the *Transactions*, by an order of the Council, of date 7th April, 1858." Blandowski was on the Council, yet there is no record of a council meeting of that date in the Proceedings. The suppressed portion of the article is explained to some extent by Castelnau (*Proc. Zool. Acclim. Soc. Vict.*, i, 1872, p. 31), who

wrote: "A rather curious anecdote is told of this production. The author had, according to the custom of naturalists, dedicated several of the sorts to leading members of the Society; but some of these gentlemen are said to have taken as an insult what was most probably intended as a compliment, and the letterpress and plates already engraved were withdrawn and destroyed before distribution."

One complete copy, however, is stored in the Public Library of Melbourne, bound in *Victorian Pamphlets*, Vol. cxxxv, and we are indebted to Mr. R. D. Boys, former Chief Librarian, for a copy of the missing pages and plates. Only fishes are dealt with, and 19 figures of 15 genera of Murray fishes are shown. Many new scientific names are proposed, and it is interesting to note among this fine collection made by Blandowski two fishes which have not to this day been recorded from Victorian waters. The first is a little Chanda Perch, called *Pseudoambassis castelnaui* by Macleay, who described it from the Murrumbidgee River, New South Wales, but the National Museum has further Murray specimens. However, as the name *Pseudoambassis* is preoccupied, we propose that this little fish be called Blandowski's Perchlet, and made the type of a new genus *Blandowskiella*, in honour of its true discoverer, and known as *Blandowskiella castelnaui* (Macleay). A fresh-water Hardyhead was given a new name by Blandowski, which had it been published, would have rendered *Craterocephalus fluviatilis* McCulloch unnecessary, but now that species may be added to the Victorian list. Originally described by McCulloch from New South Wales localities, and later recognised from South Australia, this species is evidently distributed throughout the Murray River system.

The 19 figures of fishes may now be given a modern classification:—

Plate.	Fig.	Vernacular Name.	Scientific Name.
1	1	Freshwater Catfish . . .	<i>Tandanus tandanus</i> (Mitchell)
1	2	Bony Bream	<i>Nematolosa richardsoni</i> (Castelnau)
1	3	Silver Perch, young . . .	<i>Terapon bityanus</i> (Mitchell)
1	4	" " adult . . .	" " "
2	5	" " half-grown . . .	" " "
2	6	" " young . . .	" " "
2	7	Blandowski's Perchlet .	<i>Blandowskiella castelnaui</i> (Macleay)
2	8	Freshwater Hardyhead .	<i>Craterocephalus fluviatilis</i> McCulloch
2	9	Australian Smelt . . .	<i>Retropinna semoni</i> Weber
2	10	Freshwater Sunfish . . .	<i>Melanotaenia nigraus</i> (Richardson)
3	11	Spotted Mountain Trout	<i>Galaxias truttaceus</i> (Cuvier)

Plate. Fig.	Vernacular Name.	Scientific Name.
3 12	Jollytail	<i>Austrocobitis attenuatus</i> (Jenyns)
3 13	Murray Cod, adult	<i>Muccullochella macquariensis</i> (Cuv. and Val.)
3 14	" " young	<i>Muccullochella macquariensis</i> (Cuv. and Val.)
4 15	Macquarie Perch	<i>Macquaria australasica</i> Cuvier and Valenciennes
4 16	Big-headed Gudgeon	<i>Philypnodon nudiceps</i> (Castelnau)
4 17	Carp Gudgeon	<i>Carassiops klunzingeri</i> Ogilby
4 18	Chequered Gudgeon	<i>Mogurnda adspersa</i> (Castelnau)
4 19	River Blackfish	<i>Gadopsis marmoratus</i> Richardson

This is an imposing list, and shows the skill and ingenuity of Blandowski as a collector. He also gave native names and field notes, but space prevents us from detailing these here. A genus of marine fishes has been named *Blandowskii* in his honour (*Austr. Zoologist*, vi. 1931, p. 329), and the present tribute to that naturalist will, it is hoped, raise his name from its present obscurity. We do not know where or when he was born, his nationality, or where he died. Krefft remarked that Blandowski spoke English poorly, with a German accent, and had been a soldier, evidently in the Schleswig-Holstein hostilities about 1850. His only literary efforts, so far as we know, after he left Australia (2 via Cape York and India) were a couple of papers in the *Schles. Gesell. Jahresh. Akad. Nat. Vereins zu Breslau*, Germany, 1860. We should appreciate any further information about Blandowski which may be forthcoming from our Victorian confrères, who are invited to communicate with us at the Australian Museum.

The Secretary to the Exhibition Trustees (Mr. G. C. Green), in a letter to our Club's President (Mr. J. A. Kershaw), writes:—"May I, through you, thank the members of your society who have shown such interest and given my trustees such support in their efforts to re-establish the Aquarium and bird aviaries in public favour. Much has already been achieved in improving the Aquarium, and this is in no small measure due to the individual efforts of the members of your society already referred to. Very comprehensive plans for improvements and extensions are in hand, and any assistance which your society as a whole may give would be much appreciated. With a view to overcoming the mortality among marine specimens arrangements have been made for the freighting of two hundred tons of water from the Southern Ocean, and it is hoped that with this pure water in our reservoirs it will be possible to keep specimens for a much greater length of time than has been the case hitherto. With regard to the bird aviaries, these have already been greatly extended, and a definite programme for further extensions laid down. It is hoped that eventually the aviaries at the Aquarium will house perhaps the most notable collection of birds in Australia".



Lesser Flying Phalanger or "Sugar Squirrel" (*Petaurus breviceps*)

From a painting by Mrs. Glover Flower

THE LESSER FLYING PHALANGER ("SUGAR
SQUIRREL").

By DAVID FLEAY, B.Sc.

That beautiful little creature, the "Sugar Squirrel" of bushmen, and Short-headed or Lesser Phalanger (*Petaurus breviceps*) of the naturalist, is well known and very common in both heavy forest and open bush country throughout the eastern part of Australia. Rivalling the larger and uncommon Squirrel, Flying Phalanger, in beauty, this very efficient nocturnal glider is one of the hardest of our arboreal marsupials. In this respect the species contrasts very strongly with the Greater Flying Phalanger and also with the Pigmy species.

Certainly when one has kept the "Sugar Squirrel" in captivity and suffered keen bites from its long piercing teeth, one is able to appreciate the spifire temper concealed in these beautiful little creatures. The sharp claws may also cause painful scratches, and in white-barked Eucalyptus country where these Phalangers are found, the innumerable fine marks on the trunks are indications of nocturnal "landing" places.

During the past ten years I have kept upwards of forty of these small Phalangers in various enclosures, though never more than fifteen at once, and the fact that in all this time not one of them has died speaks well for the constitution of the animals. All, with the exception of those in captivity at present, have lived to be returned to their own natural haunts, though a tragedy attended the liberation of one small family. On a perfectly still night, in the forest between Ballan and Daylesford, other Lesser Flying Phalangers were running about in the overhead trees when the captive animals were released. During the night occasional sounds of disagreement, sharp droning screams, with an abrupt rise and fall, floated down to the camp; but in the morning we found the small body of a dead Phalanger almost at our feet. There were tooth marks in its neck and the unfortunate little creature was almost certainly one of those which had so recently been returned to its haunts. The evidence in this mysterious happening seemed to place the blame on its wild relatives.

Before describing the habits of this small volplaning Phalanger, I should explain the coloured plate, from a painting by my mother. Her work on this and other marsupials has been carried out under considerable difficulties, for, naturally, all these nocturnal animals dislike the daylight intensely and they either curl up into a furry ball or climb excitedly all over the place in search of a dark retreat. Taking advantage of the presence of various marsupials—my captives—during the past few years, my mother has put much untiring effort and enthusiasm into faithful representations from life and the result has been very successful. This is the first of several of her paintings to be reproduced in *The Naturalist*.

The painting gives an excellent idea of the form and colour of the "Sugar Squirrel" and it is a curious fact that many individuals have a pure white tip to the tail. Specimens obtained from far eastern Victoria generally are longer furred and even more beautiful than those which inhabit such places as the Kinglake, Ballarat and Ararat districts. The daylight retreat is usually a hollow limb, high or low, in which a large mass of leaves forms the nest. The home may even be the deserted nest of a Ring-tailed 'Possum. However, all the nesting sites of the Lesser Phalanger possess a characteristic in common, and that is the smell, which is quite distinctive.

Two or three animals may live together, or a much larger number, consisting apparently of the original pair and also mature young ones which have remained with their parents for several seasons. Near Bendoc, in eastern Victoria, I found such a family. Rambling through the bush one day I happened to notice a small hole low down in the white trunk of a Manna Gum (*E. viminalis*). It had a well-worn appearance and a number of soft grey hairs clung to the tiny entrance. Blocking this "doorway" with a handkerchief, I cut into the lower side with an axe and brought out no fewer than a dozen "Sugar Squirrels". In this large family there were about five adults, a number of immature, but well-grown animals; and, finally, a very small infant which had just outgrown its mother's pouch. The month was January, but the breeding season on Monaro is later than in the lower country, thus accounting for the presence of a number of young marsupials at this time. The leaf nest in the hollow was very large, having apparently been added to for several generations; and the smell was almost unbearable.

Some years ago I was fortunate in observing, in a large cage, the actual nest-building methods of the Lesser Phalangers; and in the moonlight the lively little creatures were scurrying round the branches and up a big swing in the centre. One or two had the tail curled round green leaves and, as I watched, they entered the small holes to their nesting boxes, taking the new material inside. Later, the most fascinating part occurred when two others were observed hanging upside down by their hind feet biting leaves off the gum boughs (small branches were supplied occasionally so that the animals might amuse themselves stripping off the bark) and transferring these, by means of the fore-paws, to the tail, which was then twisted about the bundle. Thus loaded, the Phalangers ran lightly along the branches and into the nest.

These marsupials are not leaf-eaters, but observing the long, piercing incisors and also the way in which they occasionally gnaw their way out of a cage, one understands readily that they find little difficulty in chewing into the tender wood of young branches, seeking the inner tissue. A good deal of insect food is taken and the blossom of flowering trees is sought over long distances. With



Female Lesser Flying Phalanger, with young endeavouring to re-enter the pouch.

Photo: D. Fleay.

their marvellous gliding powers and active movements, these small animals are wonderfully fitted for hunting over a considerable area by night.

Early this year (1932), when standing quietly beneath a small tree near Flowerdale, I happened to be watching a splendid Brush-tailed Phascogale in the clear light of the full moon. The nearest trees to this small flowering group were at least 50 yards distant, but as I remained perfectly still, with one arm resting on the trunk, there occurred a sudden crack and something touched my arm. A rapid scampering on the bark of the tree followed and there, ascending with light ease, was a "Sugar Squirrel" which had just arrived from an aerial journey. Higher up it actually had the temerity to pursue the Phascogale. Imagine it—a mere Flying Phalanger harassing one of the most bloodthirsty little flesh-hunters found in the bush!

It is not difficult to understand the reason for the bushman's name, "Sugar Squirrel", for such food as jam, sugar and honey is eagerly taken by the little Phalangers; sometimes even within a few moments of being caught. When jam tins are emptied we always leave them in the cage overnight, and there is little doubt about the thoroughness of the "lick-out"!

But, with the exception of the sweet tooth, so common among almost all marsupials, there is a wide departure in diet between the Lesser Flying Phalanger and such confirmed leaf-eaters as the Ring-tailed 'Possum and Greater Flying Phalanger.

In vocal accomplishment the "Sugar Squirrel" is one of the most versatile members of the rather quiet marsupials, and it possesses a variety of calls. That most often heard is a shrill yapping grunt or bark, uttered on still nights. Almost invariably the presence of a campfire in the bush causes the little creatures to commence this call. It is also given on moonlight nights, seeming to indicate curiosity or a warning of possible danger, and the Phalangers remain perfectly still while uttering these deliberate grunting calls. Another note or series of notes is uttered in moments of disagreement or when one attempts to handle the animals, and this sharp, droning scream commences full and loud, rapidly running down to a few faint grunts. Everybody who has suffered the painful wounds from the teeth of this Flying Phalanger will remember this angry scream, which seems to be an inseparable accompaniment of biting. Finally, among themselves, "Sugar Squirrels" use a quiet, almost inaudible series of hissing cries which are probably a persisting relic of the immature or baby stage. Even the youngsters, however, possess amusing little screams of their own. The quiet hissing cries are occasionally heard from the nest in which the Phalangers curl up together during daylight.

Though variety is the keynote of the voice of the Lesser Flying Phalanger it differs very greatly from *Petauroides*—the largest of

these volplaning marsupials—in the absence of the sudden startling shriek so common in the tall timber country where the big animal is at home.

In southern Victoria, the young ones seem to be brought forth generally in July, and the usual number is two. Remarkable to relate, recently a Lesser Flying Phalanger in my collection gave birth to two embryos (July 15), and at night she may be observed to pause in her rambles, sit in an upright position and hold the pouch entrance open with her fore-paws as she carefully licks the tiny pink infants.

The gestation period is very short and the little ones at birth are more active and practically twice the size of embryo native cats (*Dasyures*) at a similar stage. Otherwise there is little to choose between them.

Developing at a comparatively rapid rate, the infants grow a covering of short fur when nearly two months of age, and very soon after this they become too large to be nursed in the pouch and simply lie with the parents in the nest. Their eyes open soon after the desertion of the pouch and when four months old they begin to rely on their own resources, though still remaining members of the family. Up to this stage and beyond it—even when quite large, these beautiful young Phalangers will cling tenaciously to their mother's fur with tooth and claw when danger threatens. The species seems to have few natural enemies which cause depredations in its ranks, with the exception of owls.

At one time when "Sugar Squirrels" chewed a hole unnoticed in the top of a very large cage, fifteen of them escaped, and for a fortnight before ten were recaptured they made merry in our garden, gliding from tree to tree at night and generally visiting their old cage in search of honeyed bread and milk. Tragedy overtook one or two which entered the lofty enclosure of a Boobook Owl and family, and I remember the shock of finding, early one morning, a satisfied Brown Owl drowsily surveying me with head on one side while in the toes of one foot he grasped the hind-quarters and tail of a "Sugar Squirrel"!

In conclusion, it would be fitting to picture the atmosphere in which these bright-eyed animals play about when night has descended over the forest. Perhaps the home is an old dry warrior of the bush dominating the surrounding forest, and out from some small crack in the tree, comes the "Sugar Squirrel" family, one by one.

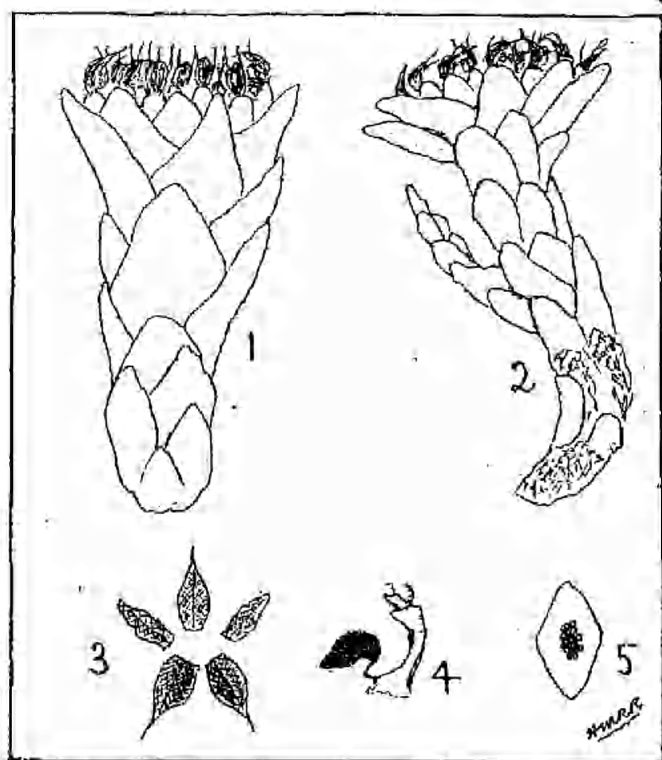
Scurrying along, with occasional halts for a languid stretching of their membrane-fringed limbs, they eventually arrive at the extremity of some old gaunt branch. Appearing to meditate for a space, one of the small creatures noses the air in front of him with sensitive ears twitching back and forth. Then impulsively bunching together and leaping forth, away he glides swiftly down and along into the darkness. The rambles of the night have begun.

A NEW AUSTRALIAN SUBTERRANEAN ORCHID.

By the REV. H. M. R. RUPP.

It will be remembered that three or four years ago botanical circles were stirred by the discovery, in Western Australia, of an orchid which apparently passed its whole life under the surface of the soil. To many people it seemed incredible that a flowering plant should adopt such a habit, but all the specimens subsequently found have confirmed the conclusions first arrived at. So unique was this plant that Dr. R. S. Rogers, who described it under the name *Rhizanthella Gardneri*, was compelled to erect a new sub-tribe in the orchid family (Rhizanthellinæ) to receive it. It was anticipated that even in a family subject to such vagaries as the orchids, the unique character of *Rhizanthella* would probably remain unchallenged. A rival, however, has appeared on the opposite side of the Australian continent, more than 2000 miles in a direct line from Corrigin, the scene of the Western Australian discovery.

In November, 1931, Mr. Ernest Slater, of Bullahdelah, N.S.W., was preparing to dig up a few roots of the Flycynth Orchid (*Dipodium*) for a friend in Maitland. Scraping away a mass of decaying debris from the base of the plants, he caught sight of a curious object, like the withered head of a composite flower. Investigating further, he found it to be the top of a small plant resembling the scaly tip of an asparagus shoot, only very much thicker. Except for the withered flower-head, which was on a level with the actual surface of the soil, but concealed under the mass of debris, the plant was wholly subterranean. Mr. Slater suspected it to be of orchidaceous character, but thought that it might be a *Dipodium* which had been subjected to some strange deformity. He sent it on to his friend as a curiosity, and the friend sent it on to me for an opinion as to its character. Despite the fact that the little composite flowers were long past maturity, a few minutes' investigation served to convince me that a discovery of first-rate importance to orchidology had been made, and that the Western Australian *Rhizanthella* could no longer claim to be unique. I immediately asked that a search for further material be made, and within a week Mr. Slater and Dr. H. L. Kesteven, who co-operated, sent four more specimens. In three of these the flowers were in an advanced stage of withering, and the seeds were ripe. The fourth had flowers only recently past maturity. By judicious handling, I was soon able to make out all the essential parts, although, naturally, some of the details cannot be made out until perfect flowers are available. I have described this remarkable plant in the current issue of the *Proceedings of the Linnean Society of New South Wales*, under the name *Cryptanthemis Slateri*. I had previously sent one specimen



1, 2—Plants of *Cryptanthemis Slateri* Rupp, showing the “heads” of more or less withered flowers. Approximately natural size.

3—Sepals and petals. Enlarged.

4—Labellum and column, enlarged. At the top of the column can be seen the remains of the anther, and the two curious appendages, which are absent in the W.A. *Rhizanthella*.

5—Cross-section of the irregularly-quadrangular ovary, enlarged.

to Dr. R. S. Rogers, who at once confirmed my view of the character of Mr. Slater's plant.

The accompanying figures will give a better idea of the plant and the structure of its flowers than a verbal description. It fits into Dr. Rogers' new sub-tribe, with the exception that the segments of the flowers are all quite free. Dr. Rogers suggests that it would be preferable to amend the description of the sub-tribe on this point, rather than to erect another new one for a plant having such obvious affinities with *Rhizanthella*. I have, therefore, included it in *Rhizanthellinæ*. Notwithstanding the affinities, however, the Bullahdelah orchid cannot possibly be regarded as a species of *Rhizanthella*, but is sufficiently distinct to constitute a separate genus. Details of the outstanding differences are given in the Linnean paper alluded to above.

All the specimens were found in close association with the roots of *Dipodium punctatum*. From this fact two things may be hoped:—(1) That the association is not merely fortuitous, otherwise the discovery of further material may be very difficult; (2) that the desire to find *Cryptanthemis* will not lead to wanton damage to the roots of the beautiful Hycinch Orchid. It is most desirable that further specimens of *Cryptanthemis* should be discovered, with living flowers, but care should be taken to avoid injuring *Dipodium* during the search. I imagine that the best time to investigate will be as soon as *Dipodium* shoots are observed above ground. The nature of the ground where the discovery was made is barren and stony, on the lower slopes of the Alum Mountain.

THE STINGLESS BEES OF AUSTRALIA.

By TARBTON RAYMENT.

6. THE FINDING OF A NEW SPECIES.

I have a correspondent in the far north-west of the Commonwealth, at Wyndham, and a short account of his unusual locality, together with the results of his activities, may not be altogether uninteresting. My friend, Doctor Webster, is in charge of the hospital.

Well, I was anxious to have some bees from such a remote district, so I wrote to my friend, asking him to fill in any spare moments that he might have by collecting a few honey-gatherers.

I then discover that the doctor has to overcome certain disabilities in his quest. There is the heat, for example. The contents of a bottle of chloroform, placed in the cellar, vanish like magic.

There is very little air circulation, for the town is built at the apex of a long inlet of the sea, and at the foot of the encompassing hills that press so close there is only space for the main street between the rises and the water. A passage through the hills serves to let the cattle travel to the coast, and affords to the residents of the township a gateway to the vast, unknown interior of the north-west.

"The bush"—that is, the trees and all the many species of flowering plants—are a few miles inland, say, eight or ten. Of course, in the summer, which is the rainy season, travel is exceedingly uncomfortable; but when the rains are over, and the "bush" bursts into bloom, the doctor and his wife travel outback in his motor car to hunt for bees.

He obtains a number of extraordinary forms, and adds several genera to the fauna of his great State. There is the great Carpenter-Bee, *Xylocopa*; strange leaf-cutters that do not look like *Megachile*, and also a new species of the social bees. In this paper I must confine myself to *Trigona*; the others will be described else-

where. Doctor Webster collected ten species of bees, eight of which were new to science.

Trigona websteri, sp. nov.

Worker. Length, 5 mm. approx.

Head wide, bright, finely punctured, with numerous appressed short white hairs, black; face-marks confined to a dull-white spot at the bases of the anterior orbital margins; frons large, shining, with numerous appressed white plumose hairs; clypeus black, shining, with a light-amber median spot and a small, triangular, dull-white mark laterally; supraclypeal area with a sub-triangular, dull-white mark; genae with numerous short white hairs; labrum dull white; mandibulae black basally, reddish apically, with a median pale-amber patch; antennae fulvous beneath, darker above, scape with white stripe anteriorly.

Prothorax black, with dull-white patches; tubercles dull white; mesothorax black, bright, with even, minute puncturing, a few white hairs, and fine, narrow, creamy line bordering the lateral margins; scutellum creamy-yellow, except for a bracket-shaped median dark mark, a few long white hairs; mesothorax with a scale-like sculpture and a small, depressed median area; abdominal dorsal segments black, polished, the hind margins with a narrow band of lineolate sculpture, six creamy-white, with a few white hairs; each ventral segment with a fringe of long, white, curled hair forming a good scopa.

Legs black, with white hair, a pale dot on the anterior knees; tarsi slightly lighter; claws reddish-brown; tegulae and axillae testaceous; wings hyaline, iridescent, anterior 4 mm., the apex of the radius obsolete in some specimens, the other nervures amber, and more or less obsolete; pterostigma pale-amber, with a darker margin; hamuli six in number.

Locality.—Wyndham, North-western Australia (U. N. Webster, M.D., 25th January, 1931).

Type in the collection of the author.

Allies.—Very close to *T. cockerelli* Raym., which is itself close to *T. cassiae* Ckll. The first has a more convex clypeus, and lacks the median dot; the scapes are not so pale; hind margins of the abdominal dorsal segments broadly light-reddish, and the basal one lighter; lighter legs with paler hind tarsi; much less hair on the disc of the thorax; the metathorax has a depressed area running down to the petiole. The yellow markings of this species are darker.

T. cassiae has shorter scapes, but a much longer flagellum; no median clypeal spot; abdominal dorsal segments covered with a lineolate sculpture, a large amount of yellow on five and six; much yellow on legs; darker tegulae, axillae, nervures and pterostigma. The species is dedicated to the collector, Doctor U. N. Webster, of the Wyndham Hospital.

Synopsis of the Workers.

Black, without yellow face-marks.

1. Worker—Length, 3.4 mm. approx.

Shining; face and pleura below tegulae covered with short, scale-like, white hair; antennae very obscurely lighter beneath.

Trigona carbonaria Smith.

2. Worker—Length, 4 mm. approx.

Shining; face and pleura with short, white, scale-like hair; disc of mesothorax with pale hairs among the black ones; antennae with a little red basally and apically; difficult to separate from the species.

Trigona carbonaria angophorae Cockerell.

3. Worker—length, 4.5 mm. approx.

Shining; face with more white hair; scutellum with much coarse black hair; flagellum a clear red beneath; larger than 1.

Trigona hockingsi Cockerell.

4. Worker—Length, 4.3 mm. approx.

Shining; face with white hair; scattered punctures on each side of ocelli; tibiae with long black hair; antennae picuous beneath. Doubtful for Australia.

Trigona canifrons Smith.

5. Worker—Length, 4 mm. approx.

Shining; face with white hair; clypeus anteriorly, antennae and legs rufotestaceous; abdomen brownish; there seems to be some doubt about this species.

Trigona laeviceps Smith.

Black, with yellow markings.

6. Worker—Length, 4 mm. approx.

Face with white hair; scape, elevated scutellum; sides of mesothorax and tubercles all testaceous; abdomen brownish, with white hair at apex. Doubtful for Australia.

Trigona cincta Mocsary.

7. Worker—Length, 5 mm. approx.

Light, creamy-colour face-marks; pale band on scutellum; pale margins on mesothorax laterally.

Trigona cincta percineta Cockerell.

8. Worker—Length, 4.5 mm. approx.

Antennae blackish above, flagellum fulvous beneath; two minute dots laterally at anterior margins of clypeus; a crescentic cream mark on supraclypeal area; cream tubercles; two cream dots on scutellum; mandibles maber.

Trigona symei Rayment (in MS.).

9. Worker—Length, 4 mm. approx.

Mandibulae, labrum, clypeus, and lateral face-marks, tubercles and scutellum all yellow; abdomen brownish.

Trigona essingtoni Cockerell.

10. Worker—Length, 4.5 mm. approx.

Scutellum with an interrupted creamy-yellow band, and dark, fuscous hair; tubercles yellow.

Trigona cassiae Cockerell.

11. Worker—Length, 4 mm. approx.

Clypeus reddish; abdomen fuscous, apex with white hair.

Trigona australis Friese.

12. Worker—Length, 3.7 mm. approx.

Mandibles yellowish; scape orange; scutellum and metathorax dark reddish-amber; legs black; abdomen honey-colour. A variety from Cape York has dark scapes. *Trigona wybenica* Cockerell.

13. Worker—Length, 5 mm. approx.

A dull-white spot at base of orbital margin; yellow band on clypeus dilated laterally; scutellum largely yellow; lateral margins of mesothorax yellow; legs black. *Trigona cockerelli* Rayment.

14. Worker—Length, 4.5 mm. approx.

Clypeus with more white hair than 13; yellow markings very indistinct. (Male has yellow scutellum and postscutellum, and three yellow bands on apical segments of abdomen.)

Trigona cockerelli ornata Rayment (in MS.).

15. Worker—Length, 5 mm. approx.

Clypeus with a median pale dot; all markings dull-white; long scapes, but short flagellum; tegulae and axillae testaceous; no pale hind margins of polished smooth abdominal dorsal segments, but each has a narrow area apically of lineolate sculpture; legs black; scutellum largely yellow.

Trigona websteri Rayment.

Amber-coloured species.

16. Worker—Length, 3.6 mm. approx.

Antennae blackish-brown; abdomen light-amber; legs amber; yellowish hair.

Trigona melipes Friese.

CORRECTION.

Page 43, June issue. No. 8, in explanation of Figure 1, should read:—Tarsal claw of the Beetle.

The study of Australian sea-slugs is being pursued by Miss Joyce K. Allan, Assistant in Conchology, Australian Museum, Sydney, who will contribute a paper on the group to *The Naturalist*. A colour plate, from the original painting by Miss Allan, will accompany the paper, which should prove of great interest to Club members. The scope, in Victoria, for work on sea-slugs is almost limitless, for only one species has been scientifically recorded for this State. Many more must reward a keen collector of these marine creatures, and the quest is commended to our young members especially.

THE STUDY OF AUSTRALIAN MOSSES.

By G. O. K. SAINSBURY.

*(Concluded from "The Victorian Naturalist, July, 1932")*17. *Dicranella Jamesonii* (Mitt.) Broth.

This moss is reported from Tasmania, but not yet, so far as I am aware, from the Australian continent. In this genus the leaves often have a distinctly sheathing base, but in the present species it is only the upper ones that possess this character. The leaves are wide below and more or less abruptly narrowed to a long subula. Nerve broad, becoming ill-defined in the subula. Cells above shortly and irregularly four-sided; larger and laxer below. Alar cells *not differentiated*. Seta *red*. Capsule inclined and *curved*. Peristome single of sixteen robust red teeth, bifid above, vertically striolate on the dorsal face, lamellate on the ventral, somewhat papillose at the tips. Operculum beaked. Calyptra cucullate. Some species of *Dicranella* have a much more robust habit than that of *D. Jamesonii*, and the capsule is often erect and symmetrical. For practical purposes the most useful distinguishing marks in the genus are the absence of differentiated alar cells, the nerved leaves which are entire or slightly denticulate at the tips and more or less sheathing at the base, and the irregularly oblong cells. The plants are found on the ground, usually in damp places, and in quite large colonies.

18. *Dicnemon calycinum* (Hook) Schwaegr.

The Australian record of this interesting moss is uncertain, and it is to be hoped that some collector will settle the question in favour of its presence there. The stem is long and creeping, with branches of different lengths, on which are borne oppressed concave leaves. Leaves entire, narrowly bordered, *nerved*. Cells with narrow lumen (cavity), strongly *incrassate*; alars quadrate, *yellow-brown*, supra-basal ones also tinted. Seta *very short*, completely sheathed by the *long, sharply-pointed* perichaetial bracts which often exceed the capsule itself. Peristome single, of 16 red, bifid, falcate teeth. Operculum with a long fine beak. Calyptra cucullate. Spores *very large*, truncated-conical in shape. *D. calycinum* is one of the most interesting mosses in New Zealand because there exist forms intermediate between it and another New Zealand species, *D. semicryptum* C.M., which may well prove to be hybrids. *D. semicryptum* has nerveless leaves and much blunter perichaetial bracts. For purposes of comparison I have distributed it also in the packets, and as it is quite common in this country there is a possibility of its being found in Australia. Both species grow on bark, and always in substantial patches. They are easily distinguished from other mosses by the golden-yellow colour and peculiar fruit.

19. *Tortula muralis* Hedw.

There seems to be little doubt that this widely-spread moss grows in Australia, though apparently it has not been recorded from there under this name. It grows in small tufts on rock or on stone walls, and often has a hoary appearance due to the long hair-points of the leaves. Leaves oblong, entire, with *revolute* margins. Nerve continued far beyond the apex as a *hyaline hair-point* which is sometimes extremely long (as in the distributed specimens). Cells small and *very obscure* above; *oblong and hyaline* below. This type of basal areolation, combined with shortish and more or less obtusely tipped leaves, is characteristic of *Tortula* and allied genera. Seta *purple*. Capsule erect and cylindrical. Peristome single, of 32 very long brown papillose filaments from a *short* basal tube or cylinder, *spirally* twisted (hence the generic name). Operculum with slightly slanting beak. Calyptra cucullate. Over a dozen species of *Tortula* have been recorded in New Zealand, and several are common to both countries.

The present species belongs to a section of the genus, the members of which are small and have a short peristome tube. In some other species the plants are tall (often exceeding an inch), and the basal peristome tube prolonged. The leaf margin may be entire, as in the present species, or somewhat toothed above, and the nerve may project very slightly or be continued as a hyaline or reddish cusp or arista. In every case the strongly spirally twisted peristome with basal tube will serve to indicate the genus, and if fruit be lacking the before-mentioned leaf characters will be very helpful.

20. *Ulota lutea* Mitt.

Common to both countries and always found on bark. It is a tufted acrocarpous moss that will be readily recognised when in fruit by the furrowed capsules and densely hairy calyptras. Leaves yellow and curled when dry; in shape, lanceolate, from a *broadened* base. Nerve continued nearly to the apex. Cells incrassate, small and rounded above and elongated towards the base. Marginal cells below strongly differentiated into several rows of *quadrate hyaline* ones which furnish a strong contrast in form and colour with the reddish-yellow central area. This type of leaf shape and areolation is also found in the closely allied genus *Orthotrichum*, but mosses belonging there can be distinguished from our plant by the possession of stomata, which are scattered about the whole surface of the capsule, whereas in *Ulota* they are confined to the *basal* part. Seta fairly long, causing the capsule to be quite exserted (in *Orthotrichum* it is often more or less sunk and hidden in the upper leaves). Capsule narrow and *ribbed*. Stomata situated as above. Peristome of 16 pale short teeth, united in

pairs. Spores rather large, irregular in shape and size. Operculum with a straight beak. Calyptra *densely hairy*.

21. *Leptotheca Gaudichaudii* Schwagr.

I have chosen this moss for distribution because the specimens, which are barren, exhibit what is in mosses quite a common phenomenon, but one that has not been mentioned hitherto in these notes, i.e., an adaptation for asexual reproduction. In the axils of the upper leaves will be found great numbers of multicellular red-brown filaments. New plants are no doubt produced by outgrowths from these filaments when detached, but the exact process of reproduction has not, so far as I am aware, been studied in this particular case. Amongst the mosses there are numerous adaptations for asexual reproduction, such as bulbils, filaments, brittle leaves, etc., and those interested are referred to Correns's masterly treatise on the subject, *Vermehrung der Laubmoose*, where the matter is treated very completely. The leaves of *Leptotheca Gaudichaudii* are irregularly and bluntly denticulate at the apex, and the strong nerve projects in a cuspidate point. The cells are isodiametrical and more or less uniform throughout. The capsule is erect and cylindrical, with a double peristome. Operculum convex and obtusely beaked. Calyptra cucullate. This species is found in Australia and Tasmania and grows on stumps or earth. So far as the New Zealand mosses are concerned, and no doubt the same thing can be said of the Australian, there is a wide field for research in the means of propagation above mentioned.

22. *Catagomium politum* (H. & W.) Dus.

This species is common to both Australia and New Zealand, and will easily be recognised by the pale *shining* leaves which are *distichous* and *boat-shaped*, suddenly terminated by a rather long and slender acumen. There is no nerve, and the cells are throughout very long and narrow, with only a *slight* differentiation at the base. Fruiting plants are rather uncommon, and in the distributed specimens the sporophyte is immature. The seta is reddish, and the capsule horizontal or sub-erect. Peristome double. Outer teeth pale yellow, densely horizontally striolate on the outer face and lamellate within. Processes hyaline and keeled, and cilia well developed. Operculum conical, with a short, slanting beak. Calyptra cucullate. *C. politum* is usually found on tree stumps or forest loam.

In connection with the foregoing notes, it should be mentioned that circumstances have not permitted the distribution of a number of species that would have been more characteristic of the New Zealand mosses than several which have had to be chosen. It will be readily understood, too, that in a flora consisting of about 300 species and 150 genera, anything like a representative selection

would have been impossible. Some beautiful and interesting mosses have had to be omitted because at this season of the year the material was not available in a suitable condition for study. It is hoped though, that enough has been done to stimulate interest and afford some help. In conclusion, I should like to emphasise the importance for a beginner in this study of not yielding to discouragement if progress is at first rather painfully slow. Cryptogamic botany in Australasia has very few followers, and the path of knowledge is by no means strewn with roses. I think, though, that anyone taking up the mosses or hepatics in Australia will be amply repaid ultimately by the additions he is sure to make to the local flora and by the interesting discoveries that reward the pioneer.

A NEW METHOD OF PRESERVING FOSSIL LEAVES.

Fossil leaves, in many of our Victorian tertiary deposits, crumble away or otherwise deteriorate on drying. The following method of preserving specimens is much more effective than the usual methods of sizing, vaselining or varnishing.

The process here described consists in steeping the matrix with the leaves in linseed oil and has given most satisfactory results. The fossils are dipped in the oil. The finer the grain of the rock the longer the soaking required. A very fine silt takes about 30 minutes or longer, whilst a coarse sandrock is given about one or two minutes. The specimens may be damp or dry. After the soaking they are baked in an oven for about 30 minutes. All that is required is an ordinary household oven, and the temperature equivalent to that which will bake dough, but not brown it.

The result of this oil-hardening is a horny product which allows every detail to be preserved faithfully. Even the structure of the leaves remains intact. In the baking process a much higher temperature can be used than that indicated, but care is required since hastening the process deepens the colour of the oil.

If the specimens are not properly hardened with one treatment they may be done a second time with no ill effects. Especially delicate fossils may be air-dried by adding a teaspoonful of litharge to a pint of boiled linseed oil and steeping the fossil in it. By this method the fossils harden in about 14 days.

A good experiment is to mix 20 parts of sea or river sand with one part of oil and bake it. You will learn a lot and not spoil anything.

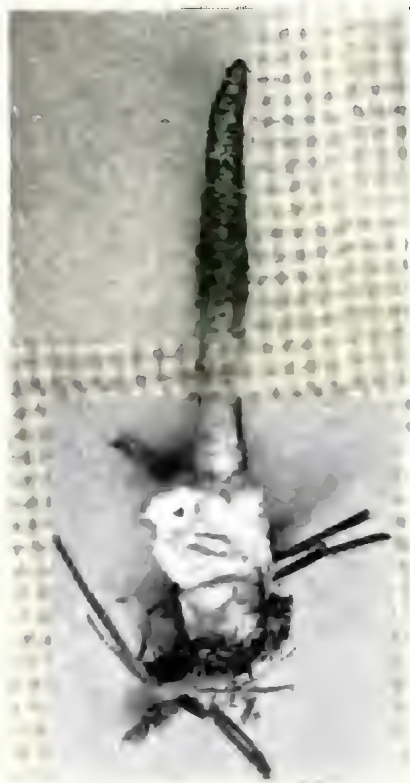
W. HANKS.

Contributions for *The Naturalist*, in the form of nature notes, are desired—original observations, not excerpts from newspapers or other journals. Where possible, MS. should be typewritten. Country members especially are invited to forward items of general interest.

NOTES ON *MUTINUS BORNEENSIS* CESATI.

By E. MCLENNAN, D.Sc.

A close search of a buffalo-grass lawn at this time of the year may reveal a fungus sufficiently unlike the more commonly occurring toadstools as to arouse interest and to create a desire to understand something about this curious little plant. A member of the Club—Mrs. E. M. Eaves, of Caulfield—was fortunate enough to

*Mutinus borneensis*

find it, in June, in her lawn. She dug up one specimen and photographed it to show its various parts, with such excellent results that the photograph has been reproduced in this issue of *The Naturalist*. Many different names have been associated with this fungus, but it has recently been shown that all of them must give place to one bestowed upon it in 1879—*Mutinus borneensis* Cesati. The type specimen was found in Borneo, hence the origin of the specific name.

M. borneensis is a Phalloid and a close relative of the "crinoline fungi", some of which were described in a previous issue, so that reference to that note will help the reader to understand its structure. The photograph is of a mature specimen and shows the remains of the "egg" at the base, which has been ruptured by the elongation of the stalk-like receptacle carrying the viscid spore mass or gleba on its upper part. The recep-

tacle is pitted, white below, but salmon-pink to red above; this difference in colour is well suggested by the photograph. Close examination will also reveal the roughened character of the coloured apical part, in this specimen extending half-way down the receptacle, over which the spores, suspended in an olive-brown slime, were distributed. When the "egg" has just burst this slime or gleba is said to have a musty smell. The red colour of the

receptacle and the smell of the spore slime serve to attract insects or slugs, which feed on the viscid mass and so distribution of the spores is effected. The more flamboyant genus—*Diclyophora*—of our previous note has, in addition, a beautiful "veil", which hangs down round the sterile part of the receptacle. *Mutinus* lacks this veil, but in most other respects resembles the "crinoline fungus".

The photograph represents only the fruiting stage of the plant, the vegetative part lives in the soil in the form of fine microscopic filaments or hyphae. Some of them tend to become compacted together into strands or cords, some of which can often be seen at the base of the egg when the "fruit" is dug out.

Every specimen of *M. borneensis* that I have personally examined has been found growing amongst a buffalo-grass lawn and although this association may not be absolutely constant, it is nevertheless a striking one. The Phalloids, as a group, are not of economic importance, although one member has been recorded as the cause of a root-rot of sugar cane in Hawaii, and another has been recorded in Australia on the roots of couch grass (*Cynodon dactylon* L.), but whether or not there is any organic connection between *M. borneensis* and the buffalo grass remains to be demonstrated.

The following notes are by Mrs. Eaves:—

The fungi appeared on June 9. There were four, three growing within a few inches of each other, the fourth being isolated. They were not erect, but leaning over. Plus eight lens showed many small holes in the succulent basal portion of the growth, and myriads of tiny grey insects hurrying to and fro as if on business bent. The translucent white part of the fungus near the ground soon became pink. This colour deepened till, at a line of demarcation, the tissue became a deep pinkish-red, and rugose externally. In shape, the fungus was rounded and elongated, becoming somewhat distended before tapering to a blunt end, with a circular aperture. On digging up a plant, the growth was seen to arise from an opaque white sac full of clear, gelatinous material. The measurement over all was $3\frac{1}{2}$ inches, including the $\frac{1}{2}$ of an inch occupied by the sac.

Dr. McLennan writes that this will be the egg of a Phalloid closely related to *Mutinus borneensis*, but from its size it may not be the egg of that species. After photographing, an incision over the darker part revealed a mass of material in appearance like wet pounded sponge; also, continuous with the little white point above, a small, round, white body running the length of the incised sac. Dr. McLennan tells me that the brownish material is spore mass, and the little white body, fungoid growth.

ORCHID NOTES AND NEW RECORDS.

By W. H. NICHOLLS.

Prasophyllum Archeri Hk.f.

An exceedingly interesting form of this species was collected recently near Maryborough, Victoria, by Mr. A. H. Chisholm, of Sydney. The specimen, with about half its buds as yet undeveloped, suggested a sturdy specimen of *Pr. despectans* Hk.f.; but the labella, owing to their very small size, were difficult to define—in fact, to see this segment, a flower had to be removed from the spike. I kept the specimen in water until the buds had developed, noting the very pronounced drooping habit of all. Colour of flowers, pale yellow with conspicuous red and inconspicuous green markings. Though but a solitary specimen has been collected, it is such a remarkable form that I suggest for it a varietal name (*Deirdrae*, in honour of Mr. Chisholm's little daughter):—

Prasophyllum Archeri Hk.f., var. *Deirdrae*, n. var.

Differt a typo: flores nutantes: Labellum parvum.

Maryborough, Victoria: A. H. Chisholm, April, 1932.

Prasophyllum Morrisii Nicholls: This species has been discovered at Creswick by Master "Dick" Bond (April, 1932): a new record for north-west Victoria. Creswick is "only just" within that subdivision.

Chiloglottis reflexa Cheel, and *Corysothos unguiculata* R.Br. Both new south-west records. The former reported numerous. Gorae, via Portland (Murray Holmes), May, 1932.

Spiculaea Huntiana F.v.M. Abundant near Harrietteville, north-east Victoria, though not a new record for that portion of the State; yet interesting in being an additional locality for a curious species. The other north-east locality is Cravensville, a third locality in Victoria being the Pyrcere Range (south Victoria). Collected by D. Matthews (Curator, Footscray Gardens), January, 1932.

Pterostylis obtusa R.Br.: Two interesting specimens of this greenhood were forwarded from Upper Macedon by Miss J. Anderson. One suggested an intermediate form between *Pt. obtusa* and *Pt. decurva* Rogers. The galea, in its fore part, was much decurved, the prolongation at the dorsal sepal being fully $1\frac{1}{2}$ inches long, those of the conjoined sepals also about the same length. In other respects it resembled R. Brown's species. The other specimen showed all the segments brief—about $\frac{1}{2}$ inch in length—(the prolongations). Stem-leaves well developed, $1\frac{1}{2}$ inches long, ovate and oblong-ovate in shape. It is interesting also to record the radical leaves of this district, of larger size and very deeply hued as opposed to the delicate-looking ones from the Dandenong Ranges.

OUR RARER ORCHIDS.

By W. H. NICHOLLS.

(6) *Pterostylis truncata* FitzGerald.

This autumn, Greenhood is rarely observed *in situ*. In certain localities, during favourable seasons only, is it plentiful, and usually, few flowers reach maturity; in very dry seasons there are none at all. This has been the experience since its discovery by the writer and a friend (Mr. F. J. Bishop), for the first time in Victoria, on the You Yangs Range, in April, 1924.

Pt. truncata is unique; someone has labelled it "The Dumpy Greenhood"! The flower is large indeed for such a (usually) low-growing species. The enormous expansion to the fore part of the galea gives it quite a "topheavy" appearance. Since its discovery in Victoria, it has been found in a number of districts within a radius of some 40 miles of Melbourne (S.W. and S.), and one locality at least, but five miles from the city proper. Especially is it abundant in the vicinity of Comadar; one of those few handy spots where terrestrial orchids still abound, under almost primeval conditions. Late in April and early in May are the best times to view it.

Pt. truncata produces seed very freely. A visit to its haunts during July and August is, after good seasons, always rewarded by a harvest of ripened capsules. *Pt. truncata* is gregarious to a considerable degree; large colonies of plants are common in many places; plainly is it seen they increase also by the vegetative process, their adventitious roots many inches in length. The radical leaves are of various types; there seems to be no end to the character of these rosettes (see figures). Like other Orchids, *Pt. truncata* has its variation. The dorsal sepal varies considerably in length and degree of acuteness (varying examples are figured). The short truncate ending—from which the species name is derived—is rarely seen, usually it is acuminate.

The following particulars from Victorian specimens are supplementary to the original description by FitzGerald [*Aust. Orch.*, Vol. I, Part IV, (1878)]. *Pt. truncata* FitzG.: A dwarf species 5-17 cm. high; stem leaves 2-5 cm., narrow-lanceolate, or lanceolate (occasionally ovate), acuminate; flowers large, solitary (in occasional specimens, two-flowered), translucent white with very fine green and prominent light red-brown veinings, which become deeper and more pronounced towards the fore part, about 4 cm. from ovary to tip of galea; fore part of galea widely expanded; dorsal sepal usually exceeding the petals by 2-6 mm.; apex acute or acuminate, rarely truncate; lower lip very narrow-cuneate, the filiform points erect, exceeding the galea by about 3 cm.; petals falcate, truncate; labellum Indian red or brown, varying in shape, but usually lanceolate, tip varying from acuminate to mucronate;



Specimens of *Pterostylis truncata* Fitzgerald, showing various forms of radical rosettes and (below) variations in the shape, etc., of dorsal sepal.

often with a tendency to a slight twist. the lip protruding well beyond the sinus of the inferior lip; column wings, each with a small, yet conspicuous spot towards the front.

Fl. April-June.

New South Wales: Paterson Valley, Weston, Klori, near Tamworth (Rev. Rupp). *Victoria*: You Yangs Range, Brisbane Range, Tottenham - Sunshine - St. Albans, Coimadai, Lara. (W.H.N., Rev. A. C. F. Gates, D. Matthews and others).

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F.N.C.V. PROCEEDINGS.

The monthly meeting of the Club was held in the Royal Society's Hall on Monday, August 8, 1932, at 8 p.m. About 130 members and friends were present, and the President, Mr. J. A. Kershaw, C.M.Z.S., occupied the chair.

CORRESPONDENCE.

From the Field Naturalists' Section, Royal Society of South Australia, asking for wildflowers for the Wild Nature Show, to be held at Adelaide in October. Resolved, that flowers be sent.

From Queensland Field Naturalists' Club, requesting Victorian wildflowers for the Club's forthcoming show. Mr. J. W. Audas agreed to have a collection made and forwarded.

REPORTS.

Excursions were reported upon as follows:—National Museum, Mr. A. S. Kenyon; Sherbrooke Forest, Mr. C. French, Jr. (in leader's absence)

ELECTION OF MEMBERS.

The following were duly elected:—As ordinary member, Mr. W. J. Trende; as country member, Miss Frances Esperson.

GENERAL BUSINESS.

Mr. F. S. Colliver was nominated for the position of Honorary Secretary by Mr. A. J. Swaby. Mr. G. Coghill seconded the nomination.

The President gave an outline of arrangements being made for the Wild Nature Show in October, and mentioned the names of section leaders.

Mr. Kenyon stated that the Forest Commission would send an exhibit, and that Mr. Commissioner Gay had also informed him that forest rangers would be allowed to collect wildflowers for the show.

Mr. E. E. Pescott announced that the Shell Oil Co. had again promised to help the Club by having collections of wildflowers for the show made in several of the States. An exhibit of special interest would be obtained from Papua.

LECTURE.

Mr. Arthur Jones gave a very interesting lecture on Victorian Orchids, illustrated by a fine series of lantern slides from his own photographs. Every genera and the majority of the species were represented.

Messrs. E. E. Pescott, G. Coghill and C. French, Junr., spoke in praise of the remarkable series of slides. Mr. Tarlton Rayment referred to the fertilisation of certain orchids by wild bees.

EXHIBITS

Mr. F. S. Colliyer.—Silurian fossils from Studley Park: Trilobite remains (?); *Ceratiocaris* sp.

Mr. S. R. Mitchell.—Crystals of *Pyrite* (Sulphide of Iron) and *Limonite* (Hydrous oxide of Iron). The Limonite specimens are pseudomorphs after *Pyrite* and formed by the molecular replacement of the sulphur by oxygen and water with the retention of the original crystal form.

Mr. G. Coghill.—Garden-grown specimens of *Grevillea rosmarinifolia*, *Thryptomene calycina*, *Tecoma australis*, *Eriostemon myoporoides*, *Brachysema lanceolata*, and *Acacia podalyrifolia*.

Mr. F. H. Salau.—Specimens of *Pterostylis vittata*, *Pt. longifolia*, *Acianthus reniformis*, and *Acacia longifolia*.

Mr. D. J. Paton.—Specimen of *Pterostylis grandiflora*, stem forking at lowest stem leaves, each stem with leaves and a flower. From Lockwood.

Mr. W. Hanks.—Fossils hardened in linseed oil; illustrating article in *Naturalist*.

Mr. T. S. Hart.—Orchids in formalin: *Calceana minor*, *Corysanthes fimbriata*, *Prasophyllum Hartii* (small samples); all from Bairnsdale district. Paintings by a member—about 1890: *Pterostylis cucullata* (Hampton), *Corysanthes unguiculata* (near Clarinda). The *Pterostylis* was placed by Baron von Mueller in his *P. Mackibbinii*, which was afterwards found to be the real *P. cucullata*.

Mr. C. J. Gabriel.—Marine Shells: *Dolabella scapula* Mart., N.S.W.; *D. gigas* Rang., Mauritius; *D. rumphii* Cuv., Mauritius; *Umbraculum sinicium* Gmel., Mauritius.

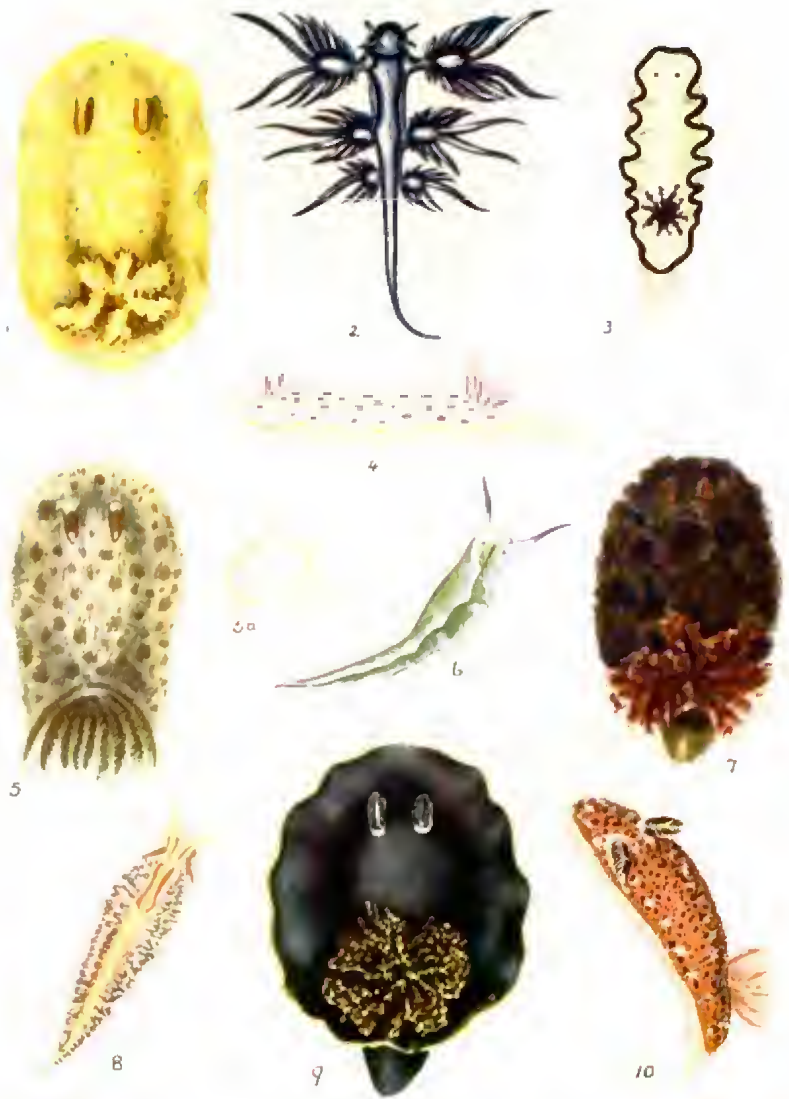
Mr. H. Stewart.—Common species of Fungi, collected in Sherbrooke Forest.

Mr. A. S. Kenyon.—Illustrations of Botany, done 100 years ago. Bunches of *Grevillea rosmarinifolia* and *G. cinerensis*, *Hakea rigida*, and *Acacia Baileyana*.

Mr. C. French, Junr.—32 species of Lichens (all sporulating), a number probably being new to science. Mosses, 15 species. These specimens will be forwarded to America and Germany to the specialists concerned, for naming; and, when named, will be returned to the National Herbarium, Melbourne, for reference and for the use of workers on these groups of plants.

Miss G. E. Neighbour.—Painting of *Pterostylis cucullata*; fossil sharks' teeth, and fossil shells, from Beaufort.

Plate VII



Joyce & Allan

Australian Sea-slugs

(1) *Archidoris staminea* Basedow and Headley; (2) *Glaucus* sp.; (3) *Casella atromarginata* Cuvier; (4) *Chromodoris festiva* Angas; (5) *Doris pantherina* Angas; (5a) Egg-girdle of *D. pantherina*; (6) *Elysia australis* (Quoy and Gaimard); (7) *Dendrodoris gunnamatta* Allan; (8) *Acolis macleayi* Angas; (9) *Dendrodoris melana* Allan; (10) *Doris arbutus* Angas.

AUSTRALIAN SEA-SLUGS.*

By JOYCE K. ALLAN,

Assistant in Conchology, Australian Museum.

There are probably few more attractive creatures in the marine world than Sea-slugs, yet no other group has been so neglected, especially in Victoria, as the Nudibranchs. Lack of literature dealing with their study is partly responsible for this neglect, for without definite information, identification and classification of even the commonest ones will prove troublesome. Added to this, they are, in most cases, of such soft, easily decomposed tissues, that the necessary preservation completely changes their shape and colour. Museum specimens rarely resemble the vivid, living Sea-slugs.

The fact that but little work has been accomplished on this group in Australia does not necessarily mean paucity of material in our seas. Extensive searching in suitable places may prove that the southern waters contain, if not quite as many as the northern ones, a good quantity of these little slugs.

Sea-slugs, or naked molluscs, as they are sometimes called, are a division of the *Gasteropoda*, one of the biggest divisions of the Mollusca. The *Gasteropoda* contains two sub-classes, one to which the spirally-coiled shells of the seashore belong, and in which the male and female have only one pair of tentacles and in which the individuals are either male or female. Those of the other sub-class have usually two pairs of tentacles, while the sexes are united, and are known as hermaphrodites. The land snail is an example of this. The latter sub-class is divided into two: *Opisthobranchiata*, having aquatic respiration, and *Pulmonata*, animals which breathe air, such as the land snails and the slugs. The *Opisthobranchiata* are again divided into two parts, of which the *Nudibranchiata*, or Sea-slugs, is one. The *Nudibranchiata* differ from the *Tectibranchiata*, or Sea-hares, in that they have a shell only in the larval stage, discarding it very early in life. The Sea-hares retain theirs always, however rudimentary it may be.

Sea-slugs are, therefore, marine hermaphrodite animals, with small, soft bodies, the largest one being not more than six inches in length. They are found all over the world, hiding away in rock crevices, under stones, or on algae in rock pools, on coast-lines where, as a rule, the bottom is firm and rocky. Where the seaweeds and corallines flourish, they congregate most abundantly, but they are often left high on rocks or mud-flats, where they await the incoming tide to take them back to the deeper water. Some are dredged in deep water, where commonly they live; and some are pelagic, crawling on the stems of floating seaweeds.

*Contribution from the Australian Museum.

Unlike most molluscs, Sea-slugs have no shell in the adult life, and it is believed that they remedy this lack of protection by hiding away, as described, or resembling in colour or marking the surroundings of the area on which they settle. In the latter case only an experienced eye can detect them. When taken from this habitat, however, their real beauty of form and colour is revealed, and they are interesting creatures to watch in captivity.

Sea-slugs are carnivorous animals, feeding on zoophytes, sponges and other small marine animals. When food was not available, some have been known to devour weaker slugs of their own species. Though they appear at intervals all the year round, and a trip to the seashore in quest of Nudibranchs is rarely quite unrewarded, they usually occur periodically in larger numbers, in the spring and early summer, coming into shallow water from the deeper zone. This is probably the breeding season, as their eggs are often found with the animals. After this they disappear, and, most likely, die, research having shown that their life history lasts not much more than a year, and usually terminates soon after breeding.

Their chief manner of travelling is a snail-like crawl, though a few have a swimming method, and all are very fond of floating inverted. When in the latter position, the animal glides along a track formed of mucus, and, being very sensitive to outside influences if disturbed, is able to drop to the bottom of a pool from seaweeds or anything else from which it is suspended.

The almost symmetrical, elongate bodies of the Sea-slugs bear on their upper surface brightly-coloured plumes and other appendages, which, besides assisting in respiration, often add to their attractive appearance. Their most outstanding feature is their colouring, which is more brilliant in the tropics than in the colder climates. Though all do not possess this vivid colouring, as a rule its range and variation is most striking, covering different shades of bright red, pink, yellow, brown, purple, blue and green tintings. Much of this brilliance depends on the colour of the food the creatures eat, and the large, bright, pigmented patches usually found on the tropical species resemble the colouring of the coral and areas on which they live. In the colder climates, the animals are paler, and spots, when present, are scattered and smaller than those in tropical forms.

The upper surface is usually extended to form a mantle round the animal, and often reaches well beyond the head and tail, even when the slug is crawling. This mantle is covered with minute granulations or ridges, protuberances, large, soft pustules, or may be quite smooth.

At the anterior end of the upper surface are two cavities, each containing a tentacle-like structure called a *rhinophore*. This may

be retracted or not, according to the species of slug. They are organs of sense, and, besides testing the quality of the water, are able to feel the presence of other like species; they also are waved at the approach of danger. On this same surface are usually the *gills* or *branchiae*, the chief means of respiration, varying in number, position, size and colour, as the case may be. In some families they are arranged like a plume in a rounded cavity at the posterior end of the upper surface, or in rows, as tufts or papillae along the sides. In other slugs they are found along the under surface between the foot and the mantle.

Some species, which have them arranged along the sides, are able to cast off their gills if handled or disturbed. Others are grown in their place, however; and, while waiting for these to mature, the animal suffers no ill-effect. When arranged as a plume, by a muscular movement in the lateral and dorsal surface, the gills can be withdrawn partly, or wholly, into a cavity. The under surface of the animal is composed of the foot, which is used for crawling. Those species with a narrow foot are usually more active than those with a broad foot. At its anterior end is a small head, with a mouth of variable size and two small tentacles.

Internally, Sea-slugs are provided with a nervous system, heart, digestive gland or liver, stomach, excretory organ and reproductive system. Situated behind the rhinophores, on the upper surface, and just under the skin, are the eyes, small organs, capable only of distinguishing light and dark.

The Sea-slugs do not appear to be intelligent creatures, or to be useful beyond serving as food for other marine animals. Being non-swimmers generally, they have not the power of self-levitation, and excursions to the surface of the water have to be made by the aid of outside agency, such as seaweed; but once there, they move about freely. The more sluggish species of Sea-slugs remain practically unadorned, flat, soft, inactive, though often attractively-marked animals; the active ones, on the other hand, grow appendages and branchiae freely, and seem to spend a more roving existence.

Their eyes being useless for protection, some Sea-slugs further safeguard themselves by giving off a distasteful mucus from their papillae; or, if distasteful to fish, by having some warning colour. Others, when handled, cast off, in a strange manner, their mantle in a complete ring, leaving the central portion of the body only, which appears to live for some time after this loss.

The eggs are laid in spiral coils or ribbons, on suitable spots among rocks and algae; laying occupies about one and a half hours. They are contained in minute capsules, in a perfectly transparent mucus envelope, and are produced in enormous quantities; many do not mature. Hatched about fifteen to twenty days

after the eggs have been deposited, the young larvae develop rapidly. On emerging from the egg-girdle, they swim freely through the water by means of two ciliated lobes, and have their bodies covered with a small, operculate shell. Very early in its life the larva breaks this shell, and continues to grow without it.

Sea-slugs are divided, roughly, into two kinds, the *Holohepatica* and the *Cladohepatica*. The former are those in which the liver is not ramified in the integuments, and, with few exceptions, includes the more or less sluggish animals of oval shape, rarely possessing any body appendages other than tubercles. The *Cladohepatica* have the liver much branched or divided and contained in the integuments and body appendages. These animals are active and slender, with numerous conspicuous body appendages.

The *Holohepatica* slugs form the largest number of families and genera, and are the ones more likely to be found in Australia. The most important family of these is the *Dorididae*, consisting of numerous genera and species, many of which have not been found in Australian waters. Known usually as *Dorids*, they are the most symmetrical in shape and the largest in size of the naked molluscs.

They are easily recognised, and distinguished by their moderately-flat, soft bodies, the surface of which may be smooth or warty; the branchial plume is at the posterior end, or, sometimes, the centre of the upper surface, where, in the case of the former, it can be retracted or not into a cavity; this cavity, containing the plume, is sometimes raised for protection or divided into lobes, which are able to converge over the retracted gills. The mantle forms a cloak round the animal, and varies in width; the head is between the foot and the mantle, and is provided with a mouth and two oral tentacles.

The *Dorids* are mostly sluggish animals, roving little except in the search for food, and often remain wedged in rock crevices or under stones in rock pools; very often they assume the shape of the crevice where they live. They are sometimes found left by the tide on high rocks, or burying themselves in, or crawling about on, mud-flats at low tide. Their food consists of coral and zoophytes, among which they live.

The chief genus found round Sydney and southwards is *Chromodoris*, in which the species are small, slender, brightly-coloured animals, with a small mantle, and the tail and head exposed when crawling. The branchiae and rhinophores generally shrink at the approach of danger, but do not completely retract. The *Chromodorids* are found between tide marks, crawling over weeds or in shallow water under stones. Their mantle margin is usually outlined with a bright, contrasting colour, and the body is often spotted with another bright colour.

It is possible that search for Sea-slugs will prove this genus to be common in Victoria, as, although there is no record of it from that State, in literature, it has been found in South Australia and Tasmania, and is common in southern New South Wales. One *Chromodorid*, often found around Sydney (*Chromodoris festiva*), is white, with a pale yellow border to the mantle and carmine spots scattered over the surface. The rhinophores and gills are purplish-rose coloured. A search in the waters of the southern State may reveal, if not this one, a close relative.

Another little *Dorid* (*Doris arbutus*), commonly called the Strawberry Dorid, because of its likeness to that fruit, is red with small, black spicules covering the surface in irregular patches. It is found crawling over stone or algae in rock pools, and has been collected far down the south coast of New South Wales, sufficiently close to the Victorian border to suggest that it may occur there.

Another genus which will probably be found in Victoria is *Dendrodoris*. Although this genus is confined to tropical seas, as a rule, many of its smaller species have been found in New South Wales and South Australia, and probably it occurs in the State between. The *Dendrodorids* are extremely soft, sluggish creatures, their surface often covered with soft, blister-like pustules. They are recognised by their large, bushy gills, which generally reach beyond the mantle at the sides and posteriorly. They may be found on estuarine mud-flats, *zostera* flats, or under stones in rock pools.

There are several other genera, somewhat similar to those already mentioned, differing, in some cases, only internally, which are quite likely to be met with on the Victorian coast-line, as they occur in the waters of other southern States and in Tasmania. Time and combined efforts of enthusiastic collectors will prove this.

The *Cladohepatica* Sea-slugs are those in which the liver is divided, or branched, extending up into the processes of the integument which are arranged along the sides of the upper surface of the body. The animals show great variety of form and colour, and are extremely active in their movements, while their dorsal appendages are brightly coloured and of varying size and shape.

The most important family is the *Acolidiidae*, composed of numerous genera and species, and commonly known as the *Acolids*. The *Acolids* are a large group of small, frail, pellucid slugs. They are very difficult to obtain and preserve, and hence may be even more numerous than is supposed. Their slender, brightly-coloured, elongated bodies terminate in a thin tail, and gills are arranged along each side of the body, either as dorsal papillae or tufts,

which can be erected, moved convulsively, or even thrown off when necessary. If the latter be the case, the animal suffers no ill-effect, but is able to exist while new gills grow. This habit, however, greatly hinders the collector; what was, in its natural habitat, a beautiful little slug, with rapidly-waving, bright papillae, often becomes, when handled or in captivity, a bare body.

Most *Aeolids* have a small sac in the tips of these papillae, containing nematocysts. The sac communicates with the liver, and the nematocysts have been found to be similar to those on marine organisms upon which the *Aeolids* feed. They are taken into the liver by the animal when feeding, and are passed through the stomach and ramifications to the sac without being digested. There they are stored, and, when the animal is irritated, pass out into the water, and are capable of stinging any delicate creature.

The home of *Aeolids* is in fairly deep water, from the littoral to the coralline zone, among seaweeds, where often they are hard to see, appearing just as small pieces of jelly until removed, when their true characters are easily observed.

These *Aeolids* should be found in Victoria; they are fairly common in New South Wales; one particular orange species (*Flabellina ornata*), with blue spots on the body and dark papillae, is common around Sydney and south of the city, and may either reach the southern State or have a closely-related species there.

The little blue and white Sea-lizard (*Glaucus* sp.) may be washed up on those beaches at certain times. It will be easily recognised by its brilliant blue colouring and the peculiar branching of the slender gills, which are arranged in three pairs of arms along the sides of the body. Sea-lizards are common in the Atlantic Ocean, and, though rarely washed ashore, are often found floating, in fairly large numbers, in the open sea during a calm. Purely pelagic animals, their life is spent upon floating seaweeds, where they feed on small jellyfish of various kinds.

Unfortunately, to my knowledge there is only one scientific record in literature of a Sea-slug from Victoria. This species, *Scyllaea pelagica*, was found in Port Phillip, and belongs to the *Cladohepatica* nudibranchs. It is about one and a half inches long, and is usually of a green colour, with dark spots scattered over the surface and on four large, erect protuberances, two of which are on each side of the upper surface of the body. The rhinophores are retractile into protuberance-like sheaths, and blue spots are sometimes found along the sides of the body. The animal lives on seaweeds, and its colour probably varies in intensity to suit that of the weed on which it lives, ranging from light brown to green. Specimens of this species have also been dredged in South Australia and washed up on beaches there.

When collected, Sea-slugs may live for some days in the salt water in which they have been brought home, provided there are not too many specimens in the jar. They can be studied in comfort, and observations made upon their habits. Very often they lay their eggs in captivity, and a record of these may be obtained for the first time.

It is essential, with such soft-bodied and easily perishable animals, that some record of their colours, particularly, and their shape should be made before they are preserved, and while they are still fresh and active, as lack of food diminishes their colours and also shrinks them. Colour sketches, however rough, are, of course, the best record one could have; but failing these, colour notes of the body, gills, rhinophores and foot, with special mention of spots or contrasting markings on them, should be written with a dark pencil on strong paper, and placed, together with the name of the locality and date of collection, in the tube in which they are preserved.

No way to preserve Sea-slugs so that their colours remain indefinitely has yet been discovered. What acts with one fails with another; so we must rely upon colour notes, as true to life as possible, and then concentrate on preserving the species without unnecessary loss of colour and with little shrinkage. This is best carried out when the animals are listless; they should be placed in a weak solution, about 3-5% of formalin or 75% solution of alcohol. When these were not available, I have successfully preserved Sea-slugs in diluted methylated spirits.

When a good, low tide is at hand, journey to a suitable or likely spot for Sea-slugs; don old shoes, and wade out as far as possible. Turn over big and little stones or rocks, look on weeds and in crevices, and keep a sharp watch for any jelly-like creature that may prove to be a Sea-slug. Touch it, and if it moves put it in a jar of sea-water, where it may be easier to examine. When the tide returns, and collecting becomes no longer profitable, take your prizes home and study them.

While searching for Sea-slugs or other marine life along the seashore, collectors will possibly come across fairly large, curious-looking, soft-bodied, slug-like animals. These are usually greenish or brown coloured, with prominent tentacular processes on a pronounced head, and slimy bodies the sides of which are often produced into wing-like lobes, which open to expose the interior, and enable the animal to move by a swimming process. When handled they give off a purplish fluid, which stains the surrounding area. Beside them are sometimes noticed large, string-like masses of light-coloured eggs. These creatures must not be confused with the Sea-slugs, as they are Sea-hares, belonging to the order *Tectibranchiata*, the other division of the *Opisthobranchiata*. ~

A NATURALIST IN THE BUNYA MOUNTAINS.

By CHARLES BARRETT.

Familiar to many Queensland nature lovers, the Bunya Mountains are little known among southerners. But we are learning that the winter trip to Cairns may be varied with advantage. The Bunyas will yet rank among Queensland's major attractions for the tourist, while to the naturalist they offer an inland rain-forest, wonderful trees, bird and mammalian life of special interest, and a ground fauna that is rich in novelties.

This isolated range rises much higher than the surrounding country, and therefore receives much more rain than its neighbour hills and the plains. Up to 38 inches is the annual rainfall on the Bunya Mountains.

My visit to these "mystery mountains", as they have been called, was brief, yet so crowded with seeing that a general knowledge of the range and its wild life was gained. In July, 1932, I travelled by rail from Brisbane to Toowoomba; thence by rail again, the 53 miles to Dalby, a thriving town of the Northern Downs. The final stage, 35 miles, was a motor car journey.

Only in recent years has the way from the lowland to the mountain tops been easy. Owing largely to the work and enthusiasm of Mr. Peter Garrow, of Dalby, and the Bunya Mountains Club, a motor road to the summit was constructed. Working bees did much, and Government grants enabled road makers to be employed on the more difficult sections. After eight years, Mount Mowbullan was reached, and about £2300 had been expended upon the road. A very commendable "community effort" has helped to open up one of the most interesting areas of southern Queensland.

I was fortunate in having as my companion Mr. Garrow, who is secretary of the Bunya Mountains Club, and loves the range, of which he has an almost unrivalled knowledge. Naturalists are welcome visitors, and I know that any member of our Club who goes to Dalby will be received, as I was, with every kindness. The mayor of the town (Cr. T. Jack) gave up a day he could ill spare to take me to the fossil beds at Jimbour Creek; while Mr. Garrow, a leading business man, like the mayor, motored me to the mountains on a Saturday. I was assured that transport from Dalby would be provided, free, should we organise an expedition to the Bunyas; also that help would be given with camping arrangements. May this generous offer be availed of soon by Victorian naturalists.

In 1908 an area of 22,500 acres in the Bunya Mountains was dedicated as a sanctuary. I wandered through portions of this



Bole of Bunya Pine, showing scars where footholds were cut
with a stone axe

Photo: C Barrett.

national park, where the Bunya Pine (*Araucaria Bidwilli*) grows in thousands. This may become its last stronghold, for the timber is valuable, and Bunya pines are being felled for the mill even near the sanctuary. They are tall and beautiful trees, familiar in some of our city parks and gardens, though none of these tame specimens has the grandeur of those that dominate the forest on the mountains.

The area reserved, if one forgets the road and the trails going through it, is to-day in the same state as it was when Captain Cook made his memorable voyage along the east coast of Australia. For all time, what remains to them of an age-old realm will be guarded for the Bunya pines against forest enemies. Timber mills have already taken heavy toll of the pines on these mountains. It began half a century ago. In 1883 the big Bunya sawmills were erected, and their opening was followed by wholesale destruction of trees that until then had been safe from the axe, excepting the stone axe of the aborigines, which cut only "steps" in the boles.

For many centuries perhaps, before the new era, the Bunya Mountains had been a great resort of aborigines. From far and near—some tribes came from coastal districts 100 miles away—the blacks travelled to the ranges for the Feast of the Bunya Nuts. In March of every third year the "Big Bunya Season" was due, and hosts of natives never failed to assemble for festivities that extended over five or six weeks.

Every year the pines fruit to some extent: but the crop is most prolific only every third season. March is the peak month, when the nuts are ripe for eating. How the aborigines measured the months so accurately as to arrive among the Bunyas in March every third year we can only conjecture. Probably, as suggested by Mr. J. C. Bennie, engineer, of Dalby, distant tribes received news from those living in Bunya pine country by smoke signals. "Smokes" made on Mount Mowbullen were repeated by one tribe after another, until the good news, "Bunya nuts are ripe and abundant," had been broadcast from range to sea.

Mr. Bennie's pamphlet on the Bunya Mountains gives an excellent account of the "guarded Bunya" in those far-off days, when first the white man came and coveted the trees and the land that grew them.

"I remember (Mr. Bennie writes) my father relating that on one occasion, probably 'big Bunya season', when the Bunyas were swarming with blacks, all timber-getters were ordered off the mountains because one of the white men, in felling another tree, happened to crash a Bunya pine to the ground. Apart from this incident, the white man never suffered molestation from the blacks, although the Bunyas simply swarmed with them in March



Photo: C Barrett.

Bunya Pines—on the edge of the jungle.

of every third year, "big Bunya season." For the feast of nuts, aborigines came from the Darling Downs, Moreton Bay, the Burnett and the Dawson Rivers, and from far down the Condamine. "In fact, I heard my father say on one occasion he saw a tribe of Barcoo blacks arrive. A lean, gaunt, miserable lot they were, but they went away happy, and with skins as sleek as mice."

The blacks long since have gone for ever; the Bunyas now belong wholly to the white man. But, happily, more than 20,000 acres of the range have been saved from exploitation. Queensland has done in the Bunyas what we should have done in the Dandenongs on a larger scale. Our national parks are small compared with Queensland's, excepting Wilson's Promontory and an area in the Mallee which should be four times greater than it is, to ensure the future of the Lowan in Victoria.

The Bunya Range is portion of the Great Divide. From plain country, on the way from Dalby, one passes into dry forest among the foothills. Then the road climbs, with some steep grades, several miles to the guest house and the peak of Mount Mowbullian (3,700 feet). A feature of the range which has puzzled geologists and botanists alike, is the open, park-like area, where neither tree nor shrub will grow. There are numbers of these remarkable stretches of country; they occur in the midst of the rain-forest or jungle, give many a ridge bare shoulders, and provide playgrounds for the winds that chill one to the bones in winter-time, blowing up from the tableland. From the summit of Mowbullian a glorious panoramic view is gained; possibly none more extensive is commanded from any mountain peak in Australia. I stood there, in sunshine, but with the wind as keen as a whetted knife, gazing over the Downs. Snow had fallen on the mount but yesterday. We went down into the forest again, and saw orchids that were coming into flower. Walking among the pines to the Festoon Falls, we forgot that winter had sprinkled Mowbullian with snow; it was warm where the trail went, past cedars and palms, tree-ferns, and *Dracaenas*. And the air had that moist, leafy smell so pleasant to nature lovers—the scent of the earth in a jungle.

Along the trails, and the roadway, are felled trees around the clearings, and in the gorges I noted over a dozen species of orchids. The Orange-blossom Orchid (*Sarcochilus falcatus*), was abundant, clinging to the trunks of Bunya pines and other big trees often very lightly. Pencil Orchids (*Dendrobium teretifolium*) were numerous, too; and some branches bore clumps of the small Leek Orchid (*Liparis coelogynoides*). Ferns were an endless delight, so abundant were they, and in such variety. Some were old friends, others new to me; nearly 30 species were noted, including slender tree-ferns, graceful as the palms. Lichens,

mosses and fungi were more plentiful than ferns, and of infinitely greater variety. A wonderful place for a fungus-foray. Strangely, land shells were difficult to find, nor did I see many insects along the jungle ways. The Bunyas, though, are rich in smaller forms of life; time and patience are needed to discover the rare or undescribed spiders, beetles, and crustaceans that surely inhabit the floor of this ancient forest. *Peripatus* also is there, as it is in the Macpherson Range, which I visited before coming to the Bunyas.

Mowbullan, with its huge bald head, is the highest and principal peak of the range. The open, treeless spaces, characteristic of these mountains, have been termed "air wells," and old Mowbullan is the largest of them all. Excepting clumps of wattles, *Acacia decurrens* var. *pouchiglandulosa*, which tuft its sides here and there, the peak lacks the grace of foliage and of flowers. Grass hides the rock, of course, in many places; but Mowbullan's beauty is austere, and where the wind revels on its bald pate, is no place to linger in winter time. In summer, no doubt, it is pleasant enough, and then Nature, relenting, gives touches of colour to the peak—everlasting flowers.

The name, Moholon, I learn from an article by Mr. A. H. Chisholm (*Emu* XIX, pp. 202-15), has been held to signify "bald-headed," the peak being named after a venerable and esteemed warrior, by the assembled tribes. More than 50 species of birds were identified by members of the Royal Australasian Ornithologists' Union party, which camped on the range in October, 1919. Rifle Birds (*Ptiloris paradisea*), Regent Birds (*Sericulus chrysocephalus*), and Satin Bower-birds (*Ptilorhynchus holosericeus*), were fairly numerous, particularly the last-named species. The paucity of bird life was notable when I visited the Bunyas; and some Queensland naturalists fear that certain species really have become scarce in these mountains within the past few years. I saw neither the Rifle Bird, nor the Regent Bird.

Nest-mounds of the Brush Turkey (*Alectura lathamii*) are numerous in the scrub; and several kinds of pigeons, including the splendid Purple-breasted Pigeon (*Megoloprepia magnifica*), and the Top-knot Pigeon (*Lopholaimus antarcticus*) are birds of the Bunyas. Formerly abundant, the Top-knot Pigeon now is said to be comparatively scarce in the Range. Among smaller birds, none is more often seen, or heard, than the Yellow-eared Honey-eater (*Ptilotis chrysootis*). The Spinebill (*Acanthorhynchus tenuirostris*) is equally numerous, too. Occasionally, I heard the call of the Cat Bird (*Ailuroedus smithi*).

Hoop Pines (*Araucaria Cunninghamii*), as well as the Bunya, grow in these mountains, but the latter is the dominant species. No range has been more appropriately named than this of Southern



Coyne's Lookout on the Bunya Mountains. The treeless spaces are known as "air wells".
Photo: P. Garrow.

Queensland. From every vantage point, Bunya pines are seen, mostly in battalions. They seem to be marching up from the valleys and over the hills; they make palisades about "air-wells" and their shapely crowns form a magnificent crest on some of the ridges. The Range without the Bunya Pine would be beautiful indeed, but less distinctive. The romance of those old tribal feasts clings still to the mountains; and sometimes relics of the blacks are found. I have two stone axes that were dropped, how many years ago? One, I believe, had lain where it was found for nigh upon a century. The blacks held their huge picnics, eating Bunya nuts instead of buns! among the foothills; not where the pine trees grow. They had legends, and, the story goes, feared to stay at night up in the mountains. On a venerable tree, here and there, stone axe wounds may yet be seen.

The Bunya Bunya or Bunya Pine is a symmetrical tree, attaining a height of about 140 feet, with a stem five feet in diameter. An unbranched stem may grow to a length of 80 feet. The cones are large and heavy, and the egg-shaped seeds may measure two inches in length and one inch in breadth. The blacks roasted these nuts at their camp-fires, to which the harvest of the Bunyas was carried in dilly-bags. I've not tried them myself, but many white people eat these pine nuts, and say that they are "very nice." Though the tribesmen have vanished for ever from the scene, Bunya cones still are gathered in Queensland. A gleaner, perhaps not a harvester; and big Bunya season picnics will never again be held—unless at some play-about pageant when white men will mimic the blacks. In another fifty years, or sooner, the romance of the early days will be more alluring than it is to matter-of-fact folks to-day. Then Queensland's mystery mountains will be a tourists' paradise. Guides from the guest-houses will show parties the tree by the creek, on the way to the Falls, which I photographed a few weeks ago. Some youth, to show off, will attempt to climb the ancient tree, and win only laughter from the girls. The blacks were skilful climbers, agile and fearless, and ascended Bunya pine trees easily, using the vine-stem loop, and chopping out toe-holds with the stone tomahawk. Are not the axe-wounds there to be seen—healed more than sixty years ago, yet plain as the tribal weals on a Queensland aborigine's body?

A new species of Ring-tailed Phalanger from the Bunya Mountains has been described; but probably it is only a colour variety. When describing it from the only known specimen, Mr. E. L. G. Troughton said:—"Recent consideration of its unique habitat and of the allied forms, indicates that it may represent an extreme blackish-red form of the *Ps. laniginosus* group, characteristic of the dense rain forests of the Bunya Range."

SWAINSON'S PHASCOGALE (THE "BUSH MOUSE")

By DAVID FLEAY.

The mountainous country of New South Wales, Victoria, and Tasmania, with its damp fern-grown gullies, is the home of the active little marsupial known as Swainson's Phascogale (*Phascogale Swainsoni*), one of the smaller members of the Dasyuridae.

The "Bush Mouse," as it is commonly termed, may often be observed in broad daylight, moving along fallen logs in its characteristic jerky fashion, but the merest movement causes its disappearance in a flash. However, a little patience is usually rewarded by the sight of the small pointed face re-appearing very cautiously, to investigate the cause of the disturbance.

These brown, mouse-like marsupials, are thus by no means strictly nocturnal, and the early morning and evening are the favoured times of scurrying about in the undergrowth and along the forest floor generally. Traps set for the animals usually secure captives at these periods rather than in the actual night time when the other common little mammal of the high country—the Allied Rat—makes a "bee-line" for the bait. Searching under the bark of trees and through the profuse undergrowth for beetles, cockroaches, moths and other insects, the active Phascogales are expert climbers, extremely keen of smell and sight. Some days ago a female Phascogale was placed beneath a glass bowl during daylight, and a beetle was dropped a foot away on the table, but as it commenced to crawl away the alert Phascogale made a bound in the same direction only to be brought up short by the wall of glass. Then the beetle was imprisoned in a match box and pushed under the bowl with the marsupial. Only a tiny chink had been left open, but the little animal, scenting a tasty meal, commenced to toss the box over and over in her efforts to open it. Eventually, when she inserted her sharp little nose into the chink and pulled on the drawer with both fore-feet, the box flew open, and loud chewing indicated the work of sharp teeth on the hard body of the victim.

The nest is composed entirely of dry leaves (in every case personally observed), and these are arranged in a circular manner packed on edge to enclose a central cup-shaped resting place. These comfortable homes are usually inside an old dead limb, a broken-off stump, a wood stack, or even in the crevice between "sister eucalypts" over which a mantle of bark has fallen. The family occupying such a nest is variable. One may disturb eight or nine in one spot, including perhaps a single male and a number of females, but at other times, especially in the breeding season, solitary animals are discovered. The female Phascogale has good reason to remain away when carrying her eight or nine offspring in

the exposed pouch area, for the male animals have decided leanings in a cannibalistic direction. The male is noticeably larger and stronger than the female in this way, not showing the variation of the Yellow-footed species.

Two pairs of Swainson's Phascogales, which I have in captivity at present, are inmates of separate enclosures, for it is rarely possible to keep two males together—or two females for that matter. If it is done, the animals fight continuously, day and night, uttering their “siss”—“siss”—“siss” cries and biting each other's tails, until these appendages lose all traces of hair and resemble pieces of chewed string.

However, with a certain amount of disagreement—Phascogales



Swainson's Phascogale. A male specimen captured in the Daylesford district.
Photo: D H. Fleay.

are not happy without it—a male and female may be kept together, though it is necessary to remove the former when young ones are born.

In connection with the captive animals described, it is interesting to note that the females were caught in a Dandenong gully early this year, and in that locality the three Phascogales captured were all females. Then in early June, while in the Otways searching for *Dasyures*, four more specimens of Swainson's species were obtained, and all proved to be the larger males. This was an interesting coincide. The first “Bush Mouse” of the kind to join my collection was procured under unusual circumstances.

It was a very hot day, and wandering through the bush near

Ballarat, I came to a curious little hollow tree on the crest of a long, low range. Down a deep crack in the trunk the dim, quickly-breathing form of a mouse-like creature could be seen, but how to get it, in the absence of a hatchet, was a difficult problem. Suddenly, however, came the bright idea of making use of a Copperhead Snake, which had been bagged several hours earlier. The reptile was introduced, head first, into the hole, and suspended by the tail. Though this occurred nine years ago, I can still picture the amazing activity of the frightened Phascogale, as it shot from the nest and spiralled round the trunk, eventually being captured by a lucky hand-grab.

Other Phascogales of the species were obtained soon after this, and for several seasons families were produced and reared. The pink naked offspring (eight or nine in number) are closely attached to the teats for seven or eight weeks, and towards the end of this period the unfortunate mother is seriously hampered in her movements by the bulging infants. I have occasionally captured a female in this condition without difficulty. Life must be both difficult and dangerous for the unfortunate little creatures in this state. Then, with a coating of short fur, which appears first of all on the head region, and with eyes just beginning to open, the young ones are left behind in the leaf nest while the mother hunts for food. In Victoria the young are born either in July or August, and at the age of three and a half months they make excursions of their own, being practically independent of the parent. In the more helpless stages they utter the slow "siss," "siss" cries if taken away from the warmth of the nest. Animals of this species are not capable of giving the vigorous bite characteristic of the yellow-footed relative, and, like it, the food is not entirely composed of insects. The unattractive carcass of a dead bird or mammal in the forest is often the scene of a meeting place and nightly banquet.

The possession of an opposite extreme, a sweet tooth, is also characteristic of this as well as of other Phascogale species, and half-filled honey tins in bush huts are frequently the scene of unintentional suicide. Memories of pleasant camps in the Mount Cole Range, near Beaufort, also come to me, for here it was no uncommon thing to see, among the scattered provisions, the hindquarters and tail of a Phascogale projecting from an open jam tin as the small thief had the time of his life.

VISIT TO NATIONAL MUSEUM.

On Saturday afternoon, July 30, twenty members and some friends assembled at the Russell Street entrance to the National Museum. The President explained some of the special attractions of the Australian Ethnological Section. The party then made its way by the Picture Galleries and the Verdon Gallery of Glass and China to the Polynesian and Melanesian Gallery, where the remainder of the afternoon was spent in inspecting the various specimens of primitive culture and art.

A.S.K.

RECOLLECTIONS OF THE REV. DR. WM. WOOLLS.

By WALTER S. CAMPBELL.

INTRODUCTION.

The writer of this article, Mr. Walter Scott Campbell, is, in my judgment, the outstanding link between the present day and the "romantic boyhood" of Australian natural history. A son of Dr. Francis Campbell (notable Sydney medical man of the 'forties and 'fifties), W. S. Campbell was born in New South Wales in June, 1844, and is thus in his eighty-ninth year; yet his step remains brisk, his voice is still hearty, his writing is firm, and his mind as clear as that of a normal man of middle-age. Indeed, I have never met a man who retained such a remarkable detailed memory of events of his youth and early manhood as Mr. Campbell does. It has been a boon, this memory of his, to the Royal Australian Historical Society, for which Mr. Campbell has written many illuminating papers, and of which he is a Fellow. Australian botanical students have reason to be grateful to Walter Campbell for the work he did in conjunction with Dr. Woolls, Baron von Mueller, Wm. Carron, R. D. Fitzgerald, and (later) J. H. Maiden; but perhaps his chief service to his country was that rendered in the capacity of Director of Agriculture in New South Wales. He was virtually the founder of the Agricultural Department in this State, and his reports on rural districts and primary industries stand as models of their kind. Mr. Campbell is now living quietly at Vaucluse, hard by Sydney Heads, where he spends most of his time tending a charming garden and writing articles on botanical, agricultural, and historical subjects.

A. H. CHRISTOLM.

In the year 1855 it was considered desirable by my father that I should attend Mr. Woolls' academy at Parramatta, for the reason, I think, that my father had formed a high opinion of that gentleman, and his method of imparting instruction. At any rate, I was packed off, without the faintest idea that I was destined to spend two or more of the happiest years of my life at that school.

Mr. Woolls arrived in the colony from England, where he was born, in the year 1831, when he was appointed one of the masters to "The King's School," which had then been recently established at Parramatta, in George Street, where the old building is still standing with but few alterations. Mr. Woolls remained at that school for four years, after which he joined the Sydney College. Soon after the King's School was removed to its present building, Mr. Woolls decided to establish a private boarding school in the old house, and, I believe, from the day it started until Mr. Woolls gave up teaching, it never lacked scholars and was always well filled.

To my great joy, I soon discovered that Mr. Woolls was remarkably sympathetic and kind, not only to his pupils, but to everyone with whom he came into contact. Never once, during the whole period I remained at the school, did I know a boy to be reprimanded or punished for any offence. The boys all behaved well, respecting and esteeming their master.

Our school-room was that used by The King's School boys, having evidently been built for the purpose. It was situated at the bottom of the school-yard, between the main building and the Parramatta River. The school grounds fronted the river, which we boys patronised frequently. There had been permanent wooden desks fixed up around the inside of the building in the old days for the use of the scholars of The King's School, and these came in handy for the succeeding boys. Therein were kept books, tops, strings, fruit at times, and other valuables. We were permitted great freedom in our movements, and frequently, before breakfast, especially on cold, foggy winter mornings, had, and enjoyed, exciting races along the deserted George Street, sometimes with the large iron hoops, then in vogue, and sometimes without. Before breakfast Mr. Woolls read prayers. At nine o'clock we went to lessons in the school-room; stood up before our desks around the room; then Mr. Woolls selected a chapter from the Bible, and each boy read aloud one verse.

With one assistant-master, Mr. Woolls carried on all the instruction work, the assistant taking such subjects as arithmetic, writing, spelling, and so on, while Mr. Woolls taught us history, geography, Latin, etc. The system of instruction he adopted was, I might say, conversational, and talking over matters and giving lucid explanations of any difficulties which cropped up. I enjoyed all this immensely, particularly when he described the distribution of various species and orders of plants to explain geography, and also, to some extent, history.

At that time I had but the slightest acquaintance with botany, but I had managed to gather, imperceptibly as it were, a good deal of information about our native plants, as well as of exotic garden plants, and gardening. Botany then was looked upon by most persons as an abstruse subject, suitable for but a few to take up and study with success. However, before I attended Mr. Woolls' school, someone (I think my mother) had given a younger sister, who was also interested in flowers and gardening, a small book on botany entitled *The Pictorial Catechism of Botany*, by Anne Pratt, 1842. I managed to get hold of this, and some of the information interested me to a slight extent; and I remember well how pleased I was to discover the reason why several kinds of plants with which I was well acquainted were called "Cruciferous." By a remarkable coincidence I happened to recall the name of that little work, which I had not seen for about seventy years—nor had I ever seen another copy—and was thinking about it when, looking over a table of second-hand books, in a large library in Sydney, I put my hand on a copy in perfect preservation. It may possibly have been the identical copy to which I have referred. I purchased it for sixpence!

The information I gleaned, historical and geographical, from Mr. Woolls' graphic descriptions led to my joyfully taking home at Christmas a handsome prize for history and geography, to the surprise, I think, of my gratified parents. This also led, I feel sure, to my being awarded a prize for the same subjects, at the Sydney Grammar School, in 1859.

After school was over for the day (at 4 p.m.) Mr. Woolls frequently took a stroll in the bush in the vicinity of the town, and some of the boys, including myself, accompanied him. His wanderings were for the purpose of obtaining specimens of flowers of indigenous plants, of which there were many genera, and as I took more interest in collecting than any of the other boys, I kept with him closely and assisted him considerably. He took much trouble in endeavouring to impress on me particulars of the different flowers and the reasons for their names. He spoke also about the different botanists who had worked in Australia. He had formed a very high opinion of Robert Brown's abilities and was particularly impressed by his naming of the plants he discovered and obtained. I heard him repeat this more than once years and years afterwards.

It was gratifying to me to learn, when reading *The Life and Letters of Charles Darwin* (1887), that Darwin, who was a friend of Brown's, had also a good opinion of that botanist's work, for he wrote: "I saw a great deal of Robert Brown, 'Facile Princeps Botanicorum' as he was called by Humboldt. He seemed to me to be chiefly remarkable for the minuteness of his observations and their perfect accuracy. His knowledge was extraordinarily great, and much died with him owing to his excessive fear of ever making a mistake. He poured out his knowledge to me in the most unreserved manner, yet was strangely jealous on some points. . . . He was capable of the most generous actions. When old, weak, much out of health and quite unfit for any exertion, he daily visited (as Hooker told me) an old man-servant who lived at a distance (and whom he supported) and read aloud to him."

Sometimes Mr. Woolls visited an old lady, the widow of a (at one time) well-known artist, Mr. Alport, who taught my brothers and sisters drawing and painting, and took me with him. The house occupied by Mr. Alport was that built and occupied by Captain John Macarthur, when he founded on his farm there (named "Elizabeth Farm," adjoining Parramatta) our great and important fine-wool industry, the backbone of Australia's progress and maintenance. In the old garden were some economic plants which were planted by Macarthur—an olive tree, a Spanish cork tree, and others. These Mr. Woolls pointed out to me and described their uses and peculiarities, and I also learnt a few particulars with

regard to John Macarthur and his splendid work in horticulture, agriculture and pastoral affairs.

On Sunday mornings, after breakfast, the boys assembled in the dining-room, and sang hymns, accompanied by Mr. Woolls on a large, old-fashioned amber-coloured flute with six finger-holes and one key. He managed to get through his work, taking things easily, and we did justice to the hymns, I feel sure. We were then marched off to church—two and two—accompanied by our master, who occasionally took part in the services to relieve the clergyman. After dinner, Mr. Woolls liked to take a ramble through "General Macarthur's bush," which extended from Elizabeth Farm to Duck River, and gather any native flowers in season. Those boys who liked to ramble, including myself, always accompanied him.

On Wednesday afternoons, and nearly always on Saturdays, we were taken for picnics into the bush, far away from Parramatta. At that time Mr. Woolls was taking great interest in the Eucalypts, being indefatigable in his researches into that remarkable family of plants. He used to offer a prize of threepence to the boy who first brought him the flowers of a "gum-tree," and I rose to wealth occasionally—but soon became impoverished!

When taking his walks abroad, about town or elsewhere, Mr. Woolls looked out for men chopping wood. There were several "old hands," who were engaged at that sort of work, for wood was chiefly used for domestic purposes there. I liked to listen to the conversation concerning wood, and the frequent quaint information supplied, as to the blackbutt, mahogany, woollybutt, stringybark, bloodwood, and others that were being operated upon. Then inquiries were made from carpenters building houses as to the lasting qualities and other particulars concerning Eucalypts. Thus a deal of information was gathered, and it doubtless served a useful purpose later on, in Mr. Woolls' invaluable publications.

In speaking about plants, especially when he was not certain about something relating to them, he would say, "I must refer this to 'the Baron.'" "The Baron" seemed to be a great authority on plants, but "the Baron" seemed to be without any other name, and it was not until some years later that I ascertained that "the Baron" was Ferdinand Von Mueller, with whom I was destined to become well acquainted.

During the evenings, after dark, the boys assembled in the dining-room, where they occupied themselves, at some amusements, reading, or working at some lessons for the morrow. Mr. Woolls generally sat at a table in one of the corners, working away very hard at botanical matters; and there he remained until very late at night. A door opened from the dining-room to the family's pri-

vate sitting room, where Mrs. Woolls and her two grown-up daughters passed the time in playing the piano, or at some sort of work. Occasionally a visitor arrived, a Mr. Baly, who kept a boarding-school about a quarter of a mile from our School. This gentleman was a skilled player on the flute. He always brought his instrument with him. It was an up-to-date flute, covered with silver keys, and possessing a wonderful tone. Mr. Baly's trills and crescendos and diminuendos, with his astonishing cadenzas, were truly wonderful, and kept us enthralled at his manipulation. The door leading to the private sitting-room was always kept open during the performances for our benefit.

In 1857 he joined the new Sydney Grammar School, and, for many reasons, was extremely sorry to leave the school at Parramatta.

After the publication of his *Contribution to the Flora of Australia*, and other works, Mr. Woolls became a Fellow of the Linnean Society and Ph.D. of Göttingen, and was then known as Doctor Woolls. He was ordained in 1873, becoming "the Rev. Dr. Woolls, F.L.S., Ph.D.," and was appointed to the Episcopalian Church at Richmond. He kept up his interest in botany, and performed a deal of good work. Some years later he removed to Burwood, where I once more came into immediate touch with him. He seemed to take a considerable interest in my progress, and we kept up a correspondence until his death, in 1893.

My work involved a great deal of travelling about the country at times, and whenever possible, I collected specimens of plants for Dr. Woolls, for which he was very grateful, especially for plants common to the north-eastern coastal districts of New South Wales.

An article of mine was published in the Press, about the distribution of weeds in the Richmond River district. One in particular, a Phytolace, was making remarkable progress, and attained great size. I had named it *P. octandra*, but Dr. Woolls doubted the validity of this. It turned out to be *P. decandra*, as he expected. In November, 1888, he sent me the following letter —

Burwood, November 17, 1888.

"My Dear Campbell,

It will give me pleasure at any time to determine any introduced plants for you. A paper of mine on that subject was read before the Linnean Society some months ago, and I regret that I have not a copy to send you. We will not say anything about *Phytolacca* and *Lepidium* until specimens can be procured. I know that herbalists have cultivated *P. decandra* near Sydney, and perhaps it may have got wild. That species is decidedly medium.

With kind regards to Mrs. Campbell,

Yours very sincerely,

(Signed) WILLIAM WOOLLS.

It is many years since I determined *Erythra australis* for your father. He told me that he used it in certain stages of dysentery."

Dr. Woolls always carefully read any contributions I made to the Press, and hauled me up, so to speak, when I made a mistake; and he never hesitated to commend when he considered anything worth commending, as may be judged from the following, which is probably as kind a letter as an old pupil could possibly receive from an old schoolmaster:—

"My Dear Campbell,

Burwood,
September 8th, 1891.

I was much pleased with your letter (I should say elaborate article) on Roses, and I recognise in it some of the ability which used to shine so brightly in your poor father's papers. He never got the credit he deserved. I am glad you are assisting Mr. Maiden in developing our native flora, and in making known noxious weeds.

I see that Baron Mueller reduces *Phitotoca Richenhartiana* to *P. Australis*. There is a form growing somewhere near Bondi which had larger flowers and longer leaves. Is it only a variety?

As an old schoolmaster, you will excuse me for reminding you that *Cryptostemma* is neuter, and therefore the specific name should be *C. Colendulaceum*. Bentham writes "a" but the Baron and most of the gardening dictionaries have "um." Bentham makes a similar mistake in the specific name of *Althosperma*.

I am much better than I was, and, as you see, can take an interest in plants, but I cannot trust myself far from home.

Yours very sincerely,

(Signed) WILLIAM WOOLLS.

In these reminiscences of a good, kind-hearted man and great worker, I have endeavoured to afford some indication of the immense amount of work performed by him, with remarkable care for the benefit of science; but I fear my endeavour has been imperfect, although it may assist in some measure to keep the memory of the Rev. Dr. Woolls highly honoured and respected.

TWO ORCHIDS AND A BEE.

To the east of Melbourne, about Heathmont, during October, the lover of nature will be able to observe the pollination of two terrestrial Orchids. The species are *Diuris pedunculata* and *D. sulphurea*, both of which are widely distributed.

The viscid disc of the pollinia is so disposed that when the bee presses its head against the labellum, in its efforts to reach the nectar with its short broad tongue, the sticky material is pierced by the plumose hairs on the frons of the insect, which is unable to remove the pollinia. The disc hardens rapidly, and the lobe-like masses project in front, exactly like the pollinia of the British *Orchis morio* on the frons of the honey-bee.

The native bee responsible for the pollination is one of the earth-digging species, *Paracollates*. She has a black head and thorax, but her abdomen is a reddish-purple. The specific description of this bee, together with a lengthy detailed account, and illustrations of these orchids, are in the MS. of a large work which I hope to publish shortly. The orchids are found also in Sandringham, but they are more numerous nearer the hills.

TARLTON RAYMENT.

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F.N.C.V. PROCEEDINGS.

The monthly meeting of the Club was held in the Royal Society's Hall on Monday, September 12, 1932, at 8 p.m. About 100 members and friends were present, and the President, Mr. J. A. Kershaw, C.M.Z.S., occupied the chair.

DECEASED MEMBERS.

The President expressed the Club's deep regret at the deaths of two members, Mr. H. Whitmore and of Mrs. G. A. Kéartland.

CORRESPONDENCE.

From the Forest League, asking for the Club's support in a protest against proposed legislation in connection with the exchanging of forest areas desired for settlement for other Crown lands.

It was resolved that the Club support the League.

From the Tasmanian Government Office, offering services to members visiting Tasmania at Christmas.

REPORT.

Excursions were reported as follows:—Sandringham, Mr. G. N. Hyam; Wattle Park, Mr. V. H. Miller; South Morang, Mr. A. Proudfoot (who acted for Mr. H. N. Beck); Spring Vale, Mr. J. W. Audas.

ELECTION OF MEMBERS.

The following were elected:—As ordinary members: Mr. F. P. Dowdell, Mr. F. C. Smith, Mrs. F. B. Sutherland, Miss Ruth Coulsell, Miss F. Graham, Miss Myra M. Johnson, Dr. J. Wunderly; as country member: Mrs. R. C. Paulkner; as associate member: Mr. L. Wilson.

GENERAL BUSINESS.

Mr. F. S. Colliver was elected Honorary Secretary of the Club.

Mr. L. W. Cooper was nominated by Mr. G. N. Hyam for the position of Honorary Assistant Secretary. Mr. F. S. Colliver seconded the nomination.

BOOK FOR LIBRARY.

The President thanked Miss J. Raff for the gift to the Club of a book, *The Story of a Loaf of Bread*.

LECTURE.

Mr. C. French, junr., gave a very interesting lecture on "Native Insects that have become Economic Pests". A number of lantern slides was shown. The President, Mr. V. H. Miller, Mr. A. Proudfoot, and others, took part in the discussion. Replying to a question Mr. French remarked that Thrips would be active this year.

EXHIBITS.

Mr. J. W. Audas.—*Eriostemon lanceolatus*, French's Forest, near Sydney; *Sprengelia incarnata* (Pink Swamp Heath), Springvale, Vic.

From the Manager, Commonwealth Government Explosives Factory.—*Acacia cyanophylla*, *A. cultriformis*, *A. howittii*, *A. longifolia*, *A. myrtifolia*, *A. normalis*, *A. podalyrifolia*, *A. pycnantha*, *A. saligna*, *A. spectabilis*, *A. leprosa*, *A. linearis*, *A. resinodes*, *A. melanoxylon*, *A. stricta*, *Grevillea rosmarinifolia*, *Eriostemon myoporoides*. All grown under cultivation on Explosives Factory Area, Maribyrnong.

Mr. F. H. Salau.—*Pterostylis nana*, *P. curta*, *P. pedunculata*.

Mr. J. A. Kershaw.—Moths bred from larvae taken at Sandringham: *Hyleora incluta*, *Danimia banksiae*.

Mr. H. P. McCull.—Pounding stone, mill scraper, from Lake Bennee, N.S.W.; shrubs from Wyperfeld National Park.

Mr. H. Stewart.—Fungi collected from Sherbrooke Forest, including: *Stereum lobatum*, *Merulius cornu*, *Polyporus adustus*, *P. lateritius*, *P. stipidium*, *Polystictus versicolor*, and *Clavaria* sp.

Mr. C. Daley.—13 sp. of home-grown wild flowers.

Mr. Geo. Coghill.—Seed of "Burrawong" (*Mucrosomia spiralis*), from N.S.W.; 10 sp. of cultivated wild flowers.

EXCURSION TO SPRINGVALE.

The excursion to Springvale on Saturday, September 10, was well attended, the party numbering 40. Shortly after leaving the station we proceeded in a westerly direction, and soon were among the wildflowers, the more noticeable being *Hypoxis glabella*, *Anguillaria dioica* and *Chamaecilla corymbosa*. On heathy ground the following plants were noted in full bloom:—*Hibbertia sericea*, *H. fasciculata*, *H. stricta*, *Bossiaea cinerea*, *Epacris impressa*, *Pimelea phyllioides*, *Leucopogon virgatus*, *Ricinocarpus pinifolius*, *Correa rubra* var. *viridis*, and *Tetralochea ciliata*. Growing near the edges of swampy ground were specimens of *Sprengelia incarnata*, "Pink Swamp Heath", well out in bloom. In the moist and half-submerged places, the flowering stems of *Villarsia exaltata* and *Limnanthemum crenatum* were observed, just coming into bloom. Later we came to a fine clump of *Castuarina suberosa*, Black Sheoke, evidently reserved for shelter purposes. Several species of *Acacia* were in bloom. We noticed, with regret, that this fine collecting ground is being rapidly utilized for cultivation.

J. W. AUDAS.

THE STUDY OF AUSTRALIAN HEPATICS.

By K. W. ALBISON.

These notes are designed to be a help to those starting the study of Hepatics, or Liverworts, as they are often called, and will be on the same plan as the recent articles on mosses by G. O. K. Sainsbury; that is, there will be a general outline, followed by short descriptions of species, of which specimens will be available to those interested. Parts of Mr. Sainsbury's articles refer as much to Hepatics as to mosses, especially the section on "Methods of Study", in the April number of the *Naturalist*, and the student is referred to them to save repetition here.

The specimens may not always be natives of Victoria, but in such cases will generally be similar to Victorian plants, and the relationship will be easily seen.

Liverworts are considered to be the lower of the two classes which make up the Bryophyta, but they vary much more in their vegetative organs than do the mosses, and are easily distinguished from them. Perhaps the most obvious difference is that the capsule normally splits to, or almost to, the base, by four valves, and the capsule stalk (pedicel) is always slender and hyaline. Other general, but not infallible, differences are that in Hepatics the leaves are borne in two rows, one on each side of the stem (bilateral), and usually there is a row of smaller and differently-shaped ones beneath the stem. The leaves never have a nerve, and the two halves may be more or less folded together (bilobed), or a small lobe may be folded on to the larger lobe either above or below. The capsule has no central columella, as in mosses, and sterile cells (elaters) are present with the spores. The male organ is round or very shortly oblong—not sausage shaped; also many Hepatics consist of a flat, expanded thallus without leaves.

Liverworts frequent damp locations and shun exposure, being, as a rule, much more tender than Mosses, though less frequently aquatic. They are either frondose or foliose. The frondose ones consist of a flat, leafless thallus, which may be more or less round, but generally is elongated and sometimes large. The stem is represented by a midrib, or may be quite absent. The capsule may be permanently sunk in the tissue of the frond, when the spores escape by the decay of the containing walls (*Riccia*), or it arises from either surface or from the margin of the frond (*Anthoceros* and the frondose *Jungermanniaceae*), or it may be borne on the lower surface of a stalked, peltate receptacle, which is usually very evident as a fully-expanded umbrella-like affair standing on the surface of the frond (*Marchantiaceae*). Very often distinctive scales are found on the lower surface.

Some genera have the margin of the frond lobed (the lobes arise exactly as do leaves, and are in reality leaves), and are known popularly as semi-frondose, and are classed with the frondose genera. These are very few, and the female fructifications being dorsal, but usually near the apex, will seldom cause confusion with the foliose section.

These latter (the foliose *Jungernunniaceae*), form much the larger number of the Hepatics, and consist of a stem bearing leaves, and fixed to the substratum, like all Hepatics, by unicellular rhizoids springing from anywhere along the stem, or even from the lower bases of the leaves. The leaves are sessile, of various shapes, toothed or entire, with thickened, or recurved, or plane margin, and form a row on either side of the stem (distichous), usually spreading, and more or less appressed to the surface on which the plant grows. They are one cell thick, and the shape and size of the cells, together with the amount of thickening of the cell walls, is often of importance, and each cell may have a papilla on its surface. The position of the leaves is especially important, as no genus includes more than one type. They may be succubous, in which case the lower margin of one leaf overlaps the upper margin of the leaf below it, *i.e.*, the lower leaf margin is dorsal, and can be seen from above; or they may be incubous, when the lower margin of a leaf is overlapped by the upper margin of the leaf below it, *i.e.*, the lower margin is ventral, and hidden from view until the plant is turned upside down, this, of course, supposing the leaves are close enough to overlap each other (imbricate). They may be distant on the stem, but it can usually be easily seen which position the leaves take. The leaf insertion is oblique or transverse, but they are usually so twisted as to take one or the other position.

The leaf may be conduplicate, that is, with the two halves more or less folded together, or the smaller lobe may even be joined on to the face of the larger lobe. The lower margin of the leaf in some genera bears a tongue or lobe which may be appressed on to its surface, and sometimes this is a swollen saccate lobule. The last pair or more of leaves below the perianth are known as the involueral bracts, and usually vary in shape, size or lobing from the ordinary leaves, or may be joined together, and are of systematic use.

The female flower may be terminal on the main stem or on a long branch (acrogenous), or may be on a very short, special branch (cladogenous), and this branch may be either lateral or postical, *i.e.*, from the ventral or lower side of the stem. There are one or more archegonia, surrounded by a perianth of various shapes; or, if this is absent, the involueral bracts take on the task

of protecting the young flower. After fertilisation of an archegonium, a delicate tissue, the calyptra, arises from the base, and encloses the young capsule, which on maturity breaks through this, leaving the fragments at its base, and not bearing the upper portion with it, as a moss capsule does with its calyptra. The capsule is globose or oblong, with walls one or two cells thick, and, as the pedicel only lengthens when it is ripe, the capsule breaks up into its four valves soon after emergence and releases its spores, and, mixed with them, long, transparent, rod-like bodies, the elaters, which bear constantly either one or two internal spiral threads, a fact used in classification.

The male organs, or antheridia, may be borne internally in the substance of the thallus, dorsally on the frond, or in the inflated bases of ordinary leaves, or of smaller bilobed special leaves (perigonal leaves), and these are either intercalary on the stem, or apical, or spicate on special short branches.

The shape and position of the perianth being of the greatest importance in identifying a specimen, special pains should be taken to collect fertile plants where possible, although, as some species have never yet been found in fruit, sterile specimens need not be rejected. Unlike mosses, a terminal fructification does not stunt a plant, as the axis is extended by one, or perhaps two, innovations, from below the perianth; and thus this latter may soon appear to be lateral, until carefully examined.

Never use great pressure in drying specimens, as this is apt to permanently put them out of shape. All Hepatics regain their shape, but not necessarily their colour, quite well on being soaked out in water. Only enough pressure is needed to flatten them out somewhat, so that they will lie flat enough to be kept in paper folders without being unduly broken up. In many cases, specimens simply dried in the air are all that could be desired, but they must not be toasted in the sunlight or in an oven, as this will make them too brittle, and also harder to soak out.

Macvicar's *Students' Handbook of the British Hepatics* is excellent and well illustrated, and will be found most useful.

Marchantia tabularis Nees.

Usually in swamps or on damp earth. Male and female flowers on different plants (dioicous). In extended patches, branching forked, irregularly lobed with undulate margins, and notched (emarginate) apex. Surface marked out by white lines into areolae, representing air cavities below, to which access is gained by a conspicuous white, raised pore, which is barrel-shaped. Scales on ventral (lower) surface in three rows on each side, large, hyaline (translucent), not reaching the margin, the medium ones bearing a rounded-triangular appendage. Female (♀) peduncle

terminal from a notch, with a green stripe on one side. Receptacle hairy below (borbate), stellate, with about nine rays. Involucals, which are on the lower surface, two-valved, fimbriate, alternating with the rays, each enclosing several capsules, each capsule surrounded by its own perianth, dehiscing (opening) by irregular valves. Elaters bi-spiral. Male (δ) receptacle on a shorter peduncle, with eight shorter, rounded lobes, the antheridia immersed in its tissue and dehiscing by pores (ostioles) on the dorsal surface. Gemmae-cups frequent on the surface of the frond, with spinous-ciliate margin; these are typical of, and almost confined to, the Marchantias.

Chiefly a tropical and sub-tropical genus, but found in all parts of the world. The species are difficult of discrimination.

Madotheca Stangeri Gottsche.

Dioicous. Leaves incubous, closely imbricating, very convex, decurved, suborbicular, margins entire, apex recurved; cells with corner thickenings (trigones) often well developed; lobule (at ventral base of leaf) oblong-ovate; margins entire, parallel to the stem. Stipules ovate, obtuse, appressed to the stem, except towards apex; margins quite entire. Perianth lateral, nearly sessile, compressed, the two lips toothed and bent over to one side. Involucral leaves unequal, toothed. Elaters bi-spiral. Antheridia solitary in the bases of closely-imbricated perigonal leaves, on very short lateral branchlets, well shown in the specimens. A world-wide genus, on bark or on earth.

Frullonia rostrata H.f. & W.

Dioicous. Small, slender, reddish-brown. Leaves incubous, imbricated, obliquely more or less oblong or sub-ovate, apex recurved and sub-acute or acute, oreolation opaque. Stipules not imbricating, small, two-lobed to about one-third, sinus open, lobes obtuse. The lobule is on lower side of leaf, near the stem, oblong, saccate, not lying on the leaf, at a small angle with the stem (30°); a small, characteristic, triangular lobe (stylus) is inserted between the lobule and stem. The lobule is occasionally "explonate", i.e., flattened and not saccate. Perianth terminal on a short branch, black, triquetrous (three-angled), with a tubular beak. Capsule four-cleft for two-thirds of its length, the lower third solid; elaters monospiral; some usually remain attached for a time to the apices of the capsule valves after dehiscence. Antheridia in the saccate bases of very closely imbricated two-lobed perigonal leaves on very short branches, reminding one of the Androecia of *Madotheca*.

A large and common genus, on bark, or sometimes on rock.

Fimbriaria australis H.I. & T.

- Monoicous, i.e., male and female organs on different branches of the same plant. Frondose. Thallus dichotomous, linear, with a midrib, often purple below, scales few in one row, ventrally on each side of the midrib, oblong, small; apex two-lobed, from the base of which spring the terminal, long-stalked receptacles. These are broadly conical, tubercled, four-lobed, and bearded at the insertion of the seta, each lobe forming a campanulate, pendent, one-capsuled involucre; perianth projecting far beyond the involucre, split into 10-14 broad white rays, cohering at their apices; calyptra obconic, nearly as long as the involucre. Capsule sessile, a cap breaking off and leaving an irregular cup-shaped remnant. Antheridia immersed in the frond, usually at the end of short ventral innovations, often easily detected as a purplish, raised, linear-oval, cushion-shaped portion on the midrib at the end of the lobe. They are present in the packets.

Several species of the genus, including this one, come from Tasmania, and no doubt it extends to the mainland. It belongs to the Marchantiaceae, but to the division that is usually considered the less highly developed of the two.

Lophocolea multialata Herzog; ined.

Dioicous. Leaves succubous, sub-opposite, orbicular, ovate, apical sinus lunate, the two teeth on either side very short; dorsal margins decurrent and joined; cells large and clear, walls thickened. Stipules with an orbicular lamina, two-fid, lobes long and slender, one tooth at base on each side; margins decurrent and joined on both sides to the leaves below the stipules. Perianth terminal, three-angled, one side (not one angle) being ventral, three-lipped, lips toothed, bearing an extraordinary number of lamellae or raised plates of tissue externally, and a few internally. Calyptra (as is usual) included in the perianth, but the capsule when mature is exerted, and splits to the base into four valves. Elaters bi-spiral. Antheridia in the inflated bases of successive perigonial leaves, forming an androecia about the middle of the stems.

The genus *Chiloscyphus* differs from *Lophocolea* only in that the perianth is lateral on an exceedingly short branch (not terminal on the stem or on a main branch, as in *Lophocolea*), and is more or less campanulate, never three-angled.

Both genera are common in temperate regions on the ground.

Plagiochila circinalis Lehm. & Lindb.

Dioicous. Stems tufted, short, a little branched. Leaves succubous, erecto-potent, imbricate, alternate, obliquely broadly-ovate, concave, entire or two-denticulate at the apex; margins

recurved, dorsal swollen and almost forming a pouch (gibbous), ventral bases connivent and forming a keel; cell walls strongly thickened with trigones in the corners. Involucral leaves larger, entire or sparingly denticulate. Perianth terminal, strongly compressed sideways, oblong, mouth truncate, very slightly denticulate, always wide, never constricted. Antheridia in the bases of small perigonal leaves, giving a conspicuous restricted appearance to the part of the stem on which they occur.

One of the largest genera of Hepatics (H. Carl in his recent systematic survey of the genus places the species at over 1,200) found in all parts of the world. The species are hard to identify; commonest on trees or logs, but often growing on earth.

Selaginella scolopendra Nees.

Dioicous. Pinnately branched, branches often attenuate and flagelliform. Leaves incubous, oblong, or slightly widened towards the base, deeply two-fid, the lobes again two-fid. Cell walls strongly thickened, the lumen or unthickened portion of the cell being quite small. Stipules rather smaller and similar, but that the margins are usually spinulose toothed. The specimens only show perigonal leaves, short, swollen lengths on the branches. The perianth is lateral, covered with imbricating leaves.

Selaginella heterodonta (Col.) St.

A small species of the genus. Rhizoids purple; scales on the stem small, two-fid. Leaves succubous, complicately two-lobed; dorsal lobe the shorter, broadly ovate, apex rounded, margins dentate; ventral lobe linear-ovate, apex sub-acute or acute, margins dentate, ventral base spinulose; lamellae few and small on ventral surface, near apex of lower lobe. Stipules deeply two-fid, dentate. Perianth in hollowed apex of stem, tubular, adnate with the involucral leaves and stipules.

A genus of the southern temperate regions, most plentiful in New Zealand. It should be searched for on damp forest floors or in moist gullies.

Trichocolea australis St.

Dioicous, but seldom found in fruit; the pockets contain only sterile material. Often growing in large, greyish or cream-coloured patches. Rhizoids practically absent. Leaves closely imbricated on the branches, transversely inserted on the stem, of turgid, pellucid, thin-walled cells, apparently jointed; entire basal portion very short, thence multifid, the capillary lobes giving a woolly appearance to the plant. Stipules smaller than the leaves. The female inflorescence is terminal, the calyptra being a prolongation of the stem tissue covered by paraphyllia; hence the

inflorescence can be considered as being sunk in the apex of the stem.

Australia and New Zealand, but scarcely differing from the widely-diffused *T. tomentella* Nees.

Matzgeria fuscata (L.) Dum.

Dioicous. Thallus flat and ribbon-like, with a midrib two cells wide above, four cells wide below, the wings only one cell deep; naked above, with scattered single cilia on the margins and midrib beneath. Fructifications from the midrib on the lower surface (ventral). Perianth absent, calyptra ascending, pyriform (pear-shaped) covered with hairs, scale at base, with ciliate margins. Antheridia (not present in the specimens) very large for the size of the plant, subtending scale without cilia, but with a midrib. Gemmae often plentiful from all parts of the thallus, but especially from the margins. They are well shown in the pockets, and at times almost obscure the thallus. They are a means of vegetative reproduction.

A cosmopolitan species, usually on bark or on rock.

Lapidolaena Taylori (G.) St.

Dioicous, but very seldom found in fruit. Bipinnately branched, branches short. Leaves incubous, closely imbricate, obliquely ovate, acute or apiculate, cauline spinulose at the base; cells opaque, walls strongly thickened, cuticle smooth; lobule saccate, clavate, with a spine from the middle on the side away from the stem, and a triangular lamina between it and the stem; this is sometimes small, but some leaves will show it well developed. Stipules four-partite, spinulose-ciliate, the two middle lobes often saccate and resembling the lobules. Involucral bracts connate, and adnate to the calyptra.

Plants of this genus rather resemble *Frullania*, but in that genus the stipules never have saccate lobules and the fructification is quite different. A small Australian, New Zealand and Antarctic genus, the above species extending to Tasmania, and probably to Australia as well. It should be looked for on trees or rocks, or on earth on sheltered hillsides and gullies under shrubs.

Cuspidatula monodon (H. & T.).

Dioicous. Stems suberect and little branched. Leaves succubous, alternate, secund, ovate, rather oblique, acuminate, often with a blunt tooth on one side. Stipules wanting. Involucral leaves two-multifid, in threes (*i.e.*, the stipule is here present below the perianth), subinvolucral bracts also more or less lobed and toothed. Perianth terminal, oblong and plicate towards the apex, mouth ciliate. Calyptra about one-third the length of the

perianth. Capsule longly exserted, brown, split to the base into four valves. Elaters two-spiral.

In New Zealand this is sometimes found growing in the tops of tall forest trees.

Isotachis subtrifida H. F. & T.

Dioicous. Stems simple erect, decurved at the tops. Leaves incubous, all pointing one way (secund), obliquely ovate, three-lobed, lobes unequal, lanceolate to broadly lanceolate, margins entire or nearly so. Cells opaque, not larger, and clearer towards the base, walls thickened. Involucral leaves toothed on the margins. Perianth terminal, narrowly ovate, mouth plicate with teeth-like lobes.

A southern genus, growing on earth, in which the stipules closely resemble the leaves in size and form.

Radula buccinifera H. & T.

Dioicous. Leaves orbicular-oblong, concave, opaque, lower lobe small and flat, trapezoid, appressed to the upper lobe. Stipules wanting. Perianth terminal, but appearing lateral by the growth of innovation shoots from below it, tenete (round in section) below, above strongly compressed, with an entire, dilated mouth. Capsule not longly exserted from the perianth; elaters bi-spiral.

A large and distinct genus, but the species are often hard to tell apart, the perianth and lower leaf-lobe generally giving the best distinguishing characters.

Lejeunea nudipes Tayl.

Minute, on bark. Leaves distant, spreading, concave, obovate, narrowed to the base, margins crenulate from the jutting out of the cells, lobule small, narrow, nearly flat, appressed to the leaf. Stipules small, two-lobed to one-third or one-half. Perianth terminal, clavate, narrowed and almost stalked below, mouth tubular, five-angled above and retuse (flattened and slightly depressed) at apex, angles crenulate. Lower third of capsule solid; elaters monospiral.

Originally a very large genus, from all over the world, but of recent years it has been split up into a great number of closely-related genera. With *Frullania* and *Jubula*, these form a distinct and interesting sub-family of the Hepatics.

SCIENCE CONGRESS.

At the meeting of the Australasian and New Zealand Association for the Advancement of Science held in Sydney in August, the Club was well represented, about a dozen members being present. The Botanical, Zoological and Ethnological sections were specially interesting and well attended.

AUSTRALIAN AND NEW ZEALAND ORCHIDS.

By THE REV. H. M. R. RUPP.

At the recent Sydney Congress of the Australian and New Zealand Association for the Advancement of Science, several speakers denounced the theory of a former land-connection between these two countries. I am not in any way qualified to defend this theory, nor am I particularly concerned to do so. But one argument used in its demolition was to the effect that the widely different character of the floras of Australia and New Zealand supports the contention that no such connection ever existed. This argument, it seems to me, is hardly square with the facts.

It is quite true that plants like *Eucalyptus*, *Acacia* and the Proteaceae, which are so characteristic of Australia, are almost entirely lacking in New Zealand. But, on the other hand, there are plants belonging to the same genera of several important natural orders, such as the Myrtaceae (*Metrosideros*, *Leptospor-mum*), Scrophulariaceae, Rubiaceae, and Pinaceae, found in both countries; while there is actually a very considerable number of identical species. This is well illustrated by a comparison of Australian and New Zealand Orchids. In New Zealand a number of "new" species of orchids found in recent years are still waiting, I believe, for publication of authoritative descriptions, so that it is not possible to state accurately the total number of species, eighty-five may be taken as an approximate estimate. Of these, only seven are epiphytes, viz. :—

<i>Dendrobium</i>	1
<i>Bulbophyllum</i>	2
<i>Sarcocylus</i>	1
<i>Earina</i>	3

The last-named is the only genus not represented in Australia, and the two species of *Bulbophyllum* are closely related to Australian forms. Of the terrestrials, the following genera are common to both countries :—

<i>Gastradia</i>	<i>Pterostylis</i>
<i>Spiranthes</i>	<i>Caleana</i>
<i>Calochilus</i>	<i>Acianthus</i>
<i>Thelymitra</i>	<i>Townsonia</i>
<i>Orthoceras</i>	<i>Lyperanthus</i>
<i>Prasophyllum</i>	<i>Chiloglottis</i>
<i>Microtis</i>	<i>Caladenia</i>
<i>Corysanthes</i>	

When we come down from genera to species, we find at least twenty-four New Zealand terrestrials conspecific with Australian forms. These include such well-known species as *Gastrodia sesamoides*, *Spiranthes sincensis*, *Calochilus pulidosus*, *C. Robertsonii*, six *Thelymitra*, two *Microtis*, *Orthoceras strictum*, *Pterostylis nutans*, *P. nana*, *P. barbata*, and *Calceana minor*.

Even more striking and suggestive is the relation between less-known and rarer forms. *Chiloglottis formicifera*, so far as I know, has been recorded only in New South Wales on our continent, yet it occurs in New Zealand. The Australian species of *Adenochilus* (*A. Nortonii*) is restricted to a few highland areas in New South Wales, and the only other known species, closely related, is *A. gracilis* of New Zealand. An analogous case is the undoubted affinity of the New Zealand *Townsonia deflexa* with the Tasmanian *T. viridis*. And it seems probable that further comparison of Australian and New Zealand terrestrials will add to the list of actual species common to both countries, for only recently it has been found that several supposed New Zealand endemic forms are identical with Australian species. Hooker's *Pterostylis puberula* is undoubtedly Robert Brown's *P. nana*; and Cheeseman's *P. Matthewsii* tallies in every detail with our familiar *P. nutans*. It is quite likely that comparative study will reveal further cases like these.

How are we to account for the identity of species and the affinities of other closely-related forms in so many genera? The orchid flora of New Zealand appears to be more nearly related to that of Australia than to that of any other region. It is conceivable, perhaps, that minute seeds of orchids have been conveyed by wind across the Tasman Sea, and that only those forms which have found suitable provision for their necessities in their new home have survived. But this theory seems to be open to many objections, and to be incapable of explaining all the facts that are involved.

The whole subject provides a most interesting field for investigation, and meanwhile it seems hardly wise to ignore the remarkable affinities between the New Zealand and Australian floras, in order to use their alleged absence as an argument against a former land-connection.

PRESERVATION OF FAUNA.

At the Science Congress the Council resolved to recommend to the Federal and the State Governments that a biological survey of the fauna of Australia be undertaken, and that each State Government establish a small sub-department to co-ordinate and administer the laws governing fauna and flora.

ALIEN PLANTS RECORDED AS NATURALISED IN
VICTORIA.

Published by the Field Naturalists' Club of Victoria from information supplied by Messrs. J. W. Audas, P. R. H. St. John, and P. F. Morris.

The migration and spread of weeds are closely studied by plant ecologists, agriculturists, systematic botanists and entomologists, and many of the problems are vital to agricultural and natural production in crops and flora.

There were 452 alien plants on the list published with the census of 1928. The present addition of 52 species is comprised of grasses, 17; clovers, medicks and other fodders, 7; gardens escapes, 12; and 16 other plants introduced from abroad, by way of boats, in ballast, packing, fodder and impure seed. Of the 20 families represented, Gramineae leads with 27 species.

Foreign plants recorded as having established themselves sufficiently to be declared naturalised now form a prominent part of the flora, and they are steadily increasing at the rate of about six a year.

Of the 504 plants now declared "Naturalised Aliens", 86 have been declared pests under the Noxious Weed Act of 1928. Several plants are poisonous to man and beast.

73. Add <i>Agrostemma Githago</i> L., delete <i>Lychnis Githago</i>	Poison	Caryop.
73. Add <i>Agrostis pulustris</i> Hudson, "Red- top Grass"	Fod.	Gram.
73. Add <i>Agrostis tenuis</i> Vasey, "Brown- top"	Lawn	Gram.
74. Add <i>Ailanthus glandulosa</i> Desf., "Chi- nese Tree of Heaven"	Orn.	Simarub
74. Add <i>Allium sphaerocephalum</i> L., "Round- headed Onion"	Weed	Liliac
74. Add <i>Aloe arborescens</i> Mill, "Tree Aloe"	Ornam.	Liliac
74. Add <i>Alopecurus pratensis</i> L., "Meadow Foxtail Grass"	G. Fod.	Gram.
74. Add <i>Ammophila arenaria</i> (L.) Link., delete <i>A. arundinacea</i>	Sand	Gram.
74. Add <i>Amsinckia lasipida</i> R. & Pav., de- lete <i>A. angustifolia</i>	Weed	Borag.
74. Add <i>Araujia sericifera</i> Brot., "Silk Pod"	Orn.	Asclep.
74. Add <i>Arrhenatherum elatius</i> (L.) Beauv., delete <i>A. avenaceum</i>	—	—
74. Add <i>Artemisia Abrotanum</i> L., "South- ernwood"	Orn.	Comp.
74. Add <i>Aster squamatus</i> Hieron, delete Spring	Weed	Comp.
74. Add <i>Avena barbata</i> Brot., "Barbed Oat- grass"	Lit. val.	Gram.

75.	Add <i>Avena sterilis</i> L., "Barbary Oat"	Lit. val.	Gram.
75.	Add <i>Avena strigosa</i> Schrad., "Meagre Oat"	Lit. val.	Gram.
75.	Add <i>Bouteloua gracilis</i> Lag., delete <i>B. oligostachya</i>	—	—
75.	Add <i>Brachiaria distachya</i> (L.) A. Camus, "Two-finger Grass"	Fod.	Gram.
75.	Add <i>Brassica nigra</i> Koch, "Black Mustard"	Pest	Cruc.
75.	Add <i>Bromus cecadilla</i> Steud., "Chilean Brome Grass"	Fod.	Gram
75.	Add <i>Bromus villosus</i> Forsk., delete <i>B. maximus</i>	—	—
75.	Add <i>Bromus tectorum</i> L., "Wall Brome"	Lit. val.	Gram.
75.	Add <i>Cirsium arvense</i> Scop., delete <i>Carduus arvensis</i>	—	—
75.	Add <i>Cirsium lanceolatum</i> Scop., delete <i>Carduus lanceolatus</i>	—	—
75.	Add <i>Cirsium Mavianum</i> (see <i>Silybum</i> , p. 82)	—	—
75.	Add <i>Carduus tenuiflorus</i> Curtis, "Slender Thistle"	Weed	Comp.
75.	Add <i>Carthamus lanatus</i> L., delete <i>Kentrophyllum lanatum</i>	—	—
76.	Add <i>Centaurea paniculata</i> L., "Purple Cornflower"	Weed	Comp.
76.	Add <i>Centaurea repens</i> L., delete <i>C. Picris</i>	—	—
76.	For <i>Cerastium quaternellum</i> read <i>Moenchia erecta</i> , p. 79	—	—
76.	Add <i>Cerastium glomeratum</i> Thuill., delete <i>C. vulgatum</i>	—	—
76.	Add <i>Crataegus monogyna</i> Jacq., "White Hawthorn"	Hedge	Ros.
76.	Add <i>Crataegus oxyacantha</i> L., "Hawthorn or May"	Hedge	Ros.
76.	For <i>Coringia</i> read <i>Conringia</i>	—	—
76.	Add <i>Cuscuta epilinum</i> Weihe, "Flax Dodder"	Pest	Convol.
76.	Add <i>Cuscuta europaea</i> L., "Greater Dodder"	Pest	Convol.
76.	Add <i>Cuscuta racemosa</i> Mart., "Scented Dodder"	Pest	Convol.
76.	Add <i>Cystisus proliferus</i> L.f., "Tagasaste"	Fod. Hedge	Legum.
77.	<i>Desmazeria</i> for <i>Desmazeria</i>	—	—
77.	Add <i>Erigeron crispus</i> Pour., delete <i>E. linifolius</i>	—	—
77.	Add <i>Erodium Botrys</i> Bert., "Needle Stork's-bill"	Weed	Geran.
77.	Add <i>Freesia refracta</i> Klatt. "Freesia"	Ornam.	Irid.
78.	Add <i>Glyceria aquatica</i> S., "Reed Sweet-Grass"	Fod.	Gram.
78.	Add <i>Heliotropium supinum</i> , "Creeping Heliotrope"	Pest	Borag.
78.	Add <i>Hordeum maritimum</i> With., "Saline Barley"	Lit. val.	Gram.

78.	Add <i>Hordeum nodosum</i> L., delete <i>H. secalinum</i>	—	—
78.	Add <i>Iris germanica</i> L., delete Lindl.	—	—
78.	Add <i>Leycesteria formosa</i> Wail, "Himalaya Honeysuckle"	Orn.	Caprif.
78.	Add <i>Lobularia maritima</i> (L.) Desv., delete <i>Alyssum maritimum</i> , p. 74	—	—
79.	Add <i>Lonicera japonica</i> Th., "Japanese Honeysuckle"	Orn.	Caprif.
79.	Add <i>Lythrum flexuosum</i> Lag., "Wiry Loosestrife"	Weed	Lythr.
79.	Add <i>Medicago laciniata</i> Mill., "Gnawed Burr-medick"	Fod.	Legum.
79.	Add <i>Medicago confinis</i> Koch, "Tubercle Burr-medick"	Fod.	Legum.
79.	Add <i>Mentha viridis</i> L., "Spearmint"	Arom.	Lab.
80.	Add <i>Onopordon acaule</i> L., delete <i>O. acaulon</i>	—	—
80.	Add <i>Paspalum Urvillei</i> Steud., "Vasey Grass"	Fod.	Gram.
80.	Add <i>Pennisetum villosum</i> R.-Br., delete <i>P. longistylum</i>	Ornam.	Gram.
80.	Add <i>Phalaris arundinacea</i> L., "Reed Canary Grass"	Fod.	Gram.
80.	Add <i>Phalaris stenoptera</i> Hack. (<i>P. tuberosa</i> , <i>bulbosa</i> , <i>commutata</i> of Aust.)	Fod.	Gram.
80.	Add <i>Phalaris paradoxa</i> L., "Gnawed Canary Grass"	Fod.	Gram.
80.	Add <i>Plantago arenaria</i> W. & K., "Sand Plantain"	Fod.	Gram.
81.	Add <i>Polypogon lutosus</i> Hitch., "Perennial Beard-grass"	Lit. val.	Gram.
81.	Add <i>Rosa canina</i> L., "Dog Rose"	Ornam.	Rosac.
81.	Add <i>Rumex luxurians</i> L., "Elegant or Luxuriant Dock"	Ornam.	Polyg.
82.	Add <i>Saponaria officinalis</i> L., "Soapwort"	Poison	Cary.
82.	Add <i>Sclerochloa dura</i> Beauv., "Hard Meadow-grass"	Sl. Fod.	Gram.
82.	Add <i>Scorzonera laciniata</i> L., "Torn Viper's Grass"	Weed	Comp.
82.	Add <i>Selago corymbosa</i> L., "Waterfinder"	Weed	Selag.
82.	Add <i>Setaria geniculata</i> Beauv., "Bent Pigeon Grass", delete <i>S. nigrirostris</i>	Fod.	Gram.
82.	Add <i>Silybum Marianum</i> Gaertn., delete <i>Carduus Marianus</i> , p. 75	—	—
82.	Add <i>Solanum elaeagnifolium</i> Cav., "Oleaster Nightshade"	Weed	Solan.
82.	Add <i>Solanum villosum</i> Willd., "Hairy Nightshade"	Weed	Solan.
82.	Add <i>Tolpis umbellata</i> Bert., "Tolpis"	Weed	Comp.
83.	Add <i>Trifolium Bocconi</i> Savi., "Bocconi's Clover"	Fod.	Comp.
83.	Add <i>Trifolium cornutum</i> Brot., "Drooping Clover", delete <i>T. parviflorum</i>	Fod.	—
83.	Add <i>Trifolium suffocatum</i> L., "Suffocated Clover"	Sl. Fod.	Legum.

THE STARLING.

By B. Blackburn.

At a recent meeting of our Club, it was a pleasure to hear members speak in defence of the Starling. Never before, in this country, have I heard a word in its favour, yet in England it is, without doubt, one of the most useful birds to the agriculturalist. Being almost entirely insectivorous, its only lapse is during the ripening of the cherry crop. The love of this luscious fruit it shares in common with many other birds, and from the time when the fruit begins to colour until the last cherry is picked, it is necessary to keep men with guns in the orchards, from daybreak until dusk, to protect the fruit.

The worst periods are at early morning and late afternoon when the flocks of Starlings are on their way to, and returning from, their feeding-grounds. During the remainder of the year they do nothing but good, and account for millions of grubs and other insect larvae which would otherwise do an immense amount of damage. I have frequently seen the birds steadily working down the rows of turnips in a field. Investigation showed that they were feeding on the larvae of a fly that causes a gall or swelling to form on the surface of the turnip. With a sharp peck of the beak, the top of the swelling is removed and the grub picked out, and one could look in vain for a gall that had escaped the sharp eyes of the birds.

It seems clear to me that Starlings have been led to attack fruit of all kinds, in Australia, owing to thirst created by the heat and dryness of the climate. The Starling is normally a ground-feeder, and dry ground and vegetation, combined with intense reflected heat, must be extremely trying to a bird native to a country where vegetation is almost always green and where the ground is never uncomfortably warm, and more usually cool and damp. Possibly, also, many insect larvae upon which it feeds descend to greater depths, attracted by the moisture lower down and to escape the surface heat, thus making it harder for the birds to get sufficient moisture for their bodily requirements.

The food of the Starling consists principally of "wire-worms", "leather-jackets", grubs, etc., and I do not remember ever having seen one eat a worm, though doubtless it would do so readily enough if it caught one on the surface. The noise made by a flock of Starlings quartering the ground would undoubtedly be heard by the worms and lead to their retreating deep down into their burrows.

One of the most wonderful sights in the bird world is that of a large flock of Starlings in flight. The marvellous evolutions performed with astounding accuracy as if at the word of command, the rising and falling, the graceful sweeps to right and left, with never a mistake in the closely packed multitude, fills the beholder with admiration. Late one afternoon, my attention was attracted by what appeared to be an immense dark cloud on the horizon, moving somewhat rapidly, and every now and then becoming invisible. As it came towards me, it resolved itself into an immense flock of Starlings, the periods of invisibility being caused by light reflected from countless thousands of wings when turned at a particular angle to the rays of the setting sun and at that moment harmonising with a background of light-coloured cloud.

The good done by these birds far outweighs any damage caused to orchardists. It is easier for the fruitgrower to protect his fruit during ripening than it would be for farmers to combat the millions of insect pests annually destroyed by these useful birds.

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FIELD NATURALISTS' CLUB OF VICTORIA PROCEEDINGS

The monthly meeting of the Club was held in the Royal Society's Hall on Monday, October 10, 1932, at 8 p.m.; the President, Mr. J. A. Kershaw, C.M.Z.S., presiding over an attendance of about 60 members and friends.

CORRESPONDENCE

A letter was received from the Chief Inspector of Fisheries and Game, Mr. F. Lewis, asking for the assistance of members in reporting breaches of the regulations. It was decided to accede to the request.

REPORTS

Reports of recent excursions were submitted as follows:—Ringwood, Mr. Geo. Coghill; Arthur's Seat, Mr. J. A. Kershaw; South Morang, Mr. A. E. Proudfoot.

ELECTION OF MEMBERS

Miss L. A. Dyall and Mr. Geoff. P. Riley were elected as ordinary members of the Club.

GENERAL BUSINESS

Mr. L. W. Cooper was elected Hon. Assistant Secretary.

Mr. Chas. Daley reported that the meeting of the Australian and New Zealand Association for the Advancement of Science, in Sydney, had been very successful.

Attention was drawn to an article in the daily press, stating that a party of 300 field naturalists had recently destroyed all the wild flowers in the country near Frankston. It was decided that the paper concerned be informed that this Club was in no way connected with the outing.

LECTURE

The lecture was delivered by Mr. Chas. Daley, B.A., F.L.S., his subject being "The Preservation of Fauna and Flora." He stressed the necessity of setting apart reserves of sufficient size and in proper surroundings and under efficient control, to enable representatives of all the native fauna and flora to be preserved for all time. Examples were given of what various countries were doing in this direction.

EXHIBITS

Mr. C. French, Junr.—*Dendrobium striolatum*, from East Gippsland.

Mr. H. P. McColl.—*Acacia saligna* and *Indigofera australis*.

Mr. G. Coghill.—*Eriostemon obovatis*.

Mr. A. D. Hardy.—*Phebalium squameus*, and *Billardiera* (sp.).

Mr. J. Freame.—*Diuris punctata*.

Mr. L. W. Cooper.—*Dianella tasmanica*.

Mr. I. Hammit.—*Chorizandra cordata*, *Chamaelaucium uncinatum*, *Lhotskya alpestris*, *Prostanthera rotundifolia*, *Daviesia latifolia*, and *Clematis aristata*.

Mr. H. Stewart.—Fungi found on decaying wood:—*Stereum lobatum* and *Poria* (sp.). Also *Acacia saligna*, *A. cyanophylla*, *A. rhetinodes*, *A. pycnantha*, and *Eriostemon myoporoides*.

Miss E. M. Haynes.—A large bean from Queensland.

Mr. A. S. Kenyon.—*Eucalyptus gracilis*, *E. torquata*, *Acacia tenuifolia*, *A. saligna*, *Grevillea ilicifolia*, *G. trinervis*, *Hakea laurina*, *H. stricta*, and *Altriplex rummularium*.

Wattle bark is of great commercial value for tanning leather for use in various trades. Recent research has shown that the names of the "Black Wattle" group have been very mixed. In Victoria the name *Acacia decurrens* is often wrongly applied to *Acacia mollissima* or *Acacia dealbata*.

The following key will help those interested to determine the two Victorian species. It is chiefly based on leaf characters:—

- (a) Glands extending the whole length of the rachis ... *A. dealbata*
 (b) Leaves and stems glaucous, pinnules usually crowded, opposite or alternate; broad linear, obtuse, attached at an angle of 60 degrees; 2.5 mm. long and 0.6-0.8 mm. broad. Flowers early spring. Tannic acid content of bark, 17-35%.
 (b) Leaves and stems rarely glaucous, very hairy when young, and yellow in colour; older leaves scattered with hairs. Pinnules often overlapping, usually alternate; spatulate to linear oblong; angle of attachment, 45-90 degrees, from 3.5 mm. long and 0.5-0.75 mm. wide. Flowers November-January. Tannic acid content of bark, 30-50 per cent. ... *A. mollissima*
 (b) Pinnules 8-18 mm. in length, widely spaced, 1-1 mm. wide. Flowers August. Native to New South Wales. Tannic acid content, 35-45 per cent. ... *A. decurrens*

Acacia decurrens Willd. (*A. decurrens* var. *normalis* Bentham). "Black Wattle" of New South Wales, is often cultivated in Victoria under the name "Sydney Green Wattle". In New South Wales, *A. mollissima* Willd. (*A. decurrens* var. *mollis*.) is known as "Black or Green Wattle", in Victoria it is "Black Wattle", whilst *Acacia dealbata* Link, is the "Silver Wattle".

P. F. MORRIS, National Herbarium.

ENTOMOLOGICAL GLEANINGS FROM THE OTWAYS

By F. ERASMUS WILSON, F.E.S.

As very little was known regarding the entomological fauna of that vast area of country known as the Otway Forest, a small party, of which I was a member, decided to spend a fortnight there in January, 1932. Unfortunately, owing to abortive settlement projects, and the too lavish use of the fire-stick, the character of the country has been changed very considerably. We were given to understand by old residents that at one time much of the country that now can only be traversed by the aid of axe and slasher was originally fine open forest, and that the early surveyors were able to ride without much difficulty through the area.

In many parts to-day, it is almost impossible to leave the roadside or firebreak owing to the density of the herbage. The Otways are notable for their excessively heavy rainfall, and yearly averages up to 75 inches are not uncommon.

At the time of our visit very hot weather prevailed, and one of the driest periods for many years was being experienced. That being so, it is probable that our gatherings were affected somewhat by the abnormal conditions. As an instance, I might mention that on previous occasions I had found at Lorne on the eastern slopes of the area, moss to be highly productive of interesting forms of beetle life. Moss gathered on this trip, however, in all instances proved very disappointing.

We made our headquarters on Turton's Track, about eight miles from Beech Forest, in a delightful piece of virgin bush, and spent about eight days traversing the country in various directions. Comparing these gullies with those of the Dandenongs, one could not but be struck by the paucity of species of the genus *Acacia*, and the absence of the familiar *Sassafras*. We did hear that there was a gully further south where this tree was reputed to grow, but no member of our party at any time saw examples on their rambles. Everywhere there was a luxuriant growth of ferns of many species, and I have never seen elsewhere such large and beautifully shaped specimens of the Christmas bush, *Prostanthera lasiantha* Labill. At the time of our visit this tree was in full flower, and the contrast of their dainty flowers against the dense masses of green, was worth going far to see.

Although our forest at Turton's Track appeared to us to be as it must have been in pristine times, with its giant trees towering into the sky, a little closer examination showed us that such was not the case. The existing large timber was but a sapling growth to the timber that at one time grew there. Mouldering stumps of former forest giants hidden in the dense growth of shrub and wire grass testified to this.

It was pleasing to us to meet that dainty little avian sprite, the

Pink-breasted Robin, in the fern glades, and the discovery of a nest showed that these birds are permanent residents of the Otway Forest. But one missed the Lyre-bird, that denizen of similar gullies in the east, and wondered why it had never penetrated into country so suitable for its mode of life, particularly when one observed that *Menura's* natural food was present in such abundance. This is not an article on the avifauna of the Forest, which has been treated with so ably by Judge Belcher in his book *Birds of the District of Geelong*. However, in passing, I might mention that it was interesting to see the prevalence of the beautiful King Parrot in the area, and occasionally to catch glimpses of natty little *Neophema* parakeets and of Bristle-birds on our wanderings.

Bush fires were raging in all directions, and for most of the time we were there a dense pall of smoke hung over the country. In the forest land, *Bursaria*, *Leptospermum*, and similar flowering plants are wanting, so that this usually prolific source of entomological collecting was denied us. Beating of herbage over the homely gamp was also more or less wasted effort, so our attention was mostly devoted to log-rolling and splitting, the examination of moss and leaf debris, and searching for aquatic forms of life.

As one might expect, beetles of the family *Carabidae* were dominant both in numbers and in species, and many fine things were secured. Although I have a considerable number of specimens mounted, I have not as yet studied them, but feel sure that some at least will prove to be species as yet undescribed. Heaps of leaves washed together in the roadside gutters proved to be veritable carab boarding-houses, and often here we also captured that fine, if not the finest of the *Adeliums*, *A. flavicornis* Cart., with its wonderfully sculptured upper surface. Here also we gathered several examples of that rare and beautiful Staphylinid beetle, *Antimerus smaragdinus* Fvl, a species which previously had only been taken on two occasions.

Stag beetles were represented by two species, both of which were numerous in old rotten logs, and of the two possibly *Lissotes furcicornis* was the commonest. The smaller *Syndesmus cornutus*, however, was not far behind it in numbers, and we thought it somewhat singular that such a large proportion of the specimens noticed were males. In the Lorne district I have taken two species of the genus *Ceratognathus*, but on this trip we did not meet with the genus.

A little mountain stream, from which we obtained our water supply, was much favoured by that handsome stone-fly *Eusthenopsis venosa* Till., and a search every morning rarely failed to produce several examples. This same creek was also the happy hunting ground of hosts of the big Gyrinid beetle *Macrogyrus rivularis*, Clk., and one member of the party could never resist cap-

turing many examples on each visit. It is one of the finest of all our Gyrinids, and was very numerous throughout the area.

A sharp look-out was kept for Saw-flies, but only two species appeared to be on the wing whilst we were there. About sixteen examples of the showy black and yellow *Perga bicolor* Leach were captured, besides a single specimen of the common *Perga dorsalis* Leach. From larvae collected near camp I later reared two specimens of *Perga bella* Newm. both proving to be females. Another member of the party bred a male Saw-fly, which is probably referable to this species also.

Butterflies were poorly represented in the forest country, only about four species being noted, and apart from the common little blue *Zisera labradus* Godart, were very scarce. Ants were not at all numerous but nevertheless several interesting forms were bottled, and about a dozen new species are to be described as a result of our efforts.

Weevils were not too plentiful, although several quite nice little things were secured, particularly of the sub-family *Cryptorhynchidos*. The large *Parapterus conifer* Boh was often found crawling on old logs and tree trunks, and two specimens of another large species, *P. simsoni* Lea were collected. Dogwood was in flower everywhere, and, as usual, was not of much attraction to insects. However, the common Longicorn *Pterostenus saturalis* Oliv. favoured it, and numerous specimens were noticed. Scarabæidae of the genus *Phyllotocus*, and three species of *Mordellidae*, were also taken in this plant. We had an interesting experience with *Phyllotocus* one day in a small open patch of grass land. The sun was shining brightly at the time, and the air was literally full of *Phyllotocus*, besides which the grass and small shrubs were bent down by the weight of clinging beetles. Very soon numbers were alighting on our clothes, and it would be no exaggeration to say that hundreds of thousands must have been congregated in the area of about one acre. The species in question is close to the common *P. rufipennis* Bois but has not as yet been determined. We were also fortunate in witnessing an immense flight of a small, green, scarabæid beetle, *Diphucephala colaspidioides* Gyll., in some low scrub country in the vicinity of Apollo Bay. In this case, all were on the wing, and flying inland, and our car was passing through them for nearly half-a-mile. To me it was rather singular that on one trip I should see two such striking flights of diurnal species, and yet have never witnessed such occurrences before.

A keen look-out was kept for beetles of the family *Dryopidae*, and although considerable numbers were seen, only four or five species were collected, and nothing new was met with. I was fortunate, however, in taking examples of *Kingobus flavosignatus* C. et Z., which had not previously been recorded from Victoria.

Several specimens of the Byrrid, *Pedilophorus atronitens* Lea, originally described from a unique example I took at Lorne, were sieved from moss, from which I also took a most interesting little bug.

About the commonest beetle met with in opening up logs was the Cucujid, *Prostomis intermedius* Blackb., some logs yielding close upon a hundred of the species. An old friend was the handsome green and red Malacoderm, *Telephorus nobilitatus* Erich. Its near relative, *T. pulchellus* Macf., was later seen in great numbers on flowering *Bursaria*, near the sea coast. *Metriorrhynchus*, of the same family, were very plentiful in the thick forest, and several species were gathered, including the fine *M. rufomarginatus* Lea, the type locality of which is Lorne. A single specimen of a very showy *Calachromus* was also netted. One of the pretty little Tenebrionids of the genus *Brycopia* was fairly numerous, and seems to be a new species. One old log yielded three examples of a new species of *Cotulades*, which Mr. H. J. Carter is describing, and a splendid beetle of the family Rhysodidae, the latter falling to the lot of my companion. Needless to say, that log was converted into chips in our excitement to get more of these rarities.

The nice little *Stenotarsus arithmeticus* Blackb., of the family Endomychidae, was frequently found, and one quite small piece of timber sheltered no fewer than thirty-four of them. Two specimens of the nodulose *Chalcolumpra pustulata* were taken on foliage, but Chrysomelidae generally were not abundant in the forest.

Our tempers were sometimes rather ruffled owing to the attacks of a particularly voracious March Fly, *Scaptia maculiventris*, which was decidedly numerous. Three other species were also encountered, but whilst we were there were not very plentiful. One fine March Fly was taken on a *Bursaria* at Horderm Vale, but as yet I have not had it determined.

Crane Flies were leading objects of my attention, and about fifty species in all were collected. Some of the small species of *Molophilus* and *Tasiocera* were, indeed, numerous, and a sweep with the net rarely failed to enmesh many of them. Possibly the finest Crane Fly taken was a huge *Platyphasia* that was new to me. I was fortunate in being able to learn something of the life history of the fine, large, mottled winged *Austrolimnophila munifica* Alex., which was found breeding under the bark of a fallen *Acacia* tree, larvae, pupae and adults all being taken at the one time.

The locality has a somewhat evil reputation for its snakes, and during our sojourn there seven Tiger Snakes were encountered. This led us to name our log hut "Tiger Snake Camp". A family of charming little Bush Mice also shared the hut with us, and



Natural Bridge, spanning a deep gully off Turton's Track, Otway Forest

Photo: Chas. Barrett

their movements at night about the walls and floor never failed to send a cold shiver down my back. Imagination runs riot sometimes, and I was convinced when one ran over my face that my visitor was a veritable Tiger Snake.

Several species of Mycetophyllid Flies were netted, and I had an interesting experience with one species in a dense Beech gully. The moss-girt trunks and limbs of several trees were absolutely covered with thousands of these flies, often two or three deep, and when disturbed it was hardly safe to open one's mouth, unless one favoured an insectivorous diet. Never before have I witnessed such a congregation of Mycetophyllidae. Near our watering place was a damp, mossy bank, which was prettily illuminated at night by luminous larvae, a single example of which I succeeded in rearing. Unfortunately, it did not fully develop, but it was, I think, a member of this family of flies.

On the roadside we discovered, or, rather, our noses did, a Wallaby that had been run down by a passing car. It was so high, however, that none of us could muster up courage enough to examine it for carrion-frequenting Coleoptera.

Land shells were often seen, and several nice species collected for the Museum. A fine black species, near the large *Paraphona* of the Dandenongs, was gathered by some members of the party.

Bees were not at all plentiful in the forest, only about four species being bottled. One nice little yellow and black species, however, was often seen hovering around Eucalypt saplings. A large chip of hard timber, with a hole recently drilled down it lengthwise, attracted my attention, and on splitting it open I found that the driller was *Colomechitta picta* Smith var. *Wilsoni* Cockrell. This was rather interesting to me, as I had previously found the species pupating in rotten, punky timber at Ringwood. Evidently, this showy Bee is quite as much at home in either hard or rotten wood.

A delightful day was spent on a motor trip which the local forester had arranged for us. We left Beech Forest, and travelled down the line to the terminus at Crowes, where we visited the wonderful Beech gully on the Joanna River. Two of us entered into a wordy argument as to which was the finest bit of Beech scenery—the Meeting of the Waters, in the Cumberland Valley, beyond Marysville, or the Joanna Gully. My vote was for the Cumberland, but the other runs it a very close second. Several fine Crane-flies were captured here, and Dryopid Beetles searched for in the river bed.

From here we descended into that most fertile of spots, Hordern Vale, passing on the way a beautiful valley, in which grew some splendid specimens of the rare tree-fern, *Cyathea cunninghami* Blk. At Hordern Vale, some large patches of *Bursaria* were in flower, which provided us with some good collecting. A very fine and

distinct form of the Cetonid, *Clithria eucnemis* Burm., was taken here for the first time, besides four or five species of Jewel Beetles. The Lucanid, *Lamprina rutilans* Erich., was fairly plentiful, and noteworthy for their large size. Later, a bait was called for lunch at the Avr River, and on the timber of the bridge I found a specimen of the metallic blue Longicorn, *Phaolus metallicus* Newm. Two species of Asilid Flies were also captured, besides a particularly nice, highly-coloured little Hydrophylid Beetle.

Our track then led through a glorious stand of *Eucalyptus globulus* Labill, and on to Apollo Bay, thence back through the ranges to our temporary home in the scrub. To me it was interesting to see lots of beautiful red *Epacris* blooming near Apollo Bay at this time of the year, January.

As some members of the party had to return to the city, we struck camp and made back to Beech Forest. Two of us, however, decided to spend a few days in the more open country at Gellibrand, and were well repaid by so doing. The fact that we bug hunters were in the country seemed to be well known everywhere, and immediately on alighting at Gellibrand I was accosted by a small urchin, who wanted to know the name of a huge specimen of the Click Beetle, *Tetralobus murrayi* Cand., which I thankfully accepted. In this more open country all insect life was far more abundant, and we added very considerably to our collections. We found the Jewel Beetle, *Stigmodera bromi* Hope, here in fair numbers, and several interesting melanic forms were secured. The ruany-spotted *Cisneis 12 maculata* Fab. was very common on the foliage of *Xanthorrhöcas*, and examples of the dainty *Stigmodera kerremansi* Blkb. also taken on flowers of *Leptospermum*. An additional Lucanid, *Rhyssonotus jugularis* Westw., was unearthed under an old log, and another welcome find was five specimens of the rare Longicorn, *Athemistus tricolor* Cart. Two species of the tiny Cetonids, *Microvalgus*, were beaten from *Leptospermum*, and further specimens of the aforementioned form of *Clithria eucnemis* Burm.

An additional Saw-fly, *Pterygophorus interruptus* Klug, also occurred here, two specimens being taken. Two species of Skipper Butterflies were sparingly taken, and a pupa, which when it emerged proved to be a male *Heteronympha solandri*.

After four days' intensive collecting in this interesting locality, we returned to the city, but with many regrets, feeling that an enormous amount of work still remained to be done towards elucidating the fauna of the Otways.

The Committee of the Field Naturalists' Club of Victoria invites members of kindred societies who may be visiting Melbourne to attend the Club's meetings.



The Two Female *Aerobates* (about $1\frac{1}{2}$ times natural size)

Photo: D. Fleay

THE PIGMY FLYING POSSUM

By DAVID FLEAY, B.Sc.

It is very doubtful whether any animal, small or large, furred, feathered, or scaled, is more aptly fitted with generic and specific names than *Acrobates pygmaeus*—the "pigmy acrobat"—one of our smallest marsupials and the midget of the Possum family. Yet this little silver-brown creature is very difficult to domicile for observation, and is of such delicate structure that one must exercise every care to avoid causing injury when handling it.

The following is simply an account of personal attempts, successful and otherwise, at hunting and keeping these delightful little marsupials. There is little need to describe the "feather-tail", except to mention that it is equipped with a narrow gliding membrane, seen in the larger Flying Phalangers, the tail is dichous, or flattened, and fringed with hair along the sides, while the total length of the head, body and tail rarely exceeds $5\frac{1}{2}$ inches.

Several years ago a friend at the Teachers College, Melbourne, who, in his rural school days, had been stationed at Bendoc, in far east Victoria, reported that he had seen large numbers of Pigmy Flying Possums eighteen months previously, when wandering through a patch of scrub in that district. Just after nightfall he chanced to flash his torch through the trees to make sure of his bearings. Imagine his amazement on seeing, all about him, tiny "flat-looking" animals, some gliding in short leaps from branch to branch, and others peering cautiously round projecting bark. According to my friend, there were hundreds of these small, feather-tailed creatures all in the one area of bush, and this is the only record I have of an apparent colony of *Acrobates*. It would be interesting to hear of any similar observations. So alluring was the news that in the following summer vacation I set out with a fellow-enthusiast to search the locality.

We arrived in due course, to find that, unfortunately, clearing operations were already well advanced on the very spot. However, a number of old dead trees among the green timber provided great exercise in the way of axe-work, and as they fell we watched expectantly for Pigmy Possums; but none appeared. But my teacher friend's story was borne out by the discovery of numbers of the ball-like leaf nests. It was not until a week later when one rotten old warrior came down with a dust-raising crash athwart a loaded rifle that three "feathertails" were seen bolting for dear life in their characteristic jumps and scurrying runs away from the ruins of their scattered nest. Only one was captured. It was nearly dusk, and, in the general excitement, which included the unforgettable explosion of the rifle (fortunately in a safe direction), it was not easy to follow the movements of our tiny quarry.

That was the only specimen of *Acrobates* captured in the area

which had previously been so rich in the species; but the evidence of deserted nests was very definitely present. Had some Brush-tailed Phascogale found them out, or had clearing activities and lack of food caused the disappearance of the Pigmy Phalangers? It was certainly a mystery.

Some miles distant from the locality, a night ramble, aided by torch beams, resulted in the actual spectacle of a "feathertail" scurrying along a slender branch, where the mite was quite dwarfed by the surrounding leaves, but soon it was lost to view. Next day, a dead tree, sixty yards distant, measured its length in very quick time, due to the effective help of the local wood-chopping champion, and in addition to a Ringtail family, a scared "pigmy" was caught. It was possibly the one seen the night before, for all other neighbouring hollow trees proved to be "blanks".

In the pouch of this Monaro female were two delightful "joeys" with the first signs of a furry coat, and naturally our spirits soared at such an unexpected stroke of luck. This nest and also the other deserted ones, were of the characteristic ball-shape, made exclusively of dry eucalypt leaves, the whole structure being of a size to rest comfortably in one's hand. The situation varied from knot-holes to the much favoured small branch traversed by a hollow, even to nests placed inside a dead trunk.

Our captives were progressing very favourably in camp at Bendoc until the day of an absence of 14 hours, when we returned to find that small black ants had scented the honey food of the little animals, and were overwhelming the cage and its inmates in thousands. The female had thrown her offspring from the pouch, and was frantic. That was the end of the poor little "pigmys", and of our luck at Bendoc. We spent half the night picking those horrible ants from the Phalangers, but all to no purpose. They gradually became weaker and weaker, refused to eat, and only one reached Melbourne, to die very soon afterwards.

The Pigmy Flying Possum seems to inhabit a variety of forest country, though it is most at home in the thick timber typified by Gippsland. The first specimen I had came from the red gum country near Mathoura, N.S.W. "Erastus", as we named him, arrived by post with his brother, packed in cotton wool, in a match box. The two were very young, as may be guessed, and only "Erastus" survived, to delight us for nearly three years with his tricks at night. He had some hair-raising escapes from annihilation during this time. One day he was being shown to visitors when he became frightened and leaped to the ground. "Micky", a black-and-tan terrier, had focussed a wicked pair of eyes on him from the beginning, and now with a single snap he gathered poor "Erastus" into his mouth. A frenzied kick such as "Micky" had never experienced before or since caused him to drop the "pigmy", and instead of mangled remains there sat "Erastus" quite alive and well, though considerably damp from "Micky's" saliva.



Photo: D. Fleay.

Pigmy Possum (natural size) licking honey from a spoon. The syndactylous toes of one hind foot are visible.

On another occasion, it was thought an excellent scheme to endeavour to take a flashlight picture of "Erastus" in his lively nocturnal mood. Everything was beautifully arranged. The subject was nicely in front of the lens, and, with the usual swishing flare, the sheet was fired. When vision returned we were very concerned to find that "Erastus" had collapsed with fright. However, it took more than a mere flashlight to kill him, and soon he had recovered from the faint and was dashing about his cage, as lively as ever.

A Boobook Owl, which escaped from its cage for a while was much intrigued by the continued flashing back and forth of "Erastus's" white under surface as he shot repeatedly from cage wall to wire. Only just in time was the bird discovered making determined drives through the wire with strong taloned-feet in the effort to add "Erastus" to the supper menu.

As previously stated, it is extremely difficult to persuade *Acrobates* to settle down to captivity, though once this has been accomplished the tiny creatures seem to do well.

Early this year a female *Acrobates* and her three daughters were captured near Warburton. Receiving news of the capture, it was not long before we went to Warburton and took charge of the little creatures. They were perfectly healthy, with the exception of one of the immature females, which had a wound on the head, due to the bite of a dog which discovered the "pigmy" when the home-tree fell. However, the mother refused to settle down. She declined food, and within a week had passed away in the manner of the unfortunate "pigmy" from Bendoc. As the small creatures dislike cardboard boxes, cotton wool, or flannel to sleep in, they were supplied with a hollow log, the sectioned end of this natural home being fitted with a pivoted board, cut to shape, so that an occasional inspection is possible. Dry leaves dropped inside the main entrance (there is another small hole at the upper extremity) were taken down to the end covered by the board, and here the three young Pigmy Possums fashioned the round, ball-shaped nest which is so typical of the species.

Under these conditions the tiny animals seemed fairly content, though it is only recently that they have become sufficiently confident to remain outside the log at night on the approach of visitors with lights. In connection with the transportation of leaves to the nest by the animals in their wild state, I am inclined to think that they are carried in a roll of the tail in the manner favoured by *Petaurus breviceps*—the "Sugar Squirrel". There is no direct evidence to establish the fact, but the Pigmy Flying Possum may occasionally be observed to walk along with the tail rolled in a tight ring—this being a typical habit of many of the larger members of the Phalangeridae.

Otherwise, at night the curious flattened tail is held straight at



Photo. D. Fleay. Two Pigmy Possums and the hollow log in which they made their leaf nest

an elevated angle to the body when the small Possum is dashing about like an animated spring. So energetic are the nocturnal movements of the "pigmys" under discussion that as they leap from the log home to the fly-wire cage front, and back again to the far wall, the sound produced is a continuous and very rapid "ping-pong", "ping-pong"! By means of the extremely light little bodies and the well-developed claws and pads of the digits, the Pigmy Possums run up the fairly smooth, vertical walls of their cage with the greatest of ease, and now that they have settled down to the new life their extraordinarily active movements when they are apparently flitting about all night, seem to indicate that in the bush the species searches very actively and long for its food.



"Erastus", the Pigmy Possum which was sent by post from the Murray River in a match-box. (Figure actual size.)

Photo: D. Fleay.

It is engaging at night to see a tiny bright-eyed face gazing curiously at one from the log entrance, but the little fellows become very annoyed should the movable end be opened during the day time. In a moment a small face appears through the screen of leaves, and if a gap is exposed, the leaves are actually pushed up to shut the daylight out!

Naturally in order to get the inmates out, one regretfully destroys the order of the nest, but pushes the leaves back into the log. When the little fellows are returned they dive through the en-

trance away from the daylight, with never a backward glance, and for a long time, intent listening is rewarded by continuous rustling as the "pigmys" re-arrange the leaves into some semblance of order.

In captivity Pigmy Possums are very fond of a diet of sugar, a dish of honeyed bread and milk and occasional hard-boiled fragments of egg-yolk. The chewing of sugar crystals was a sound which came to one's ears at all times of the night when the cage was brought inside during cold weather.

All experiments in the way of supplying the animals with termites, moths, and other small insects, have been unsuccessful, though they are keen on the nectar from Eucalypt blossom. Sweet exudations from the trees, and also those from hemipterous insects probably supply a large amount of food in nature. The cage in which several specimens of *Acrobates* are kept soon acquires their characteristic odour—a sickly sweet honey smell, not by any means unpleasant. In their nocturnal movements, the small creatures pursue a very definite track. From frequent trips to the sugar and small dish of bread and milk they get their toe-pads dirty, and so any spot on the cage wall from which they habitually spring is definitely marked out.

One generally thinks of the Pigmy Flying Possum as an animal entirely lacking in powers of vocal accomplishment; and though it is mainly a silent species, soft little sounds are occasionally uttered, usually in daylight, when the "pigmys" are rolled up together in the nest. It is difficult to describe these low sobbing calls, but probably as good a description as any is to compare them with the quavering whistling notes of Dottrels flying over in the night skies.

In the colder months of winter, before these "pigmys" had fully adapted themselves to captive conditions, they were by no means robust and healthy, and frequently, on cold mornings, they were discovered in a dormant state, very reminiscent of *Dromicia nana*, the Dormouse Possum.

The "pigmy" with the tooth-marked head became very sickly two months after its arrival, and was repeatedly discovered in this dormant state. Finally, after a week of continued torpidity, without touching a morsel of food, it died.

The breeding season apparently coincides with that of the Lesser Flying Phalanger, for one family found in the Ballarat district, had several furred young ones in the month of October. The mother and young ones captured on the Monaro Plateau during the trip previously referred to were found in January, but as numbers of marsupials in this high country had very small young at the same time, it is probably an indication of a later season than that occurring in lower Victoria.

Again, in similar fashion to the Lesser Flying Phalanger, the

Pigmy Possum evidently inhabits a nest as a family group. In support of this there is the evidence of the family found at the "White Swan", near Ballarat, and the present survivors of the Warburton group, where the three immature females were caught with the mother, while one active member, which escaped altogether, was probably the male. Finally, without taking into account the Bendoc experiences, there was another family containing several immature specimens discovered at a spot near Arthur's Creek (Vic.) last year.

However, there is a great deal to be learned about the interesting habits of this beautiful, though secretive, little sprite of the tall gum trees. It has yet to be bred in captivity, and almost certainly most of the habits that are chronicled must be those observed in captivity.

A LIZARD NOT PREVIOUSLY RECORDED FROM VICTORIA

By C. W. BRAZENOR, National Museum of Victoria

The specimen of *Physignathus gilberti* Gray here recorded was presented to the National Museum of Victoria by Mr. W. J. Quarterman, who obtained it at Werrinull, in the extreme North-west of Victoria.

Gilbert's Water Lizard is earthy brown above, with two longitudinal lighter stripes along either side of the back. The under side is a light reddish brown. The head is rather long, the eye mid-way between the ear and the snout, and the nostril a little nearer the eye than the end of the snout. There is a feeble crest on the neck and back, and the scales of the back are keeled, the keels parallel with the mid-line. The hind limb reaches the tip of the snout when pressed along the body. The full size of this lizard is, from nose to tail, about 18 inches, of which 13 inches is made up of tail. The present specimen is about half that length. The species was previously recorded from Northern and Western Australia.

The genus is represented in Australia by four species, but hitherto in Victoria by only one, the Gippsland Water Lizard or "Crocodile" *P. lesueurii* Gray. As the name suggests they are usually found in the neighbourhood of water, into which they jump, when disturbed, with a loud splash.

Gilbert's Water Lizard casually resembles the common Tree Dragon or Bloodsucker *Amphibolurus muricatus*, but may be recognized by the fact that its body is compressed, whereas the body of the Dragon is depressed, and also by its stance, which is characteristic of the genus. The lizard stands high on its fore legs and the head is held well in the air.

ABNORMAL FORMS OF COMPOSITE FLOWERS.

By TARLTON RAYMENT.

The spring of 1932 might be referred to as a "Capeweed year". Not only has the weed covered every piece of "vacant" land, but it has invaded the pastures and the roadsides, and last, but not least, the golden flowers adorn even the Tea-tree groves of Port Phillip Bay. Capeweed is ubiquitous, and strangers pardonably may regard it as a native of the country.

This plant, *Cryptostemma calendulaceum*, is a native of Africa, but Australians usually refer to it as "Dandelion". Why they should do so is not at all clear, since the two flowers are not alike; however, both plants belong to the great Family, Compositæ.

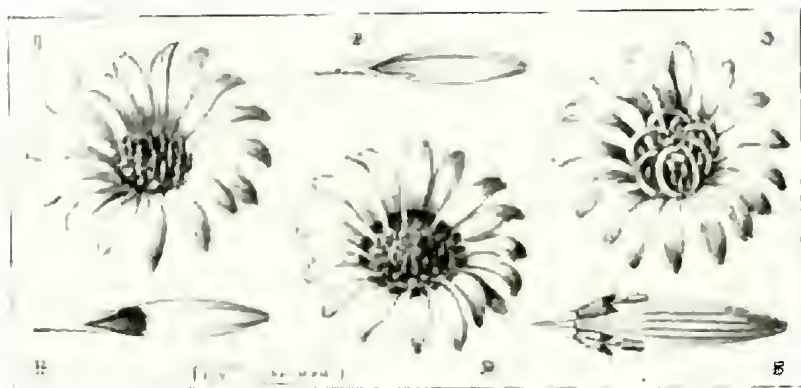


Fig. 1. Capeweed.

The pollen of Capeweed is much favoured by almost all bees, both hive and wild, so that the plant is a good "hunting-ground" for the hymenopterist. During my excursions I pay great attention to the golden flowers. But I observe the plants as well as the bees—indeed, the study of the bees impels one to do so—and I am surprised to note several departures from the normal form. The ray petals are very long on some plants, and one form has developed a beautiful brownish-red "eye"; that is, a ring of reddish colour. Each of the ray-petals has a dark spot of a lovely tint.

Another form has two rows of petals, the outer ones being longer and more numerous, while the inner ones are narrow, and incurved in a graceful way over the purple-tipped florets grouped in the centre. I had previously observed these abnormal forms as far distant from Melbourne as Geelong, and brought some of the plants home, so that I am now able to find them at Sandringham.



Fig. 2. Marigold.

In the garden, the common Marigold, under the influence of the bountiful season, developed some remarkable features. Some flowers had extraordinarily large ray-petals, others an excessive number; a few had centres and tips of petals carmine.

But the most remarkable forms developed a cluster of green flower buds in the centre of the capitulum. When the ray-petals withered and fell off as the seeds developed, the "secondaries" grew very quickly, and finally expanded to exhibit yellow petals. Indeed, on one flower some 31 "secondaries" developed, but several of these exhibited a single petal, of more or less tubular form, and with as few as two florets. The stems of these abnormal groups were fasciated, and it was noticed that the fertile seeds of the original flowers were very few.

EXPLANATION OF FIG. 1

1. An entirely yellow form of "Capeweed" (*Cryptostemma calendulaceum*) with long ray-petals.
2. Some have a reddish-brown ring forming an "eye".
3. Others have a second row of narrow ray-petals incurved over the capitulum of florets.
4. Upper surface of a ray-petal, shewing the dark colour.
5. The under side of the normal petal is olive for the greater part; these are purely ornamental, for they bear no seed, being placed between the florets in the outermost row. Note the pollen-covered anthers standing up above the tiny corollas.
6. Upper surface of a normal yellow ray-petal.

FIGURE 2

1. After the ray-petals on the normal capitulum had fallen, a fasciated group of abnormal buds appear.
- 2, 3 and 4. Some of the abnormal florets.
5. Normal form of floret.
6. Normal form of floret unopened.
7. Abnormal floret opened.
8. (a) Small abnormal seed, and (b) normal form.

NOTES ON *DIURIS PEDUNCULATA* R. BROWN.

By W. H. NICHOLLS.

Diuris pedunculata doubtless is our most abundant "two-tail orchid." It was first collected by Robert Brown, at Port Jackson, New South Wales, the brief description appearing in *The Prodramus* (p. 316). This species is met with almost everywhere, from the lowlands to the tops of our highest mountains. Cowslip, Golden Moth, and Snake Orchid are perhaps the best of the many popular names bestowed upon this exceedingly variable spring-time species. Though variable, it is easily recognized.

Bentham (*Flora Australiensis*, Vol. VI. p. 328) writes:—"This species, with the flower usually pale-coloured and narrow, and easily known by the pubescence of the centre of the labellum, varies much, nevertheless, in the breadth of the several parts of the flower and in the raised lines or plates of the labellum, which sometimes end in broad, pubescent calli, separated by the broad base of the central pubescence of the lamina, sometimes are much rounded, incurved at the end, almost meeting, the pubescent centre of the lamina very narrow. The latter form characterizes the *D. lanceolata* Lindl.; but I have found many intermediates, with slight difference in other characters variously combined."

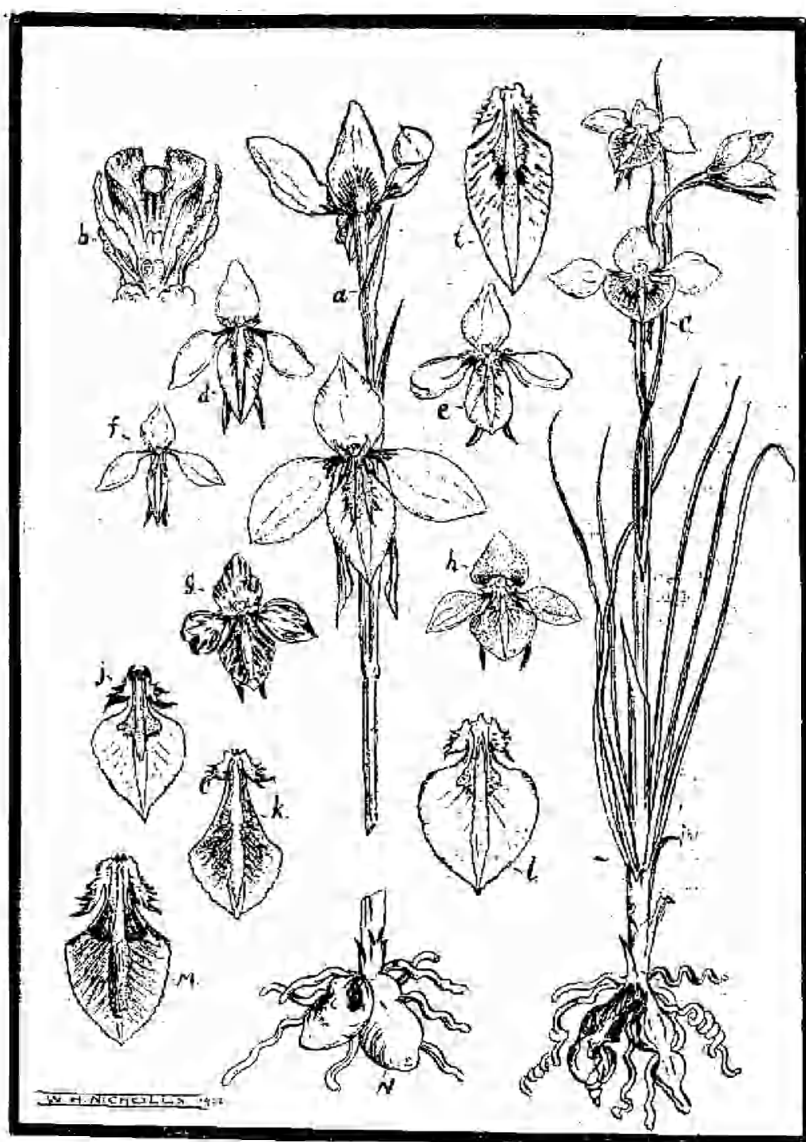
Bentham recognizes a variable plant. The pubescence, often remarked, is the chief characteristic of this species. The form Lindley described as *D. lanceolata* is doubtless the most common one, with the long, narrow labellum. The largest form of *D. pedunculata* is best referred to as variety *gigantea*. It differs from the typical form only in size.

(*Differt a typo, planta 30-35 cm. alta. Flores magnus.*)

I have collected this large form at Nobel Park, Victoria. In some of the specimens the blooms attain a width of $2\frac{1}{4}$ inches = app. (6.5 cm.). It occurs in swampy situations. Some of the flowers have the segments marked with brown, almost as generously as is usual in the Leopard-Orchid (*D. maculata* Sm.). The flowers of *D. pedunculata* vary in colour from pale lemon-yellow to orange—with green markings at the base of the segments—the lateral sepals (as usual in this genus) greenish.

On the plains to the west of Melbourne, the plants with orange-coloured flowers are oftentimes plentiful, growing chiefly in hard ground. Some are very dwarfish. This season a surprise awaited me when roaming the plains not far from Sydenham; for there I found a colony of plants with flowers exquisitely coloured, bright canary yellow. The throat was *vivid* orange—at first glance, orange-red, this bright colour extending along the pubescent plates to within a brief distance of the margins of the lamina.

On the plains—where the soil is very hard—*D. pedunculata*



Diuris pedunculata R.Br

(Note: Figures of the flowers drawn comparatively. Figure "a": actual size of the flower is $2\frac{1}{4}$ inches across.)

grows in tufts of many plants; the tubers are sardined together, and much misshapen through pressure; the roots often are cork-screwy.

It is not necessary to give here a description of this species, which is widely distributed throughout Victoria, New South Wales, Queensland, South Australia and Tasmania.

The illustrations accompanying these notes show some of the many variations found in the species figured.

Fl. September to November; later in sub-alpine regions (until February).

KEY TO ILLUSTRATIONS, P. 19

- a. *Diuris pedunculata* R.Br. var. *gigantea* n. var. (Nobel Park).
- b. Column from front.
- c. A plant with misformed tubers, etc. Flowers canary yellow with vivid orange lamina. (Sydenham-St. Albans).
- d. Flower, pale lemon yellow-brown markings.
- e. Flower, canary yellow (Lang Lang, Victoria).
- f. Flower, canary yellow, very narrow labellum (Wonthaggi).
- g. Flower, pale yellow, dark brown markings (Cravensville).
- h. Flower, soft orange, wholly (St. Albans).
- i. Labellum, canary yellow, red brown markings (Cravensville).
- j. Labellum, lemon yellow, lateral lobes with deep brown (Cravensville).
- k. Labellum, deep orange, brown lines (Cravensville).
- l. Labellum, pale orange, wholly (Cravensville).
- m. Labellum, deep orange and light brown markings (Bayswater).
- n. Normal tubers, etc.

CONCERNING CATERPILLARS.

For the Club's December meeting, the subject proposed is "Caterpillars". Members are asked, to collect specimens during their rambles, keep them alive, and exhibit them at the meeting. Even very common kinds are desired for a display that will be unique and excite general interest.

The present is a good season for insects of various orders, and caterpillars of moths and butterflies are abundant in many localities. Probably some of the specimens brought to the meeting will prove to be the larvae of scarce insects.

A revival of interest in Lepidoptera is noticeable. Years ago, butterflies were as popular with the field naturalist as orchids are nowadays. There were dozens of butterfly hunters in the Club, and several whose interest deepened into scientific work on Australian Lepidoptera. Important papers dealing with moths and butterflies have been published in the *Naturalist*, and the editor hopes to include in the next issue an article on one of the migratory species, by Mr. A. N. Burns. Field notes on butterflies will be welcomed. This may be a "butterfly summer".

The publication of Dr. G. A. Waterhouse's book, *What Butterfly is That?* should do much to stimulate interest in the most beautiful of all insects, whose life histories are of absorbing interest.

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PROCEEDINGS

The monthly meeting of the Club was held at the Royal Society's Hall on Monday, November 14, 1932, at 8 p.m., the President Mr. J. A. Kershaw, C.M.Z.S., presiding over an attendance of about 100 members and friends.

DEATH OF FOUNDATION MEMBER

The President expressed deep regret at the death of Mr. T. G. Sloane, a foundation member of the Club, and a leading entomologist. Members stood in silence as a mark of respect to his memory.

CORRESPONDENCE

From Mr. F. Lewis, Chief Inspector of Fisheries and Game, regarding permits being issued to dealers to capture a limited number of seagulls.

From the Forests Commission, regarding the gathering of wild flowers by school children.

REPORTS

Reports were given as follows:—Wild Nature Show, Mr. W. H. Ingram; Excursions, Bayswater to Ringwood, Mr. C. French, Jun.; Eltham, Mr. C. Barrett (in leader's absence); Beaconsfield, Mr. A. S. Chalk; Brisbane Ranges, Mr. V. H. Miller; Royal Park, Mr. W. Hanks; Upper Ferntree Gully, Miss J. Raff (in leader's absence).

ELECTION OF MEMBERS

The following were duly elected:—As ordinary members, Mrs. A. Howell, Miss A. Jones and Mr. F. Oswald; as country member, Mr. J. A. Dundas; as associate member, Master Chas. Davis.

GENERAL BUSINESS

Mr. C. Barrett referred to the campaign against Emus in Western Australia. A discussion followed, in which Mr. A. H. E. Mattingley, Mr. C. Daley, Miss R. Chisholm, and others took part. The Secretary was instructed to convey to the Prime Minister the Club's protest against the method adopted (use of machine-guns) to destroy the birds; and to write to the Royal Society of Western Australia, asking for further information on this matter.

LECTURE

Mr. J. W. Audas read an interesting paper on "A Trip to the Blue Mountains." The scenery and botanical features were described. A number of lantern slides from negatives by Mr. J. H. Harvey was shown.

EXHIBITS

Mr. J. W. Audas.—Botanical specimens in illustration of his paper.

Mr. C. J. Gabriel.—Cockle shells, including *Cardium edule* Linn., England; *C. unedo* Linn., Lord Howe Island; *C. tenuicostatum* Lam., Victoria; *Hemicardium cardissa* Linn., China; *H. dioneum*, Sby., Willis Island.

Mr. A. Mattingley.—Aboriginal remains from the Coorong, South Australia.

Mr. W. Hanks.—Specimen of leaf beds material, situated under the older basalt at Royal Park.

Mr. H. P. McColl.—Cast skin of cicada, live cicada, hawk-moth, cup-moth caterpillar, fungus found on sawdust dump at old mill, Mason's Creek, West Kinglake.

Mr. H. Stewart.—Lerp scale insects on Eucalyptus leaf, also five species of fungi, including *Boletus* sp. and *Polyporus* sp.

Mr. G. Coghill.—*Chamaeleum uncinata*, Kunzea.

Mr. A. J. Swaby.—*Billardiera cymosa* (garden grown).

Mr. A. S. Chalk.—*Ranunculus* sp. (garden grown); nests of the White-browed Scrub Hen, Spotted Pardalote, White-eared Honey-eater, Bell Miner.

Mr. Leo W. Stach.—Fossils from Largon Creek, off Toorloo Arm, eight miles east along Prince's Highway from Lake's Entrance. About a quarter of a mile past Toorloo Arm a track leads to the left to Largon Creek, on the other side of which is a high bluff of pure Miocene polyzoal limestone with a thick band of *Ostrea* sp., and *Clypeaster gippslandicus* at the top. Exhibit included: *Monoporella crassatina* Waters (Bryozoa), encrusting *Ostrea* sp., *Pectin gambierensis*, *Hinnites corioensis* McCoy, *Cassis* sp., *Clypeaster gippslandicus* McCoy.

Mr. George Lyell, of Gisborne, a member of the Club, has presented his magnificent collection of Australian Moths to the National Museum, and has already sent part of the collection (the Hawk-moths). The collection consists of 44,325 specimens, representing 5,522 species, and including 395 type specimens described by Turner, Meyrick, Prout, Lower, and others. Each moth is beautifully mounted and is accompanied by full data, giving name, locality and date. The collection is housed in 267 cabinet drawers and 52 store boxes.

POLLINATION OF *DIURIS PEDUNCULATA* R.Br.

By EDITH COLEMAN

Most nature lovers are familiar with the early morning visit of the bee to flowers of the poppy. There is something spectacular in its movements as, lying on its back, it scrapes vigorously at the abundant and heavily-laden stamens. The frenzied actions suggest that time is the essence of its contract. Intent only on the filling of pollen-baskets, it is quite indifferent to the efforts of perhaps five or six neighbours foraging in the same flower. By 9 o'clock every poppy-flower in the garden is bereft of most of its precious dust.

The pollination of orchids is certainly less spectacular, but it provides an even more wonderful example of the perfection which insect-plant association has reached. There is no feverish haste. Only rarely is there any pushing and scrambling; yet each insect visitor may set in motion mechanical processes of almost incredible perfection. Without apparent effort on its part, it becomes the unconscious agent of the orchid in a vital process—the transference of pollen. To serve this purpose there is no need to coat its body with pollen grains, for in most orchids they cohere in neat bundles, mealy or waxy, all ready for transport. With simple, effortless action the insect carries off, usually attached to its "head", in tidy, compact bundles as Nature has packed them, the precious grains essential to the increase by seed of the plants. The pollination of *Diuris pedunculata* is one more chapter in that amazing story of which Darwin wrote the opening chapters.

The pollination of this orchid is carried out in an efficient manner by a small black bee, *Halictus languinosus* Smith. The present paper deals with a variety of *D. pedunculata* having flowers so large that each step in their pollination may be followed without the use of a field-lens. Using no technical terms, with the aid only of a few diagrammatic drawings, the process may be described so simply that a child can fully understand the purpose of an association between insect and flower, without which the orchids must cease to reproduce from seed, or evolve some other means of securing fertility. For in all species of *Diuris* the structure of the flower precludes self-pollination. They rely for fertility upon the more or less frequent visits of insects. A little study of their floral mechanism reveals how beautifully the flowers are adapted to pollen-transference by insects. In exceptional circumstances self-pollination may be brought about by the same agency, but this is a mere fortuitous happening, so rare that it need not be taken into account.

The flowers of *D. pedunculata* var. *gigantea* appear to be visited by only one species of bee capable of removing the pollen masses. Like so many insect-pollinated flowers, they are very conspicuous



Diuris pedunculata R.Br., var. *gigantea* Nicholls. Flowers golden-yellow (or sometimes orange) with brown markings. (Nearly natural size.)

and have a slight perfume. They secrete no free nectar, but around the top of the receptacle is a fleshy, glandular ring which secretes a fluid apparently palatable to the small bees. To reach the nectar, tissues must be pierced by an insect having mouth-parts suitable for the purpose.

Many orchids have evolved more highly specialized nectar-glands. The "honey-disk" in *Diuris* appears to be a vestige of more primitive structure. The finding in one flower of a larger bee, probably *Apis mellifica*, gripped so firmly by four protrusions of the mouth-parts that it was unable to escape, suggested the presence of nectar in the upper part of the ovarial cavity. The insect had not, however, disturbed either gland or pollinia.

In all species of *Diuris*, with the exception of slight differences in shape and size, the parts of the flower directly concerned with pollen-transference follow the same plan, and there seems to be no reason why one species of bee should not pollinate them all. It is quite possible that it sometimes does, but that fertilization does not always follow. Though, under natural conditions, hybrids in the genus are not uncommon, it may be assumed that certain insects associate themselves with but one species, or that only one species of bee is able to remove the pollen-masses.

Cut racemes of different species may be hand-crossed and will produce full capsules of seed. Whether these are fertile I have not been able to ascertain; probably not, for in certain orchids pollination may not be followed by fertilization for some weeks, though the swelling of the ovary is sooner apparent, and infertile seeds develop.

It is interesting to follow the structure of the flower in *Diuris* and to note how beautifully every part is adapted to the accomplishment of pollination. The labellum is rigidly sessile. Its base, and the wing-like lobes embrace the foot of the short column so closely that, together, they form a small, tubular opening leading to the ovarial cavity. To reach the glandular, inner edge of the receptacle the visiting insect must exert pressure on the labellum in order to widen the opening sufficiently for the insertion of its mouth-parts. The contracted lower margin of the stigma extends into this passage, partly filling the already narrow opening. Occasionally an upward counter-pressure of the labellum proves too much for the small bee, and it remains, with mouth-parts firmly gripped, to perish in the flower. Placed in a killing-bottle, it may, either as a result of its death struggles or the relaxing of the labellum, instantly become free.

The dorsal sepal is almost erect until pollination is effected, offering an open doorway to invited guests. One may safely say "invited", for, like the opening in sunshine, or sultry weather, of unpollinated flowers in the genus *Thelymitra*, and the spreading of segments in *Calochilus*, this position of the dorsal sepal may be read as an open invitation of which the small bees not infrequently avail themselves. After pollination the fall of the dorsal sepal indicates that hospitality ceases. This movement differs from the sleep-movement noted in many orchids, and from the mechanical action of parts directly concerned with the removal of the pollen

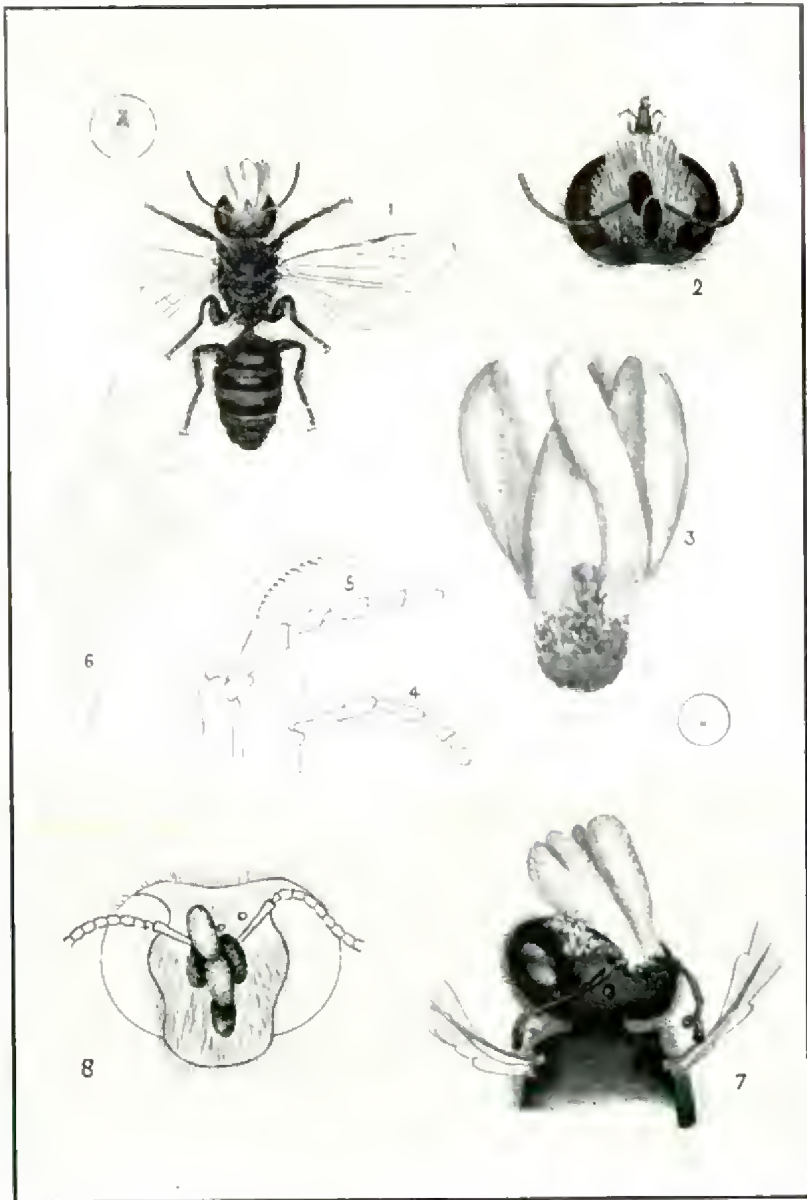
masses. It differs again from the movement of irritable or sensitive labella in other species. I find, in the house or in the field, that the fall of the dorsal sepal invariably follows pollination.

The pollinia do not lie above the stigma, but are carried vertically behind the erect stigmatic plate. They are partly supported in their shallow cells by the column-wings, which fit snugly on either side of the narrow anther. The two bilobed masses are attached by their apices to a large gland behind the rostellum, which is situated directly above the stigma, practically in the same plane. The rostellum, which includes the gland, stands out, like a white button, fitting neatly into a U-shaped notch in the upper part of the stigmatic plate. Ovoid in shape, this rostellar-gland might be taken for a drop of boiled starch.

In the mature flower the gland lies free in its notch, except for a slightly-viscid, covering film, or membrane, resembling the film which settles on boiled starch. This membrane is continuous with the stigmatic secretion. Pressure on the centre of the turgid rostellar-gland by the head of a bee brings it in contact with the more viscid secretion of the gland. At the same time the circumference of the covering membrane ruptures, and the gland now lies quite free in its U-shaped notch. After rupture of its protective membrane the gland becomes most tenacious, and adheres firmly to the head of the bee, which, as it leaves the flower, drags from behind the stigmatic plate, *in an upward direction*, the golden pollen-masses attached to the sticky disc. There are no caudicles to the pollinia. They are attached directly to the back of the gland. Thus, beyond a slight, forward depression as the gland contracts in drying, there is no change in their position after removal. They remain poised in the most advantageous position to ensure their deposition on the stigma of the next flower visited.

In an hour the smooth, opalescent appearance of the gland is completely changed. The edges have become crenulate. In 24 hours it is golden in colour, like dried gum, tough but not brittle. Though both pollen-masses are frequently deposited by the bee on the stigma of another flower, the now hardened gland to which they were attached is only rarely dislodged, so securely is it glued to the head of the bee. It can only lose this part of the pollinarium when freshly removed from behind the covering membrane, before it has time to dry and set.

One may see a bee with a piled up mass of these glands, in pyramid shape, with, attached to the apex, the pollinia withdrawn from the last orchid it visited, standing out, like a remarkable golden head-piece. Without pressure on the rostellum, and the consequent rupture of the membrane, the masses cannot be removed, undamaged from their cells, nor can the gland, when properly "set", be transferred from the head of the bee.



Pollination of *Diuris pedunculata* by *Halictus languinosus*

In one locality, where *D. pedunculata* var. *gigantea* is abundant, eight bees were taken in less than half-an-hour. Seven of them bore a varied assortment of glands, and complete or broken pollinia, some quite dry, others freshly removed. One was taken as it left two racemes in succession, and entered a flower on a third. It bore three freshly removed, scarcely damaged pollinaria. Occasionally a bee emerged without pollinia. In this case an examination of the flower usually showed that they had been previously removed. On a sunny day one finds 50% of the pollinia removed from open flowers. In about 20% pollen is found on the stigma, a fairly high percentage for insect-pollinated orchids.

On sunny days after rain the bees are very active, and one may then see them bearing two or three scarcely broken pollinia. Having entered a flower, they are withdrawn with difficulty, so powerful is the attraction. Landing on the labellum, the bee enters swiftly, always, as the pyramid of glands testifies, in the same manner, its head in close proximity to the base of the stigma, the dorsal surface pressing the rostellum. Back legs grip firmly the long, pubescent ridges on the base of the labellum. These fleshy ridges probably serve as guide-lines, forming and holding it in a channel, a direct passage to the exact spot to serve the purpose of the flower. It remains awhile, apparently motionless, then, turning in the flower, retreats as swiftly as it entered, bearing, if they have not previously been removed, the pollinia, glued firmly to its head.

Except in accidental circumstances its escape from the flower is as easy as its entrance. One was removed from a flower whose gland was intact, showing that these accidental imprisonments are not due to the viscid matter of either gland or stigma. The mischance is not infrequent. One finds the captive firmly wedged, gripped, one assumes, between the base of the sessile labellum and the column. Only by force could the mouth-parts have entered that narrow opening. Was the desire for nectar the only cause of the bee's eagerness, or has the orchid another attraction for which it is willing to risk life itself? On several occasions two or more bees have been found in the same flower, apparently asleep or stupefied. Though they were not caught, or held in any way, they remained motionless for hours. When removed they were very active, showing that they were not injured or disabled.

In October, 1929, I found three of these helpless bees in the same flower, and submitted them to Mr. Rayment, who identified them all as males. (See note in the *Naturalist*, February, 1930). This season I have submitted to Mr. E. Jarvis fifteen bees captured in or about the flowers of *Diuris pedunculata* var. *gigantea*. Fourteen of them were males. The only female captured was taken in a dandelion flower, and belongs to another species, though to the eye of a botanist it closely resembled *Halictus languinosus*.

It had no white blotch on the front of the labrum. This bee carried neither glands nor orchid-pollen, showing that, though taken in the vicinity of the *Diuris*, it had not visited these flowers.

Two of the bees sent to Mr. Jarvis were taken in the smaller form of *D. pedunculata*. These also were males of *Haliectus languinosus*. They carried complete pollinaria. In observations during the past six seasons I have more rarely seen this bee visiting the smaller, type form, the flowers of which are less open. It is possible that the new variety owes its vigour to well-established cross-pollination. The localities in which I have studied these robust plants are not especially moist. They flower later than the type, commencing their season when the smaller form is practically over. As some indication of the attraction held by the orchids for *Haliectus languinosus*, I may mention that three of the small bees were captured carrying neither glands nor pollen. They were then enclosed in a large glass jar in which had been placed a few racemes of *D. pedunculata*. I was able to see them freely enter the flowers and remove the pollen-masses. They transferred three pollinaria to various segments of the orchids, and one pollinarium to the side of the jar. Broken masses also lay on the floor of the jar. Removed under natural conditions, the pollinia would only rarely be transferred. The bee would, presumably, make an uninterrupted flight away from a visited flower, the gland thus having time to harden before the next orchid was reached.

In the confinement of the jar, while the glands were still moist enough to be dislodged, the bees brushed against one flower on leaving another, or as they searched for freedom. Their heads bore glands and broken pollen-masses, showing that they had freely visited the orchids, even in captivity. Three other bees, without glands or pollinia, were then enclosed in the same jar. This time flowers of *D. sulphurea* were used, but were not visited, though the bees were active. Both of these species are of the same bright yellow colour. The latter, however, are vividly marked with dark-brown, eye-like spots, and have very different markings on the labellum. In *D. pedunculata* the labellum is only lightly streaked with brown. One flower of this species was then dropped on the floor of the jar. It was almost immediately visited, and the pollinia removed.

It is possible that, under normal conditions, both species share the favour of the bees; but I think not, for I have seen the pollinia of *D. sulphurea* removed by a very different bee, which I hope may be discussed in another paper.

A few figures taken from my note book will illustrate the pollen transference in other species of the genus.

D. longifolia, 21 open flowers examined, pollinia removed in 6.

D. sulphurea, 18 open flowers examined, pollinia removed in 5.

D. maculata, 25 open flowers examined, pollinia removed in 10.

D. palachila, 10 open flowers examined, pollinia removed in 8.
D. punctata, 16 open flowers examined, pollinia removed in 2.
D. setacea, 18 open flowers examined, pollinia removed in 2.
D. n. sp. N.S.W., 38 open flowers exam., pollinia removed in 9.
D. pedunculata, 20 open flowers exam., pollinia removed in 12.
D. alba, N.S.W., 40 open flowers exam., pollinia removed in 13.
 In only 16% of these flowers was pollen shown on the stigma.

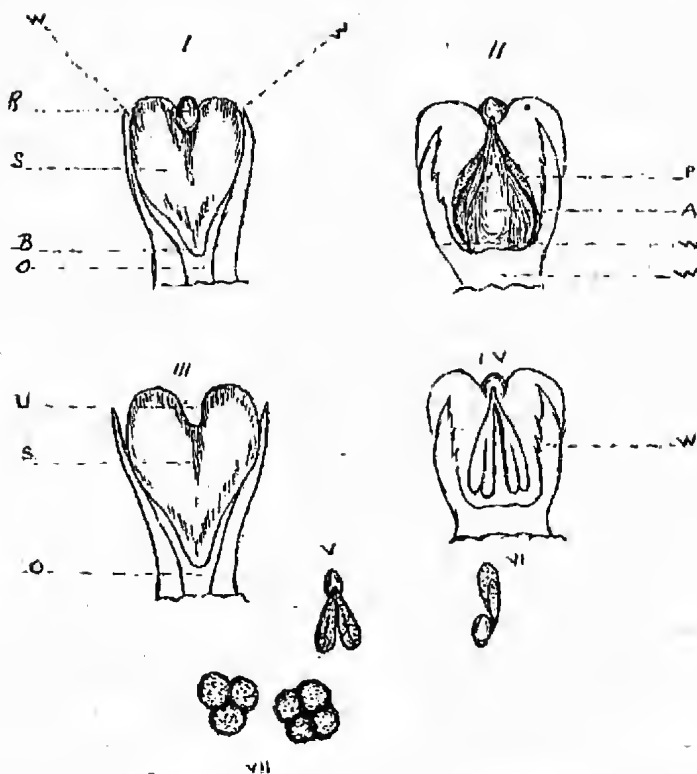
The Western Australian species, *D. setacea*, shows a low percentage of removals, but probably most of these flowers were in bud when posted to me. *Diuris* species do not as a rule carry well over long distances. The low percentage of pollination in *D. setacea* accounts for this species reaching me in excellent condition. On the other hand, the flowers of *D. palachila* which came from N.S.W. were well pollinated, and consequently travelled badly.

I must express my gratitude to correspondents without whose kind co-operation these notes would not have been possible. For Western Australian species I am indebted to Miss Rica Sandilands, Miss Estelle Nelson, Mr. F. Walton Rowe, Mr. Arthur Walters, and Lieut.-Col. Goadby. For those from New South Wales to Mr. C. W. Boase, and in Victoria to Mrs. Rich (Rushworth), Mrs. Brooks (Maldon), Miss Jean Parker (Mitcham), and Mr. Homann (Wonthaggi). For the very beautiful plate illustrating the activities of the bee I am greatly indebted to Mr. Edmund Jarvis, the Queensland entomologist.

In a letter, dated November 7, 1932, Mr. Jarvis tells me that he has just examined an antenna of *Halictus languinosus*, and has found a high development in the olfactory sense of this bee. He adds: "I was almost sure you were right in surmising that, in the pollination of *Cryptostylis erecta* R.Br. everything points to scent as the chief attraction for insects—a scent so subtle as to elude human perception. (Vide *V.N.*, April, 1930). This has been my opinion also, but I wanted to obtain scientific support, which has now been established, or practically so, by the discovery on the points of the flagellum, of hundreds of olfactory pori, each containing a peg-like body, somewhat resembling those occurring in lamellae of the club in antennae of scarabaeid beetles."

EXPLANATION OF PLATE XIII.

1. *Halictus languinosus* Smith., with pollinarium of *Diuris pedunculata* adhering to its head. (Male specimen X 6).
2. Head of *H. languinosus*, showing vestiture on vertex; and two viscid discs of pollinarium found attached to same. X about 14.
3. Complete pollinarium of *Diuris pedunculata*; drawn above six weeks after removal. Note the concave form of pollen masses. X 45.
4. Labial palpus of *Halictus languinosus* (male). X about 64.
5. Maxillary palpus of same. X about 86.
6. Plumose hairs from vertex of head of *Halictus languinosus*, highly magnified.
7. Diagrammatic sketch of side view of head of *H. languinosus* carrying pollinarium; drawn 41 days after capture. X about 12 times.
8. Outline of vertex of head of *H. languinosus* showing five glands of pollinarium from *D. pedunculata*.



Diagrammatic sketches of column in *Diuris pedunculata*, showing parts concerned with pollen-transference. Labellum stripped off.

- Key I. Column, front view, showing rostellum (R) in its U-shaped notch on the upper margin of stigma (S), the contracted base of which (B) extends into ovarian cavity (O). Part only of column-wings shown, flattened.
- II. Back view of same, showing anther (A), its apex behind rostellum. Pollen masses (spotted) visible on each side. Part only of (flattened) column wings shown.
- III. Front view with pollinarium removed, showing notch into which rostellar-gland fitted.
- IV. Back view, with anther removed to show pollinia still *in situ*. They are slung, saddle-wise, over a low, longitudinal keel, which corresponds with a shallow furrow on the stigmatic plate.
- V. Pollinarium (pollinia and gland) from the back.
- VI. Pollinarium, side view.
- VII. Pollen tetrads, H.P. All greatly enlarged, diagrammatic.

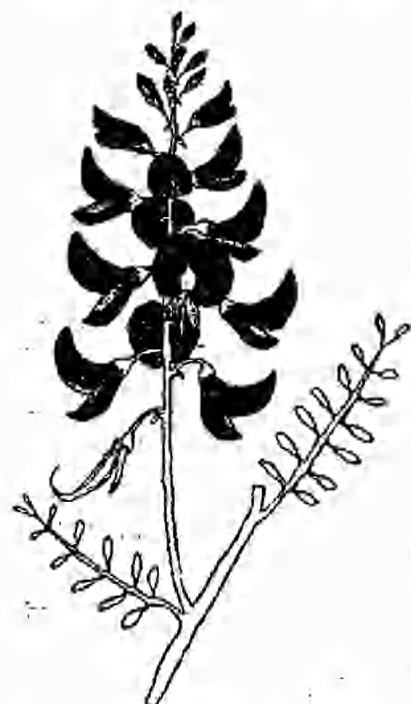
PLANT LIFE IN THE PILLIGA SCRUB

By THE REV. H. M. R. RUPP

The Pilliga Scrub is known as a naturalists' paradise beyond the confines of its own State; but inasmuch as some of the readers of this journal may be hazy about

its location, a word or two on this point may serve to introduce my subject. From the Liverpool Range, in New South Wales, a rugged spur of mountains runs far out westward almost to Coonamble. This is the Warrumbungle Range; and from its northern foothills a great plain stretches out to the north, covered for 60 miles—to the Namoi River—with a more or less dense scrub of Cypress-pine, Belah, Box, Ironbark, and other trees of the Western Plains. This is the Pilliga Scrub.

From Baradine, near the southern edge, to Pilliga, near the Namoi, the road runs for 44 miles between unbroken walls of scrub. Monotonous? Hardly that, even if you have no eye for plants or birds or insects; for, if fine weather prevails, you will be lucky to get through the sand, and if it rains you may have to spend the night in a bog; and, wet



Swainsona galegifolia. Dark red form (reduced).

or fine, you are sure of a varied assortment of bumps. Half-way through the scrub is the railway terminus, a timber settlement rejoicing in the name of Gwabegar, which you may pronounce Wobbie-gar. Pilliga lives in hope of the extension of the line—and so should I if I lived here permanently.

When I accepted an offer of four months' work here, I anticipated opportunity to investigate certain imperfectly-known ground-orchids of the Western Plains. The season, however, was adverse; no rain had fallen for months, and when it came it was apparently too late for the orchids. Somewhat to my surprise, I discovered that one epiphyte, *Cymbidium canaliculatum*, had crept away out here on the plains, and was successfully combating the severe

conditions to which it is so often exposed. Further, when it came into flower, I was delighted to find in it the most beautiful variety of this capricious species I have ever seen. The prevailing form is bright golden yellowish-green, heavily splashed with red or sometimes red-brown; labellum white with purplish-red spots. The perfume is delicious. This is the only orchid I have met with. But there is a wealth of lovely flowers of other kinds, and the flora generally is intensely interesting. Mistletoes are very much in evidence among the trees. I dislike these parasites, but

one cannot ignore the presence of eight or nine species. Many of the unfortunate Belahs are so infested that it is not easy at a glance to say how much of the foliage is *Casuarina* and how much is terete-leaved *Loranthus*. Even the pines are not immune, the dainty little *Phrygilanthus Bidwillii* being often seen on their branches. The pines themselves are chiefly *Callitris verrucosa*, and there are some noble trees among them.

Outstanding among the showy flowers of the area are the Swainsona Peas, one or two of which bear such a bad reputation among stock-owners under the name of "Darling Pea." Even my personal experiences, years ago, of the ill-effects of these plants upon stock, could never blind me to their beauty, and the Pilliga Scrub forms are the loveliest I have seen. *S. galegifolia* occurs with flowers as large as a shilling, and the colours vary from deep blood-red to dark rose, purple, and pink. *S. Cadellii*, with equally large flowers, subtended by bracts, on very long racemes, is found in white, cream, many shades of pink and purple, and pink-and-purple striped. *S. oncino-tropis* favours the open country outside the scrub; it is a small herb with large lustrous mauve flowers with twisted keels.



Swainsona Cadellii. Pink-and-purple striped form (reduced).

found in white, cream, many shades of pink and purple, and pink-and-purple striped. *S. oncino-tropis* favours the open country outside the scrub; it is a small herb with large lustrous mauve flowers with twisted keels.

Another gem of the Scrub is a species of *Calycotrix*, locally known as Heather. This occurs in large "patches" on sand, the bushes being from two to eight feet high. They seem to care little for dry spells; when I came they were in full bloom, each bush covered with dense masses of white and pink flowers so that the foliage was almost invisible. Nor is the beauty of this shrub exhausted when the petals fall. The sepals are persistent, turning deep red, pale red, yellowish-green or cream, but maintaining the principle "one bush one colour." The species may be *C. longiflora*—but the genus is at present under review.

Among the other shrubs and trees are many with charming flowers. The Budda or Sandalwood (*Stenochilus Mitchellii*) is common in the scrub, and arrests attention by its masses of creamy blossom and its neatly-tesselated bark. Like the Heather, this tree has persistent calyces; they are creamy, like the petals. Another *Eremophila* (*S. longifolia*) is known as Emu Bush, the birds (Emus are plentiful here) being fond of the fruits. The flowers are red and tubular. A third species, *S. maculata*, has larger flowers, orange, bright red, or pale green, with deeper red spots. Two species of *Capparis* deserve mention. *C. Mitchellii* is the Bumble, which develops from an untidy straggling shrub into a shapely little tree. The large white or cream flowers, with long streaming stamens, bloom chiefly at night, and are intensely fragrant. The fruit attains the size of a small orange, and is edible. Personally, while I found the aroma most enticing, the taste suggested an over-mellow papaw with turpentine sauce. *C. lasiantha* is a large scrambling climber with stipules like rose-thorns, and a profusion of lovely white flannelly flowers with a honeysuckle perfume. The fruit, which is not in evidence yet, is said to be quite good.

The Quandong (*Fusonus acuminatus*) is another of our "fruit-trees" here. The gorgeous scarlet colour is better than the flavour. Still another is the Gruy (*Ozonia acidula*), a beautiful tree with erect foliage, otherwise resembling that of the pepper-tree. The fruit is pleasantly acid and makes good preserves. The Leopard-tree (*Flindersia maculosa*) is well-named, for its trunk is truly "spotted like the pard." In its young stage this tree would never be recognized by anyone unfamiliar with it, so unlike the adult is the sapling. *Apophyllum anomalum*, finally attaining the rank of a small tree, is more commonly a tall shrub of most uncouth aspect. Quite leafless, it develops an untidy mass of wiry branchlets with small green flowers, followed by little acid fruits. In graceful contrast is the shapely Wilga (*Geisera parviflora*), with aromatic bark, wood, foliage, and berries. Its dense foliage is of "weeping" habit, and forms fine shade for sheep, who crop it off as high as they can reach. *Grevillea striata*, the Beefwood, is an interesting species, unlike any other of this genus. A small tree with a

very hard, deeply-furrowed black bark, its leaves simple, linear and channelled, up to 18 inches long and silvery-grey, it forms a striking object among the pines and belahs. I have not seen the flowers; the wood somewhat resembles dark silky-oak. Its sole relative here is the Needlewood (*Hakea leucoptera*), which was exploited some years ago for making pipes.

The western Jasmine (*J. lineare*) is plentiful. Its affinities are obvious in its flowers and their perfume, but it is inferior to our eastern New South Wales species, of which there are several. The genus *Acacia* is well represented. The lovely *A. spectabilis*, now well in vogue for garden culture, is abundant in the Scrub, as is another "feather-leaf" Wattle of doubtful identity. So also is *A. viscidula*, a shrub of somewhat untidy habit, but worth notice for the exceptionally deep gold of its flowers, borne in great profusion. The curious *A. conferta* is there, too, with its heath-like foliage and broad pods. Towards the open country are groves of Brigalow (*A. harpophylla*), with sickle-shaped leaves, most silvery among all "silver Wattles", and not far away as a rule is the sprightly, erect-leaved Yarran (*A. homalophylla*). The Weeping Myall (*A. pendula*) is almost confined to the black soil. Of the Myrtaceae, the local Heather has already been noted. *Collistemon linearis* and *Leptospermum flavescens* are in evidence along some of the sandy creeks. I was surprised to find the former so far west. There are two "Apples" (*Angophora*)—one the common *A. intermedia*, the other a peculiar form the identity of which I do not yet know, with almost decussate leaves. Not many Eucalypts are yet in flower, but I have recognized the Red Gum (*E. rostrata*), Grey Box (*E. hemiphylloia*), Poplar Box (*E. populifolia*), Coolibah (*E. microtheca*), and an Ironbark (*E. sideroxylon*).

Herbaceous plants are making a poor show this year at the Pilliga end of the Scrub, owing to low rainfall. Still, there are a few worth mentioning. The Darling Lily (*Crimin flaccidum*) and the Native Jonquil (*Calostemma*) are in great abundance, but many are withering off, and their annual November Show is not likely to be a record one. There are half-a-dozen bright little Goodenias, and a quaint little Composite which I take to be *Angianthus pusillus* forms yellow patches. The ubiquitous Bluebell (*Wahlenbergia*) makes "lakes of blue" in the distance. On the few pools to be met with, the dainty *Limnanthemum crenatum* grows to perfection, wreathing the pools with gold. For the first time I have come upon the Western Plains Trigger-Flower (*Stylidium glandulosum*), a charming little tufted plant with as many as thirty flowering stems, the flowers often varying on the same plant from white through pinks to mauve or magenta.

The course of the Pilliga lagoon, which is fed from the local artesian bore, is marked by a rank growth of Bulrush (*Typha*), and the water is covered, often from bank to bank, by an *Azolla*, with the largest fronds I have ever seen.

THOMAS GIBSON SLOANE (1857-1932).

A notable Australian and a lovable man died at the Burrangong Hospital, Young, New South Wales, on Thursday, October 20. T. G. (Tom) Sloane, of Moorilla Station, Young, sheep-breeder, philosopher and naturalist, is a name deeply engraved in the entomological records of Australia, as his personality is engraved in the hearts of his friends.

One of the five sons of Alexander Sloane, of Mulwala, Murray River, Victoria, a well-known merino expert, he was born in Melbourne and educated partly at the Scotch College, of that city, partly by tutor at Mulwala.

Literary taste and literary discussions seem to have been prominent features in the household, with some resulting original work, and Tom Sloane had a wealth of quotation at command from his favourite poets. But natural history soon became his passion, and when he came to Sydney to learn business in the early 'eighties he found the company grouped around Sir W. Macleay and the new Linnean Society more interesting than that of his stockbroker colleagues. Already that fine friend of scientific youth, the late J. J. Fletcher, had marked him down, and a devoted friendship began here that never deviated from its constancy. Whatever other engagements were due on Sloane's periodic visits to Sydney (generally for the sheep sales), an evening at Hunter's Hill with the Fletchers was never missed.

In 1888 T. G. Sloane took on the management of Moorilla for Alexander Sloane and Sons, and in this year contributed his first paper to the Linnean Society of New South Wales—"A Note on the Carenides, with Descriptions of New Species".

He had already published two papers "on the Carenunms of Mulwala (1881-1882)", in the *Southern Science Record*—a Melbourne journal that ran a brief race of three volumes. His careful, accurate work was at once noted, and soon Sloane became associated with the study of that difficult group, the Carabidae, in which he became the supreme authority in Australia, entering deeply into the anatomy, phylogeny and distribution of the family. For this work he had prepared himself by a close study, not only of the technical literature of the subject, but by an enthusiastic research into the philosophy and work of Natural History in general. An intensive rather than a discursive reader, he remembered, as few men do, the books he found worth while. I have never met anyone who knew his Darwin—especially *The Origin*—as intimately as he did—that book that Wallace said he had read seven times in order to understand it. He was also deeply versed in the Darwinian controversies, and read and re-read everything he could get of that wonderful quartette—Wallace, Huxley, Hooker and Lyell. The writer greatly treasures two volumes—

A. R. Wallace: Letters and Reminiscences—that Sloane unearthed at a secondhand bookstall, and presented during a visit about 1920.

In 1889 occurs a note by Blackburn (*Trans. Roy. Soc. S. Aus.*, 1889, p. 233): "Mr. Sloane occupies a foremost place among the rising entomologists of Australia." Later papers by this veteran



author contain frequent references to his valuable correspondence, and shortly after this date seems to have left the field of Carabidae to the now recognized specialist in the group. This specialization reached its culmination when Sloane published the "Classification of the Family Carabidae" in the *Transactions of the Entomological Society of London*, 1923, a work for which he had been sedulously preparing ever since—and made possible by—his purchase of the Van de Poll collection of Carabidae.

How valuable to the world was this research is shown by a curiously well-timed quotation from the last number of the *Transactions of the Entomological Society, London*, received by the writer (June, 1932, p. 87). In this, A. W. J. Pomeroy, writing on African Carabidae, states: "Sloane's Table of Tribes has been adopted as being the most satisfactory classification in existence." It was with great satisfaction that I called my friend's attention to this appreciation, and though suffering from his last affliction he was pleased at this recognition of his work by a stranger. In his last letter to me (September 8) he wrote: "I hardly expected to see any use made of this system in my time; it seems to take fifty years to get a new idea in circulation amongst entomologists." In 1922 I met his English colleague, H. E. Andrewes, who spoke very highly of Sloane's work. Indeed, when from 1924 on Sloane suddenly cut himself adrift from entomology, both Andrewes and Dr. Walther Horn, of the Berlin Museum, wrote me in great concern on the matter.

Besides his work on the Carabidae, Sloane revised the Cicindelidae (Tiger Beetles) of Australia, again being recognized as the authority here. His chief paper on this, published 1906, was illustrated by A. M. Lea, a generous help characteristic of that big-hearted colleague. Sloane also devoted considerable time to the study of the *Paussidae*, but his work on this was unfortunately never published, though it would have cleared up the synonymy due to the almost synchronous publication of papers on Australian species by Macleay and Westwood. He also described the *Amycterini* of the Elder Expedition. Apart from systematic work, Sloane was interested in distribution, and his paper, "On the Faunal Sub-regions of Australia" (*Proc. Roy. Soc. Vict.*, 1915), is a classic frequently quoted.

To all collectors, Sloane was a mine of information, and like A. M. Lea, was generous of his time and knowledge, naming specimens and writing helpful notes. No less than fifty-nine papers are recorded in Musgrave's *Bibliography of Australian Entomology*, as written by Sloane for various societies, of which forty-nine were published by the Linnean Society of New South Wales. But this list omits two on the Carabidae of New Guinea, published respectively in the *Records of the Australian Museum* and the *Deutsch Entomologische Zeitschrift*.

As manager of Moorilla, Sloane took a keen interest in sheep-breeding and showing, and won numerous prizes at various sheep shows, keeping, in his methodical way, records of the leading studs. He had a stud of his own registered in the *Flock Book*. In one of his letters I find: "I have been looking at my average weights of wool, comparing five-year periods. Between 1891-95 and 1921-25 the weight of the flock under my control had increased 30 oz. per head, or 1 oz. per annum on the average."

We made many interesting trips together, the most extensive being to Western Australia in 1913, to the Victorian Alps and Warburton in 1921, and to Queensland in 1924. We were the first entomologists to explore the wealth of the Dorrigo and the Barrington Tops, the former in mid-winter with frost on the ground; but even then Sloane recorded the capture of fifty-two species, of which he described sixteen as new.

A more delightful companion could not be conceived. Unselfish and cheery, with an unlimited fund of anecdote, he was a good "mixer" with the bush folk, whom he thoroughly understood. Perhaps the only jars occurred when—as among the Western Australian timber men on New Year's Day—there was a difficulty in accepting alcoholic exchanges, for he was a total abstainer and a non-smoker; but his unflinching good temper and sense of humour always pulled him through these crises. Generous in excess to others, remorselessly economical as to his own wants, he carried out the Stoic philosophy to its limit, never complaining when fate struck him—as it did—in many a tender spot.

His later years were clouded by economic burdens that closed around him. In one letter he wrote: "Perhaps being in debt is good for the man on the land, like the fleas on David Harum's dog." Greatly interested in the visit of the British Association to Australia in 1914, he found much to criticize in Bateson's presidential address, being little in accord with Mendelian theories, likening himself to the Scotch gardener who, being shown to be at variance with St. Paul, answered, "But that is where me and the apostle differ."

In August of this year I received two pathetic letter-cards in pencil from the Burrangong Hospital, telling me of his attack of cardiac asthma. A later letter from Moorilla was cheerful and hopeful, but a second attack took him again to the hospital, where the end came. He had known little illness in his life, possessing a strong, vigorous physique, capable of great endurance on his long walks. He was a foundation member of the Field Naturalists' Club of Victoria, the nurse of so many leading students of natural science.

It would be a fine thing if the Club were able to endow a Sloane Medal for annual or biennial presentation for successful achievement in Natural History.

H. J. CARTER.

The Committee of the Field Naturalists' Club of Victoria invites members of kindred societies who may be visiting Melbourne to attend the Club's meetings.



Prasophyllum pyriforme n.sp. Coleman

A NEW VICTORIAN PRASOPHYLLUM.

By EDITH COLEMAN.

Prasophyllum pyriforme.—Planta terrestris, robusta, 30-40 cm. alta. Spica laxiuscula 12 cm. longa. Flores 30-50, subvirides, pedicellis perbrevis; ovaria gracilia, elongata; florales bractea, latae, adpressae, circa 3 mm. longa. Folium vaginatum, lamina circa, 10-16 cm. longa. Sepalum dorsalum 8-9 mm. longum, ovato-lanceolatum, basi concavum, apice deflectum; lateralia 8-10 mm. longa, connata, falcata, acuminata, apicibus liberis; petala linearia, subaequilonga sepalo dorsalio, apicibus obtusis. Labellum pyriforme, 5-6 mm. longum, nervatum, apice recurvato, basi sub-concavum, breviter unguiculatum; 2-3 angustis lineis longitudinalibus vix elevatis ad apicem confluentibus, margines membranacei integri. Columna brevis, laciniis 2-lobatis rostello brevioribus, loba inferiora crassiuscula. Anther pyriforme, rostello brevior apice porphyreo.

Croydon, E.C., Nov., 1921. Wonga Park, Doncaster, Miss F. Bullock, and E.C., Oct.-Nov., 1931, 1932.

The new species, while having affinities with *P. Frenchii* and *P. fuscum*, differs considerably from both. The pale green flowers are almost translucent. In some specimens the thin, membranous margins of the labellum turn pink when the flower has been open for some time, and occasionally the rest of the segments are pink-tinted.

The dilated portion of the labellum is conspicuously veined. The lamina is traversed longitudinally by two or more rows of small, bead-like, continual glands. These merge into a slightly swollen ridge towards the apex. They exude moisture which gives a glistening appearance to the labellum. The lower lobe of the column-wings is produced into a thick, fleshy tooth, which also exudes moisture. In freshly-open flowers the laterals sepals are connate, almost to their tips. Under a lens, the minute apices are seen to be curled or rolled. In many flowers this curling extends downward until, in a day or two, the sepals become quite free. This curling is probably the origin of free lateral sepals in other species of *Prasophyllum*.

This season I have found the leaf-lamina rather variable, in occasional instances extending to, or even beyond, the apex of the inflorescence. *Prasophyllum pyriforme* is found in rather hard conditions in lightly-timbered forest country. It was found by the writer in 1921, but was incorrectly classified under *P. fuscum*. The specific name refers to the shape of anther and labellum.

Mr. Allan MacCaskill, junr., Coleraine, Vic., would be pleased to receive specimens of lichens from such places as MacPherson Ranges, Liverpool Ranges, Bunya Mountains, and Cairns, and also specimens of fungi, especially *Clasaria* species.

AUSTRALIAN ORCHIDOLOGY.

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

That the mantle of R. D. Fitzgerald, Australia's first great orchidologist, has fallen worthily on to the shoulders of Dr. R. S. Rogers, no one will deny. And even as Fitzgerald's work was greatly advanced by his lithographer, Arthur J. Stopps, so, in the same way, will the name of Miss Rosa Fiveash always be associated with that of Dr. R. S. Rogers. As long as Australian botany stands, and that will be for all time, these names must stand pre-eminent in Australian Orchid lore.

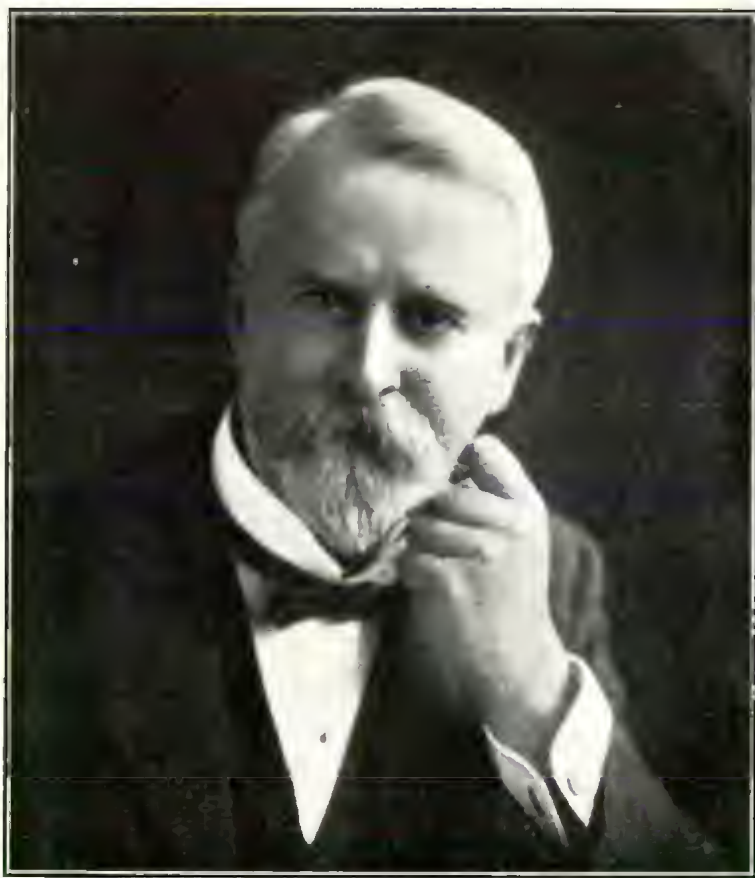
It seems to be accepted in science that the busiest of people, those who are enthusiastic in their own work, are usually the ones who have or who make time somewhere for a hobby, and to give the world the benefit of their enthusiasm.

Dr. Rogers is well known for his very extensive labours in his own science. Master of Arts, Doctor of Medicine, Master of Surgery—these are his academic qualifications. He has, in his profession and elsewhere, been Consulting Physician to the Adelaide Hospital, Lecturer in Forensic Medicine at the Adelaide University, President of the Justices' Association, member and Deputy Chairman of the Adelaide University, of the State Children's Council, the Medical Registration Board; President of the Board of Governors of the Public Library, Museum and Art Gallery; official visitor to the Lunatic Asylum, acting City Coroner, President of the Council of the Royal Society of South Australia, President of the South Australian Literary Societies' Union. He published a report on a medical survey of 1,000 State school children, and on the numbers and distribution of the feeble-minded in the State. He accompanied the South Australian troops to the South African War; he was officer commanding all military hospitals in South Australia during the Great War.

It would surely be thought that such a man would hardly have time to sleep, let alone take up such an intensive study as that of orchidology. But Dr. Rogers took up the study of Orchids before he began his medical course, and he kept steadily on, his work increasing with the years. Right throughout his life, he has been very ably assisted by Mrs. Rogers, herself gifted with the "orchid eye", who has collected many new and rare specimens, and who collected the Orchids of the Loch Lomond district in Scotland before she met her future husband.

His association with Mueller and Tate gave the doctor a keen love of botany, finally leading him to specialize in Orchids. His first published description was that of *Calodenia tutelata*, a new South Australian species, published in 1903. Since that time he has published over two hundred new species of Australian, Papuan, and New Zealand Orchids—truly a great record. In

addition to these new species, many articles have been published, one on the Distribution of Australian Orchids (1923) being especially useful to students. Revisions of various genera, many special articles on Pollination of Orchids, publications of special collections—these are a few of the articles that were published in the



DR. R. S. ROGERS

Transactions of the Royal Societies of South Australia, Victoria, Queensland and Western Australia. He has an article on the Orchids of Vanikoro—that island famed for the wreck of La Perouse's ships—ready for publication; but it is unfortunate that portions of this collection disappeared when it was en route via the New Hebrides.

Dr. Rogers' book on South Australian Orchids, which has passed through many editions, was originally written and published for State school children. One of his most useful works is the orchideal section in Black's *Flora of South Australia*, covering over forty pages, well illustrated, and giving very valuable, exhaustive and model descriptions of species.

In his study, the doctor has a card index of many thousands of cards of reference of Australian, Polynesian, New Guinea and New Zealand Orchids, authors, plates and all information published on this subject.

Somewhere about the year 1913, when, with Charles French, junr., I was hard at work attempting to classify the Orchids of Victoria, I was inspired to call in the help of Dr. Rogers, particularly over some difficulties of the genus *Pterostylis*. The doctor immediately responded, and since that time he has always willingly aided not only us but all investigators. Since then, he has described two dozen new species of Victorian Orchids, and has in many ways contributed to the Orchid literature of this State.

Reference has been made to Mrs. Rogers, whose indefatigable help and good-natured assistance have been to her husband a labour of love. When Dr. Rogers journeyed to Western Australia to search for many of Fitzgerald's "lost" species, he was accompanied by his wife. Together they recovered most of the species they went to look for and new ones as well. As a result of this journey, Mrs. Rogers is commemorated in *Droakea Jeanensis*.

When, many years ago, the South African Orchid, *Satyrium corufolium*, was brought to the doctor from Victor Harbour, it occasioned a very considerable sensation. Mrs. Rogers at once went to collect specimens, and at the end of a weary, rainy day, tired and wet through, located the Orchid in a farm garden and in the adjacent paddock. It had been brought over by a soldier after the Boer War.

One day, when Orchid hunting, Mrs. Rogers approached a local resident, and inquired if he knew of any Orchids hereabouts; his reply was: "Oh, yes, there's any amount of good shootin' here."

MISS ROSA FIVEASH.

The wonderful and very accurate paintings of Miss Rosa Fiveash, which always accompany Dr. Rogers' articles, have materially helped students in orchidology. Miss Fiveash began her paintings many years ago, in association with her work in the Adelaide Field Naturalists' Club. She studied general art under H. P. Gill, at the Adelaide Gallery, but in the painting of the native

flora in which she excels she is self-taught. She painted the illustrations for Brown's *Forest Flora of South Australia*. Her excellent painting of the Marsupial Mole, with anatomical drawings, her work on the Toas (aboriginal signposts), these all point to a catholicity in art obtained by few workers. Many of her wild-flower studies are now exhibited in the South Australian Art Gallery. She exhibited a collection of paintings in 1887, and received a first award. These pictures were to go to England, but Lord Tennyson and Mr. R. Barr Smith ultimately purchased them for Adelaide.

But we will always appreciate her for her wonderful Orchid paintings. Dr. Rogers was attracted by her flower paintings, and invited her to assist in his work. She has provided coloured and plain drawings of many hundreds of species, and the doctor's collection of these amounts to as complete a collection of Australian Orchids as possible, as well as all others he has described. It is a wonderful experience to go through book after book of the perfect and accurate paintings.

Miss Fiveash has always been devoted to her work. Some years ago I sent the doctor the first live specimens of *Burnettia cuneata* he had seen. These were taken at once to Miss Fiveash, who was told closely to watch the buds until they opened. It is well known that this Orchid rarely opens. Miss Fiveash religiously stayed at home for nearly a fortnight, but the flowers refused to oblige. Having to go to the city urgently one day, and the Orchid buds still being asleep, the painter set off for the tram. She was just about to board the car for the city when her companion excitedly rushed up with the news that the Orchid flowers were opening. Hurrying back home, there were seen the flowers fully expanded in the studio. Without changing hat or dress, the sketches and paintings were made right away, and permanently recorded for the doctor's collection. Two hours later the flowers closed for ever. This illustrates Miss Fiveash's devotion to her work, for, with her, painting always comes first.

It is a great joy to visit the artist in her charming old-world studio, packed with art treasures, with windows looking out on to a lovely old-time garden, and to listen to her tales of the painting of Australia's great floral treasures.

Too great tribute cannot be paid to Dr. Rogers for devoting the spare moments of a very busy life to the study of our wonderfully beautiful and popular Orchids, and his recent appointment as President of the Botany Section of the Australian Association for the Advancement of Science is but a small reward for his services. The association of Dr. Rogers and Miss Fiveash will ever stand as monumental in this section of our unique flora.

A BOTANIST IN THE BLUE MOUNTAINS.

By J. W. AUDAS, F.L.S., F.R.M.S.,

National Herbarium, Melbourne.

(Read before the Field Naturalists' Club of Victoria, November 14, 1932.)

While in Sydney attending the meeting of the Australasian and New Zealand Association for the Advancement of Science, in August last, I took the opportunity of visiting the Blue Mountains.

Leaving Sydney by motor at 9 a.m. on August 20, we took the main road, via Parramatta. Settlement was established here in 1820, and Parramatta still has the first public school (King's). This building was the early residence of the first Governors of New South Wales. Close by the roadside, a stone house (known as "Elizabeth Farm"), built in 1793, is in good preservation and still occupied. It is usually referred to as the first house built in Australia.

Growing near the Parramatta are *Callicoma serratifolia*, "Native Beech", one of the trees called by the early colonists "Black Wattle", from the fancied resemblance of the flowers to those of some of the wattles; *Ceratopetalum gummiferum*, known as "Christmas Bush" and "Officer Plant" (from its bright-red appearance); *Baccharis myrtilifolia*, "Lancewood" or "Grey Myrtle", an elegant tree with white flowers; *Eugenia Smithii*, "Lilly Pilly"; and *Prostanthera lasiantha*. Near St. Mary's a sandy area is crossed, where the trees comprise *Eucalyptus siderophloea*, "Red Ironbark"; *E. paniculata*, "Grey Ironbark"; *E. eugenioides*, "White Stringybark"; *E. haemastoma*, "Scribbly Gum"; *Melaleuca genistifolia*, "Ridge Myrtle"; *M. styphelioides*, "Black Paper Bark"; and *M. ericifolia*, "Swamp Paper Bark".

Passing through Penrith, we crossed the picturesque Nepean River, which runs about ten miles north of the site where the three explorers, Blaxland, Wentworth and Lawson, first crossed the river, to penetrate the ranges of the Blue Mountains. This river is spanned by a very fine bridge and splendid specimens of *Casuarina Cunninghamiana*, "River Oak", line the banks. Along the flats, nearly the whole of the geological formation is composed of Triassic Sandstone, and the flora is largely made up of *Eucalyptus tereticornis*, "Forest Red Gum"; *E. hemiphloea*, "Grey Box"; *Angophora intermedioides*, "Gum Myrtle"; *Acacia decurrens* var. *normalis*, "Sydney Green Wattle"; and *Casuarina glauca*, "Grey Buloke". The Emu Plains stretch for some distance before the gradual ascent to the mountains begins.

Proceeding through the small towns of Glenbrook, Blaxland and Linden, the scenery is rugged and grand. Many fine views of the extensive ranges are obtainable. Various Acacias (in full bloom) and other shrubs are seen intermittently during the journey, while the trees are composed of *Eucalyptus corymbosa*, "Bloodwood"; *E. piperita*, "Peppermint"; *E. Sieberiana*, "Silver Top"; *E. capitellata*, "Brown Stringybark"; and *E. australiana*, "Common Peppermint". The most extensive shrub is the stately *Telopea speciosissima*, "Waratah" or "Warratah"—the national flower of New South Wales. Its glorious blooms of vivid red brighten the bush in the Waratah's flowering season, and its large, tubular flowers abound in honey. Another attractive shrub is *Actinotus Helianthii*, "Flannel Flower". The Boronias, *B. pinnata*, *B. floribunda*, and *B. ledifolia* var. *triphyllo*, beautify the rocky spurs and fill the air with their fragrance. *Styphandra glauca*, "Nodding Blue Lily", was in full bloom. *Helichrysum lucidum*, "Golden Everlasting", a typical everlasting, and *Tetratheca ericifolia*, "Pink-eye", were observed.

At Leura, in one of the delightful gullies, we admired many fine ferns bordering the track, and large tree-ferns that formed a canopy. About a mile farther on is Katoomba, situated on a ridge of the roof of the Blue Mountains. Leaving Katoomba, we inspected the explorers' "Marked Tree". This historic tree had to be destroyed some time ago, as it was

decaying and dangerous to traffic. An inscribed tablet is attached to the stump.

At Medlow Bath and Blackheath, fine views are obtained of the Kamimbla Valley. Regaining the main western road, Mt. Victoria is reached. Here, in a paddock opposite the post-office, I noted some fine specimens of *Eucalyptus maculosa*, "White Brittle Gum". It is a moderately-sized tree, about fifty feet high, with a smooth, grey, blue, or yellow spotted bark.

Reaching Mt. York, which is one of the prominent elevations on the western side of the range, I spent some time botanizing. The rocky sides of this mountain—which is named after the Duke of York—rise abruptly from the valley to a height of 750 feet, its topmost point being 3,292 feet above sea-level. It is of historic interest, as well as of beauty, being the point from which the explorers, Blaxland, Lawson and Wentworth, descended into the "Fertile Plains of the West" in 1813, and a monument—forming a conspicuous mark on the landscape—has been erected to commemorate the event. A magnificent panoramic view is obtainable from the mount. In a north-westerly direction is the Lithgow Valley, and the valley of the Clwydd, and the longer and more beautiful Hartley Vale. The forest flora of the mount comprises chiefly "Blue Peppermint" and "Common Peppermint", but there is a sprinkling of *Eucalyptus exoniæ*, "Yellow Bloodwood", throughout. This tree does not afford durable timber, the wood being too soft; it, however, makes good fuel. Growing among the disintegrated rocks were many interesting plants, such as *Scaevola ericifolia*, "Heath-Leaf Banksia", a tall shrub, compact and ornamental, with flowers orange to red; *Lambertia formosa*, "Honey Flower", sometimes called "Mountain Devil", but bears clusters of reddish flowers and dark-green, glossy leaves. Its curiously-shaped fruit or follicle, containing one carpel, has three humps, which give it an extraordinary appearance. It splits open along the top between the two larger humps and discloses the seed. This plant is much frequented by birds and insects, for the flowers contain large quantities of clear, honey-like liquid.

Other plants noted were *Styphelia triflora*; *Brachyloma daphnoides*, "Daphne Heath", a small shrub with pointed leaves and small, creamy-white flowers, with a distinct, Daphne-like scent; *Dillwynia ericifolia*, "Heathy Parrot Pea", and *D. floribunda*, "Showy Parrot Pea", heath-like shrubs, blooming profusely, in colours of deep orange and red; *Phyllota phylloides*, another heath-like shrub; *Pinetia involucreata*, a shrub one to two feet in height, with white flowers tinged with pink, which has many popular names, such as "Granny's Bonnet" and "Queen of the Bush"; "Tough Bark" and "Slender Rice Flower".

Plant associates here were *Lomatia longifolia*, *Styphelia tubiflora*, *Leucopogon Fraseri*, *Grevillea oleoides*, *Phebalium squamulosum*, *P. obtordatum*, *Hovea linearis*, *Helichrysum elatum*, *Leucopogon esquamatus*, *Gompholobium latifolium*, *Darwinia taxifolia*, *Hakea propinqua*, *Isopogon acanthifolius*, *Conospermum ellipticum*, *Persoonia pinifolia*, *P. virgata*, *Pollenaea plumosa*, *Symphonesta montanum*, and *Bossiaca scolopendria*.

Descending into Hartley, a convict settlement of older times, the remains of a court house, dated 1815, and the relics of an old toll gate and convict quarters are seen. Only a few people reside in this place. A Wedge-tail Eagle (*Uroaetus aulax*), evidently tamed, has a favourite perch on a small bush near the dwelling of a householder there. Coming to the Lett River, granite boulders are observed by the roadside, while growing on the river banks are splendid specimens of *Leptospermum flavescens*, "Tantoon", and *Casuarina Cunninghamiana*, "River Oak". On the narrow flats bordering the stream are the Eucalypts, *E. stellulata*, "Black Sallee"; *E. viminalis*, "Manna Gum"; and *E. coriacea*, "White Sallee". On ascending from the river, *E. rubida*, "Candlebark"; *E. dives*, "Blue Peppermint"; and *E. australiana*, "Common Peppermint", are seen.

The small settlement of Hampton, situated right on the edge of the Kanimbla Valley, next comes into view. Here shapely trees of *Acacia penninervis*, "Hickory Wattle", and *A. melanoxylon*, "Blackwood", with its very dark-green foliage, form a delightful contrast. Further on, *Eucalyptus variacea*, "White Sallee", almost takes possession, and forms a forest of shiny leaves and smooth white trunks. On the descent from here the following plants were noted, hanging over the roadside cuttings, viz.:—*Veronica Derwentis*, "Derwent Speedwell"; *Leucopogon lanceolatus*, "Lance-beard Heath"; *Casuarina suberosa*, "Black Buloke"; *Senecio laetulus*, "Variable Groundsel"; and *S. macranthus*, "Long-flowered Groundsel", both the latter covered with bright yellow flowers, and spreading down the slopes; *Hardenbergia monophylla*, "Purple Coral Pea"; *Clematis aristata*, "Clematis"; and *Tecoma pandorana*, "Wonga Vine", twined the Eucalypt saplings and shrubs, making a pretty combination of colours. Farther on were seen *Hymenanthera dentata*, "Tree Violet"; *Dodonaea viscosa*, "Giant Hop-bush"; *Coprosma hartella*, "Rough Coprosma"; *Sambucus australasica*, "Yellow Elderberry"; *Pittosporum undulatum*, "Sweet Pittosporum"; and *Bursaria spinosa*, "Sweet Bursaria", laden with light-brown, flat capsules.

The Caves House area at Jenolan has been planted with ornamental trees, pines, etc. Nature supplies *Eucalyptus viminalis*, "Manna Gum", which is the chief timber tree; also *E. globulus*, "Blue Gum". On the surrounding cliffs are seen *Ficus rubiginosa*, "Banyan Tree"; *Brachychiton populneus*, "Curtajong"; *Persoonia linearis*, "Narrow-leaf Geebung"; *Daviesia latifolia*, "Broad-leaf Bitter Pea"; *Pittosporum undulatum*, "Sweet Pittosporum"; *Sambucus australasica*, "Yellow Elderberry"; and *Gymnosporia australis*, "Staff Climber"—a tall, woody climber, with white flowers. Growing in the fissures of the limestone rocks was seen *Dendrobium speciosum*, "Rock Orchid". Ferns noticed were *Adiantum aethiopicum*, "Common Maidenhair Fern"; *Asplenium rabelliforme*, "Necklace Fern"; *Polystichum aculeatum*, "Common Shield Fern"; *Polypodium pustulatum*, "Scented Polypody"; *Pellaea falcata*, "Sickle Fern"; and *Pteris tremula*, "Tender Bracken".

Returning by a different route through Kurradjong Heights, the sight of kerosene shale heaps at Hartley Vale recalled the bygone industry of the oil refinery which once made much employment there. Proceeding onwards, a mile or two of rough country was passed over, and growing among the rocks in great abundance were *Boronia ledifolia*, "Ledum-leaf Boronia", an erect, rough shrub, with bronze-green leaves, which are marked by characteristic oil-dots, from which an aromatic scent is given; *B. pinnata*, "Pinnate Boronia"; and *B. floribunda*, "Profuse Boronia". Another rutaceous plant, equally plentiful, was *Eriostemon lanceolatus*, "Lance-leaf Eriostemon". The pretty pinkish flowers last a long time on the plant, and will keep fresh in water for a month. In some places four or five species of *Persoonia* occur, such as *P. linearis*, *P. mollis*, *P. salicina*, *P. lanceolata* and *P. rigida*, together with *Isopogon anemonifolius*, *Grevillea punicea*, *G. sericea*, *G. huxifolia*, and other proteaceous plants.

Some splendid views are obtainable on this route. Near Mt. Tomah we proceeded along the edge of a beautiful valley, where the Eucalypts were exceptionally tall and straight, in great contrast to the specimens previously seen. They comprised: *E. pilularis*, "Blackbutt"; *E. corymbosa*, "Bloodwood"; *E. obliqua*, "Messmate Stringybark"; *E. piperita*, "Peppermint"; *E. engeloides*, "White Stringybark"; *E. resinifera*, "Forest Mahogany"; and *E. tereticornis*, "Forest Red Gum". In this well-watered valley, tree-ferns, such as *Dicksonia antarctica*, "Soft Tree Fern", and *Alsophila australis*, "Rough Tree Fern", together with numerous smaller ferns, flourished.

EXCURSION TO ELTHAM.

After a spell of wet and cold weather, came a fine and sunny day, Saturday, October 22, when thirty-five members of the Club and friends enjoyed the afternoon excursion to Eltham Heights. Among the birds seen and heard were the White-winged Choughs (*Corcorax melanorhamphus*), Rufous Whistler (*Pachycephala rufiventris*), Orange-winged Sittella (*Neositta chrysoptera*), Black-faced Cuckoo-shrike (*Coracina novae-hollandiae*), White-throated Tree Creeper (*Clamatoris leucophaea*), Grey Thrush (*Colluricincla harmonica*), Speckled Warbler (*Chthonicola sagittata*), and Buff-tailed Thornbill (*Acanthia reguloides*), and several species of Honey-eaters. Among the nests observed were those of the White-winged Chough, Sittella, Scarlet-breasted Robin, Buff-tailed Tit (containing two newly-hatched young), Grey Thrush (with three eggs, since hatched out), and Cuckoo-shrike (three eggs, hatched out next day). One interesting find was a nest of the Speckled Warbler, containing two Warbler's eggs and an egg of the Black-eared Cuckoo (*Ovenaris osculans*). Some of the migrant birds did not arrive in the district until a few days after the excursion. Several species of *Caladenia* and *Diurnis*, *Glossodia major*, and other orchids were in flower.

W. C. TONGE.

WILD NATURE EXHIBITION.

The Club's Wild Nature Exhibition was held at the St. Kilda Town Hall on October 11 and 12, 1932, its character and scope being well seen in the list of sections and those supervising the same, viz.:—General Zoology (Mr. J. A. Kershaw), Birds (Mr. V. H. Miller), General Botany (Mr. E. E. Pescott), Reptiles (Mr. H. W. Davey), Ethnology (Mr. A. S. Kenyon), Geology (Mr. S. R. Mitchell), Conchology (Mr. C. J. Gabriel), Plant Classification (Dr. C. S. Sutton and Miss Jean Galbraith), Orchids (Mrs. E. Coleman and Mr. W. H. Nicholls), Marine Life (Rev. G. Cox), Marsupials (Mr. D. Fleay), Microscopes (Miss Janet Raff), Cultivated Plants (Mr. H. Jenkins), Botany (Mr. J. W. Audas), Entomology (Mr. F. E. Wilson), Aquarium and Pond Life (Messrs. Green and Kershaw), Sale of Pot Plants (Mr. G. N. Hyatt), Cut Flower Sales (Miss F. Smith), Information and Publications Bureau (Mr. C. Daley). Mr. W. H. Ingrain acted as hon. secretary, and Mr. V. H. Miller capably combined the offices of director and transport superintendent. The section leaders were ably assisted by other members in the effective arrangement and presentation of exhibits.

The exhibition, presenting a most attractive appearance, was opened by His Excellency the Lieutenant-Governor, Sir William Irvine, who was introduced by the President of the Club, Mr. J. A. Kershaw.

His Excellency, in declaring the exhibition open, stated that from the very nature of the profession which he had taken up opportunities for nature study were necessarily circumscribed, but he was fully convinced of its value, and appreciated the work of those who so thoroughly fostered and encouraged it.

Exhibits were as varied as they were interesting. The favourable season had ensured a fine floral display. In this section the classification table was both instructive and attractive. Plants listed under the Wildflower Protection Act were for educative purposes placed on view.

The Shell Company again had a pleasing exhibit, spirited by aeroplane from every part of the continent, plants distinctive of Western Australia, New South Wales, Queensland, Tasmania. Specially beautiful were choice Australian flowers from the home gardens of Mr. E. Ashby, Blackwood, and Mr. W. Burdell, Basket Range, South Australia. A novel exhibit by Hon. A. C. Bajnes, Suva, Fiji, showed the plant, leaves and bowl for making the native beverage, kava.

Seldom has a more representative collection of Victorian plants been assembled. Seventy-seven species of dainty and graceful orchids in all the

charm of quaint form and varied colour—whimsical sprites of the floral world—arrested attention, and induced pleasure on inspection. Of these, sixty-six were Victorian species and eleven from sister States, terrestrial and epiphytal, *Dendrobium Sarcophilus* and *Cymbidium* being in vigorous bloom. The tasteful arrangement displayed these popular flowers to advantage. Good business was done in the sale of native flowers and pot plants, and 1,500 Waratahs were disposed of.

Among the many shells in the exhibit of Conchology were the largest Victorian shell, 12 inches, and the smallest one, .03 inch. The destructive powers of the Teredo were plainly shown. Snakes, skinks and lizards, newts and frogs of several species, as well as goldfish and other denizens of aquaria were objects of popular curiosity and observation. Mr. Davey's Japanese toads and a live giant earthworm were centres of attraction. The National-Museum kindly showed a collection of mounted birds, life histories of Australian insects, and a giant earthworm.

The collection of Australian Butterflies by Messrs. A. N. Burns and J. A. Kershaw was in beauty and variety an attractive exhibit. The Geology section comprised a fine series of minerals, from the basalt, and rock-forming minerals, crystals, etc. also typical fossils of various measures.

In Ethnology there was, as usual, a representative collection of aboriginal stone age culture, Dr. Wishart contributing examples Australian and Tasmanian. Records of aborigines' songs, lent by the National Museum, were let loose on the air at intervals.

An outstanding feature was Mr. D. Fleay's valuable collection of marsupial fauna:—Native Cats, including a whole family; Mountain Opossum, Tiger Cats, Silver-grey Opossum, Ringtail and young, Dormouse Opossum, Flying Phalanger, Short-nosed Bandicoot, Water Rat, Allied Rat, Marsupial Mice, and a Wombat, specimens rarely or never seen by most Australians, and, on that account, of additional interest.

Among the many exhibits may be noted, from the Forests' Commission, a collection of building, furniture and cabinet timbers from native trees; also an exhibit of plants, flowers, etc., from the School of Horticulture, Burnley; models of nuggets from the Mines Department, and exhibits of marine shore life, etc. from the League of Nature Lovers, per Rev. Geo. Cox.

In the Microscope section, organized by Miss J. W. Raff, microscopes and exhibits were provided by Club members, friends and members of the Microscopical Society of Victoria. Subjects for demonstration included Pond Life, Entomology, General Biology, Rock Sections, etc. Mr. B. Blackburn took charge of the afternoon sessions. The following exhibited Misses M. A. Ball, D. Eddy, C. Glass, K. Hall, G. Neighbour; Messrs. B. Blackburn, Carter, F. Chapman, J. Eaton, Harcourt, A. D. Hardy, E. W. James (for Mr. R. H. N. Seward), H. McCloskey, A. O'Brien, G. Ogilby, A. L. Scott, J. Stickland, A. J. Swaby, T. A. Walter, L. Wilson, T. W. Winn, B. Young, Dr. Sutton; and Messrs. J. Ingram and J. Searle kindly lent microscopes. On the walls of the room allotted to this section were hung the series of excellent paintings of wildflowers by Miss Amy Fuller, which were much admired.

In spite of inclement weather, the attendance of the public was very satisfactory, their interest unabated, and their appreciation freely expressed. The members in charge of sections were often kept busy in supplying information or explanation to inquirers.

The exhibition was well organized and efficiently carried out, reflecting much credit on the director and all concerned in its arrangements. The committee of the Club desire gratefully to extend thanks to the many willing workers who gave such ready assistance; to the ladies especially who, convened by Mrs. C. Barrett, did such admirable service; to members and friends who helped in so many ways; and to the large number of exhibitors in respective sections who so cheerfully and practically contributed to the successful issue.

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PROCEEDINGS

The monthly meeting of the Club was held at the Royal Society's Hall on Monday, December 12, 1932, at 8 p.m. The President, Mr. J. A. Kershaw, C.M.Z.S., presided over an attendance of about eighty members and friends.

MEMBER'S DEATH

The Chairman made feeling references to the death of Dr. W. Heber Green, of the University Staff, and spoke of the work accomplished by him for the Club and for the State generally. The Chairman also referred to the loss to the State caused by the death of Donald Macdonald, his remarks being supported by Mr. E. E. Pescott and Mr. F. Pitcher.

CORRESPONDENCE

From the Forests Commission regarding the gathering of wild flowers by school children.

REPORTS

Reports of excursions were presented as follows:—Wandin, Mr. E. S. Hanks; Montmorency, Mr. A. E. Proudfoot; Heidelberg, Mr. J. Wilcox; Langwarrin, Mr. T. S. Hart.

ELECTION OF MEMBERS

The following were duly elected:—Miss I. Morris and Miss A. Lambourn, as ordinary members; Mr. A. Holland and Mr. J. H. Willis, as country members; and Master G. C. Wade, as associate member.

LIBRARY

The Chairman drew the attention of members to the recent additions to the Library, which were placed upon the table for inspection.

LECTURE

The lecture for the evening, "Some Victorian Moths and their Larvae", was delivered by the President. Mr. Kershaw dealt at length with the life history of moths. Illustrating his remarks with lantern-slides, the lecturer described the various stages in detail. Many of the more common species of moths met with around Melbourne were shown on the screen.

EXHIBITS

Mr. J. A. Kershaw.—Living larvae of *Diacrisia canescens* (Tiger Moth), *Anthelia ocellata*, *Orgyia anartoides* (Vapour Moth), *Ectropis excursaria* (a geometrid), and *Cebysa leucoteles* (a case-moth). Also, on behalf of The National Museum, a case of Victorian moths and larvae.

Miss J. W. Raff.—Life history stages of the Cypress Looper Moth, the Cup Moth, and a species of *Pinara*, processionary caterpillars, pupa and moth. Also Cicada nymphs, adults emerging from split nymphal skins, and a twig showing egg scars made by the female.

Mr. Chas French, Junr.—Specimens of caterpillar fungi, namely, *Cordyceps Taylori* and *C. Gunnii*, from Apollo Bay.

Mr. T. S. Hart.—Emperor Gum Moth in two stages of growth, and Vine Moth caterpillar.

Mr. L. W. Cooper.—Saunders's Case Moth.

Mrs. A. E. Hill.—Abnormal flower spike of *Plantago*, and a fasciated specimen of *Tetratheca*.

Mr. A. S. Blake.—Two species of garden-grown *Anigozanthus*.

Miss Bolton.—*Isotoma axillaris*, from Beechworth.

Mrs. M. Prema.—Collection of shells.

EXCURSION TO BEACONSFIELD

The excursion to Beaconsfield on October 29, despite delightful weather, was attended by only about twelve members and friends. The day was very successful as regards bird observing, the number of species recorded being forty-one. A feature was the accessibility of nests. With few exceptions, they were so close to the ground as to enable us to examine them while standing beside shrub or tree. Being able to look into the nests and view the eggs added a charm to the day's outing. Beil Miners, with their tinkling notes, maintained an incessant melody. They were well supported by the Harmonious Thrush and the Whip-bird. Throughout the day, over a large area of country, these three species in particular welcomed us with an almost continuous outpouring of their delightful notes. The Golden Whistler, although not so numerous, now and then treated us to a recital of his sweet strain.

Nests of the Ring-tailed Possum were located. Many were occupied by parents and their young. On two occasions young ones were captured and released after being handled and admired. The parents viewed these proceedings from adjacent branches with anxious eyes. When searching the banks of a sand-pit for a Pardalote's nest, one of these birds was seen darting about in an agitated manner. The commotion was discovered to be due to the presence of a Copperhead Snake, apparently about to plunder the birds' nesting-burrow, which was drilled into the wall of the sand-pit. We quickly removed the cause of the small bird's distress. Wildflowers were plentiful. A number of Orchids was seen, including several species of *Caledonia* and *Diuris*, and *Glossodia major*.

SUNFISHES

BY GILBERT P. WHITLEY*

The oceanic Sunfishes are the giants of the fish world, and when one is washed ashore or harpooned by fishermen, its great size and unusual shape always arouse curiosity. Thus we read in a letter from Venice, so long ago as May, 1590, an account which evidently refers to a Sunfish:

"During the last days a large fish was caught by the fishers near Malanocco. It weighs more than a thousand pounds, according to our weights, and measures twenty spans. It has two wide wings, eyes as large as those of an ox, and a round, small mouth with two teeth, one in the upper and one in the lower jaw. They are almost as thick as a finger and the fish has a strange colour. What kind of a fish it is the fishermen are as yet unable to say."—Quoted from Chary, *The Fugger News Letters*, 1925, p. 150.

And so, through the ages, Sunfishes evoke almost the same comments, and history repeats itself in the words of a modern newspaper:

"The species of a half-ton fish caught at Port Melbourne last night defies definition even by members of the 'Discovery's' crew. From the tip of its nose to the end of its body (there is the merest vestige of a tail) the freak measures 5 ft. 3 in. The mouth is only three inches in diameter. The teeth appear to be old, and are similar to those of a horse. The eyes resemble a cow's in size and appearance."—*Daily Telegraph Pictorial*, Sydney, April 25, 1930.

What are these monsters, and how do they live? Evidently, Sunfishes are inhabitants of the open ocean, following the rich supply of living food borne on the great currents, and it seems only as the result of accident that they lose track of their feeding places, and, flurried and exhausted, become stranded on our shores. Travellers on ocean-going vessels sometimes see Sunfishes basking on the surface, lying half-sideways with the dorsal fin out of water.

These large fishes, which seem to be "all head" because of the truncated and rudimentary tail-fin, swim by turning both the dorsal and anal fins to one side at the same time. These fins are opposite one another, and twist slightly as they are moved from side to side, the result being rather like the action of a ship's propeller. The side fins, or pectorals, flap continually, somewhat like the ears of an elephant, and the stumpy tail acts as a rudder. As an "auxiliary engine", either gill-opening can squirt a powerful jet of water at will, and the Sunfish can also shoot water from its beak-like mouth. Sunfishes usually swim upright, often with the dorsal fin out of water like a shark's, and they are said to travel in pairs. The strength of these sluggish monsters is considerable,

*Contribution from the Australian Museum, Sydney.

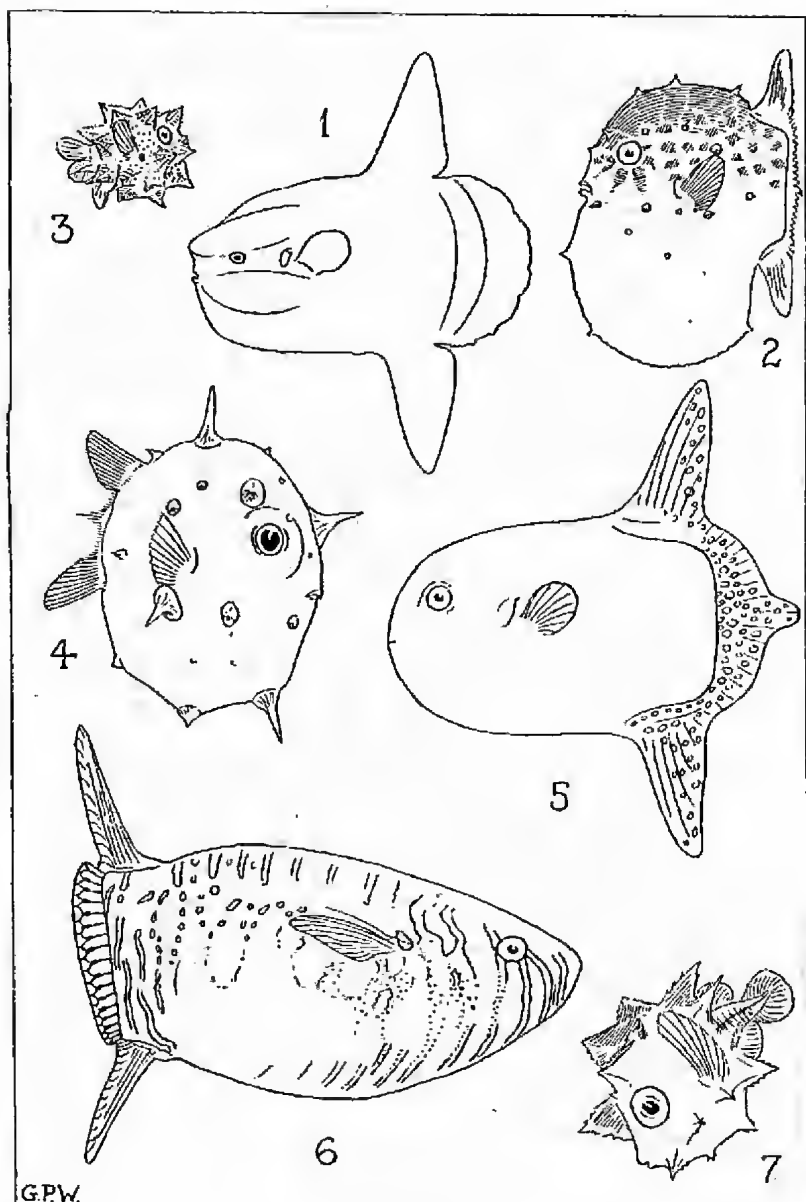
as one which had been harpooned nearly dragged the boat of its captors below water.

Sunfishes feed on jellyfishes, especially *Velutella*, larval eels, and other pelagic organisms of small size. A seven-foot female Sunfish, dissected at Botany Bay by the writer, had an intestine 24 feet in length! The largest Sunfishes grow to a length of over 10 feet with a fin-span of 13 feet and a weight of over a ton. The skin is thick, often studded with scutes, and, in the case of the Botany Bay specimen, proof against Winchester rifle bullets. Sunfishes are apparently very prolific, as the ovary of a European specimen contained 300 million unripe eggs (Schmidt: *Nature*, March 17, 1921, p. 76). The larvæ and young specimens are very unlike the adults in form, being armed with spines, which probably assist them to float. They also have fin-rays in the tail, but these are later lost and replaced by the stumpy, fleshy tail of the adult. Sunfishes often carry interesting parasites. My Botany Bay specimen had stalked barnacles on the roof of the mouth and curious crustaceans (*Copepoda*) attached to the sides of the head and body. It was accompanied by half a dozen rare fishes (*Centrolophus mauricus*), which were thought at the time to be Pilot Fish. Thus the messmates of the Sunfish well repay study as well as the monster itself.

Three genera of Sunfishes are recognized: the Ocean or Short Sunfish (*Mola*), upon which most of the foregoing remarks are based; the Tailed Sunfish (*Masturus*), which has a pointed tail, even when adult; and the rare Oblong Sunfish (*Ranzania*), which is the smallest of the three, and will be considered in greater detail hereafter. *Mola* and *Ranzania* have been caught in Australian seas, but *Masturus* has not, so far, been recorded from our shores. The young forms of Sunfishes have received various scientific names, but as they are synonymous with the three genera mentioned, they need not concern us here. Many nominal species of Sunfishes have been described from various parts of the world, but much of the literature concerning them is not available in Australia.

Mola is a Latin word meaning a millstone, the body of the Sunfish being similar to one in shape and size. *Masturus* comes from the Greek, and means a breast-shaped tail. *Ranzania* was named after Camillo Ranzani (1775-1841), a professor of Bologna, Italy, and dean of the cathedral there. He wrote several articles on Sunfishes, and, in one of his natural history books, generically named an Australian bird, the Cape York Palm-Cockatoo (*Salanoglossus*).

The three kinds of Sunfishes most likely to be encountered in Australasian seas may be briefly noticed as follows:—



Sunfishes

Family MOLIDAE

OCEAN SUNFISH OR SHORT SUNFISH

Mola ramsayi (Giglioli)

Figs. 1 and 2

Adult, with blunt, lobed tail, without fin-rays. Skin granulated. Eyes about midway between snout and gill-openings. Colour uniformly dull brown or greyish, turning white after death. Attains a length of over 10 feet and a weight of over one ton.

Larva unknown, but, if like the European species (*M. mola*), would have prominent spines upon which are transverse ridges. The *young* of *M. ramsayi*, here figured for the first time from a Lord Howe Island specimen, $1\frac{1}{2}$ inches long, has the outline of the belly rounded.

Range.—South Australia, Victoria, Tasmania, New South Wales, Lord Howe Island, and New Zealand. Doubtfully recorded from Queensland and Western Australia.

References.—A detailed technical account of this species, with references to literature, is given in *Records Austr. Mus.*, XVIII, 1931, p. 126, and figs.

Remarks.—This species was named after Edward Pierson Ramsay (1842-1916), one of Australia's foremost native-born naturalists, who studied many of our largest fishes, but is chiefly famous for his ornithological work.

TAILED SUNFISH

Masturus lanceolatus (Liénard)

Figs. 3, 4 and 5

Adult with the posterior part of the body pointed, without fin-rays. Skin covered behind and below with scutes of various and often elongate forms. Eyes nearer snout than gill-openings. Colouration modest, generally spotted towards the tail. Length to just over 6 feet, weight about $5\frac{1}{2}$ cwt.

Larva with prominent spines with transverse ridges. In the *young*, the outline of the belly is angular, not rounded, and the median fin-rays of the tail extend beyond the others.

Range: South Africa, Indian and Atlantic Oceans. Hawaii, Japan, Florida. A form from the East Indies and Malaysia has been specifically separated as *M. oxyropterus* (Bleeker); the young of which, from the Central Pacific Ocean has been illustrated by McCullench (*Proc. Linn. Soc. N.S. Wales*, xxxvii, 1913, p. 553, pls. lviii-lix). *This species is not so far known from Australia.*

References: the most important recent writings on this species, with special reference to young specimens, are Schmidt, *Medd. Komm. Havunders.* (Copenhagen) vi, 1921, pp. 1-13 and figs. and *Nature*, March 17, 1921, p. 76; and Fowler, *Mem. Bishop Mus.* x, 1928, p. 474, fig. 80.

Family RANZANIIDAE

OBLONG SUNFISH

Ranzania laevis (Pennant)

Figs. 6 and 7

Adult with the form more elongate than in *Mola* and *Masturus*, with the tail bluntly truncate, but supported by fan-like fin-rays. Skin with small, mostly hexagonal scutes. Eyes nearer snout than gill-openings. Colouration brilliant, silvery, and varied with stripes and spots. Length up to about three feet, weight about twenty pounds. The pectoral fins are more pointed than in *Mola* and the mouth is almost covered by flaps of skin on each side.

The *Larva* has no transverse ridges on its spines as in *Mola* and *Masturus*. The *young* soon develop the elongate body-form characteristic of the species, which is in many respects the exception to the general Sunfish rule, being a swift swimmer from the time of hatching, and very different in structure, proportions, and colour.

Range: The Oblong Sunfish has been recorded from the Mediterranean Sea, British Isles, and Atlantic Ocean, Martinique, Bermudas, and Brazil. This is apparently the distribution of the typical form which was called *Osteocion laevis* by Pennant (*Brit. Zool.* iii, ed. 4, 1776, p. 129, pl. xix, fig. 54) several years before Retzius (1785) named *Tetradon truncatus*. Thus the Oblong Sunfish usually called *Ranzania truncata* should be *R. laevis*, assuming that the Brazilian and British species are the same. A second species, or form, from California, Hawaii, Japan and the Philippines was named *R. makua*. Its appearance at Honolulu was looked upon as the visit of the fish-god ancestor of the mackerels and bonitos by the natives, who would not kill it. From Mauritius and South Africa comes a third form called *Cephalus varius* by Shaw over a century ago, so it seems that the Oblong Sunfish is either a world-wide species, or is separable into subspecies which follow the main currents in the North and South Atlantic and Pacific Oceans, also living in the Indian Ocean. It is difficult to separate these forms from a comparison of descriptions and figures, so for the present I call them all *Ranzania laevis*. The eggs of this species have been hatched in the Sargasso Sea, and a South African specimen was observed to have fed on seaweeds.

The Oblong Sunfish was first recorded from Australia by McCulloch, who received a specimen from Middleton Beach, Western Australia. While in Melbourne, a few years ago, however, I noticed a fine specimen of this rare Sunfish on exhibition in the National Museum, labelled Portland Bay, Victoria, June, 1861 (No. 45,586), and this constitutes a new record for the State. I recently wrote to Mr. D. J. Mahony, Director of the

Museum, for further details regarding this specimen, and he very kindly sent me a photograph of it. Mr. Mahony stated "The length over all along the middle line of the body is 22 inches, the length from snout to base of caudal fin being $20\frac{3}{4}$ inches and the fin $1\frac{1}{2}$ inches wide. I have not been able to find any published reference to it, but Mr. Kershaw is under the impression that McCoy recorded it somewhere." The present writer has not traced any notice of this species in McCoy's works. The photograph agrees well with a specimen from Mauritius in the Australian Museum, so that if the Australian form is distinct from the Atlantic, it may be tentatively known as *Ranzania laevis varia* Shaw (*Gen. Zool.*, v. 2, 1804, p. 439).

References: The earliest reference to an Oblong Sunfish I have been able to find is an excellent figure in Bonnanno's *Rev. Hist. Nat.*, published about 1773. Since then much has been written about the species, which has been given various names. I hope to assemble the synonymy and bibliography of the species for publication in some technical journal at a later date. Beautiful figures of the Oblong Sunfish have been given in Tanaka's *Fishes of Japan*, and by Jenkins (*Proc. Calif. Acad. Sci.* (2), v, 1895, frontispiece); these represent the form called *Ranzania makua*.

Remarks: Among some fish drawings belonging to the late Allan R. McCulloch, I find an unsigned painting of a *Ranzania* which is unfortunately without data, unless the pencilled remark on the back, "Aneiteum. 'Fasi—the chief of the island", indicates a New Hebridean origin. The general colour is dark blue on the back, becoming lighter on the sides and belly and crossed by lighter bars with dark edges which are oblique anteriorly and vertical posteriorly, and mingle with dark blue spots towards the ventral surface. Two broad transverse bands of rich brown join the dorsal and anal fins, which are blue, and the anterior portion of the tail and some spots on the hinder part of the body are light green. The eye and some of the tops of the oblique bars are red, and there is a wedge-shaped light blue area (evidently the pectoral fin) behind the head and pointing towards the back. The bars do not radiate from the eye as in most figures of this species or as in the specimens I have seen, but the latter have lost most of their original brilliant colouration, which is said to change soon after death.

The flesh of the Oblong Sunfish is said to be edible, but other Sunfishes are not experimented with as food because of their close zoological relationship to the poisonous toadfishes (*Tetraodontidae*).

EXPLANATION OF FIGURES

Sunfishes, drawn to various scales

Figure

1. Ocean Sunfish (*Mola ramsayi*). Adult. 7 ft. 4 in. long. (from Botany Bay, New South Wales. Austr. Mus., regd. No. 1A4100.

2. Ocean Sunfish (*Mola ramsayi*). Young, 1½ in. long, from Lord Howe Island. Austr. Mus., No. 1A2423.
3. Tailed Sunfish (*Masturus lanceolatus*). Larva, ½ in. long, from the Sargasso Sea (modified after Schmidt).
4. Tailed Sunfish (*Masturus lanceolatus*). Young, ½ in. long, from the central Pacific Ocean. Austr. Mus., No. 112286.
5. Tailed Sunfish (*Masturus lanceolatus*). A specimen, 3 ft. 1½ in. long, from Hawaii (modified after Fowler).
6. Oblong Sunfish (*Ranzania laevis*). A specimen, 1 ft. 13 in. long, from Mauritius. Austr. Mus., No. B5903.
7. Oblong Sunfish (*Ranzania laevis*). Larva, less than ½ in. long, from the Atlantic Ocean (modified after Schmidt).

FLOWERS' MOVEMENTS FELT

I wonder if any of those Club members who take an interest in botany have had an experience similar to mine? I had gathered eight or nine specimens of the little orchid *Caleana minor*, and when I reached home the flowers were closed—the labellum pressed tightly against the column. I put them in water and stood them in a sunny window, but for two days they refused to open. Then, deciding to press them, I carried them loosely in my hand through the hot sunshine (it was about 2 p.m.). I had gone about 100 yards when I felt a sudden movement and, looking down, found one of the flowers wide open. Another small shock, and a second flower opened; and by the time I had walked another 100 yards all were open. The labellum seemed first to rise slowly and, when rather more than half open, spring back into its reflexed position so quickly and forcibly as to convey a slight but distinct shock to my fingers. We sometimes talk of a vigorous plant that we almost *see grow*, but I had not previously heard that one actually could feel a flower *move*. Possibly my experience is not unusual, but it was novel to me.

GEO. LITTLE.

EXCURSION TO WANDIN

The excursion to Wandin on November 19 was attended by 27 members and friends. The day was fine, and wildflowers were abundant. Thirty-one species of birds were noted, and of these, 13 were found nesting. In the nest of a Bell Miner was found an egg of the Pallid Cuckoo; and in the nest of a Blue Wren an egg of Horsfield's Bronze Cuckoo. A boobook owl—one of a pair that has occupied the locality for some years—was an object of great interest to visitors. The species of birds found nesting were:—Grey Thrush, White-naped Honeyeater, Yellow-faced Honeyeater, Striated Thornbill, Magpie-lark, Bell Miner, Grey Fantail, Black-faced Cuckoo-shrike, Yellow Shrike-rob, Red-browed Firetail, Golden Whistler, Brown Thornbill, and Blue Wren.

E. S. HANKS.

The Committee of the Field Naturalists' Club of Victoria invites members of kindred societies who may be visiting Melbourne to attend the Club's meetings.

POLLINATION OF ORCHIDS:
GENUS *PRASOPHYLLUM*

By EDITH COLEMAN

In the Orchidaceae the number of self-fertile species is gradually diminishing. There is good evidence that certain species provided with mechanism, only rarely brought into action for the purpose of cross-pollination, now depend entirely upon the latter. This is probably owing to an increase in the number of insects capable of removing the pollen-masses, and the consequent better adaptation of the special parts of the flower concerned with pollen transference. We may safely say that the structure of almost all orchids is related to pollination by insects, though they are not equally successful in securing it.

Pollination in the genus *Prasophyllum* is of especial interest. There are indications that it, too, was once self-fertile, and may, in occasional instances revert to its pristine habit. That its pollinary mechanism is one of the most highly specialized in the Order is suggested by the great fertility of a genus in which the flowers are of small size and inconspicuous colour. They are advertised in Nature's customary manner in dealing with insignificant flowers, by strong perfume and massing. Sweet as the perfume is, it would scarcely be noticed but for the fact that the flowers are produced in great profusion on the spike-like inflorescence. The present paper deals with robust spring and summer forms.

In studying cross-pollination of orchids, we have been accustomed to regard the labellum as the most important segment of the flower, providing insects with sometimes, a feeding-ground, and, always, a landing-platform; but in the genus *Prasophyllum* the labellum holds an inverted position on the upper part of the flower.

Whether this reversion of the flower marks a retrograde movement, a return to the ancestral orientation of orchid-flowers, or a progressive step, is difficult to determine. It is, however, quite clear, from the fertility of the flowers, that insects are well able to play their part in the process of pollination with the labellum in this inverted position. This is well illustrated in *Cryptostylis*, another genus with reversed flowers. Here the insect-collaborator, which is actually upside down under the labellum during the process, is able to remove the pollinia as effectively as if the labellum were in the orthodox position.

In *Prasophyllum* the labellum serves a more important purpose than that of providing a convenient platform. In many orchids the dorsal sepal, and sometimes the two lateral petals, form a more or less hooded protection over the column, in which are welded the organs of fructification. In this genus we find the function

served by the labellum, which forms a roof over this all-important part of the flower. Male and female elements are situated much as we see them in *Diuris*, except that, owing to a half-turn of the ovary, the flower is nearly at right-angles with the floral axis. Thus the short column lies almost horizontally. Above is the stigma, with the rostellum at its apex awaiting the insect-touch

that shall rupture the covering membrane, and release the viscid gland from its tiny notch. Below is the anther in which lie two bi-lobed pollinia, attached to the gland by a thin, semi-transparent, strap-like tail, the caudicle. As in the pollination of other orchids discussed in these papers, everything hinges on pressure of the rostellum. The importance of this small organ can hardly be over-estimated.

For successful cross-pollination three things are imperative. (1) The attraction of the right insect. (2) Its entrance into the flower in such a manner as to bring it in contact with the rostellum. (3) Its delay for a sufficient period of time to ensure the adherence of the gland to a part of its body which will facilitate the deposit of the pollinia on the stigma of the next orchid it visits. Pollination depends, then, not only on pressure of the rostellum, but on a special part of the insect's body coming in contact with it. Let us now see how beautifully the parts of the flower are adapted to fit in with these essential points.



Sweet Leek-orchid (*Prasophyllum odoratum* Rogers). One of the most variable of all the Leek-orchids—both in colour and shape of the segments (natural size).

In some species of *Prasophyllum* the sides of the labellum towards the base, are more or less erect, forming a longitudinal channel which holds the insect in a direct line with the rostellum. Otherwise it might quite as easily rest sideways on the "platform" to enjoy the entertainment provided. In this case it would leave



Prasophyllum odoratum var. *album* Rogers.

A large-flowered variety from Lara, Wonthaggi, and other Victorian stations

the flower without touching the rostellum; or it might touch it at such an angle that the pollinia are removed on a part of its body which would not aid their disposition on the stigma of the next flower visited.

The labellum serves another purpose. On the lamina in all species I have examined, and in which I have noted an exceptional fertility, are glandular excrescences, either in the form of a raised plate, or a mere longitudinal thickening. These secrete copious supplies of fluid which is obviously relished by small insects. The seductive purpose of these glands is beautifully illustrated in *P. odoratum*, more particularly in the variety *album* Rogers, in which the green glands stand out in strong contrast with the glistening, white labellum.

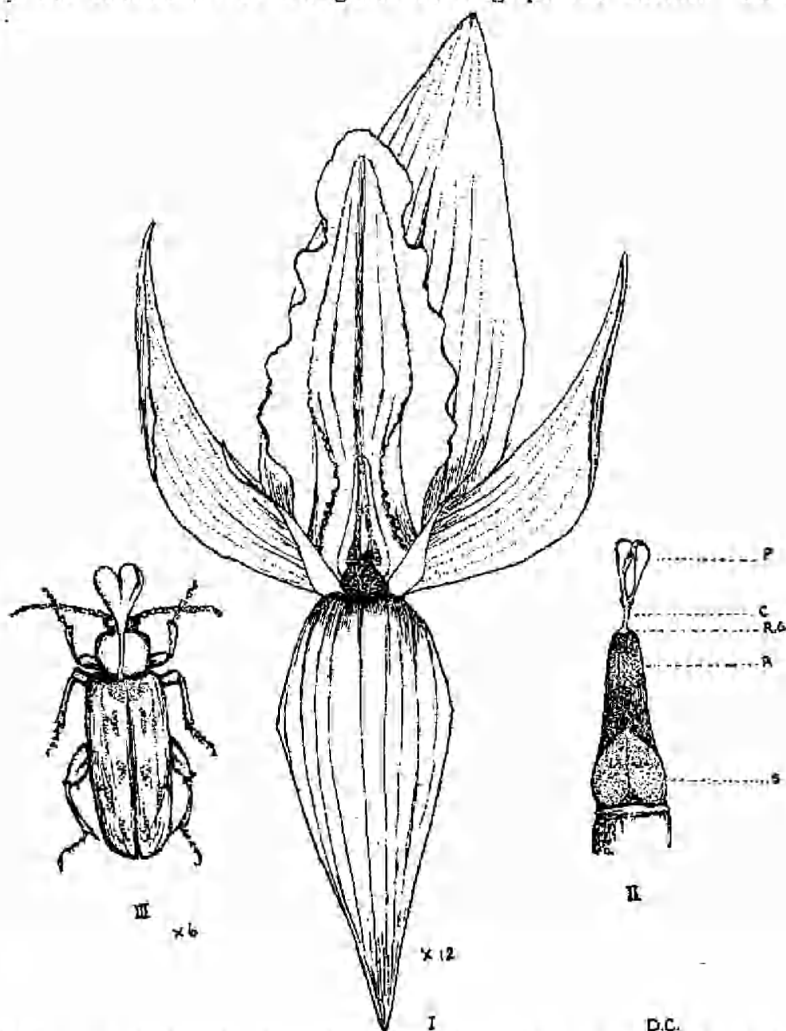
In response to a delightful fragrance, possibly also to the glitter of glandular exudations, an insect alights, the inverted position of the labellum forming no obstacle. On the lamina it finds a bead of nectar, then another, and another, leading to a large swollen gland at the base, a solid triangle in shape, full of nectar which exudes freely at a touch. Following a diamond-strewn path it has reached a veritable well of delight. No piercing organ is necessary. The visitor has but to apply its mouth-parts until appetite is sated.

As the insect leaves the flower the gleam of yellow pollen tells that it has paid for its entertainment, but only in part. The removal of the pollinia is only one step in the important work of pollination. The next step will be taken when, in response to the scent and glitter of another flower, it transports them to a stigma. Much, too, depends on the moment of its visit. If the viscid secretion of the gland be not ready, its covering membrane may be ruptured to no purpose: the gland will remain in its notch on the apex of the rostellum. But if contact be made at the right moment, the floral device works without a hitch, and the pollinia are withdrawn, unbroken, from their cells. When they are mature the anther recedes, allowing the friable masses to be released without separation of the grains. I have never seen the withdrawal of a broken pollinium, though the grains separate readily after removal.

In the variety *album* the various movements may be followed without the use of a lens. They may be clearly demonstrated with a dissecting-needle or the point of a pencil, which must be inserted in the flower in the direction taken, of necessity, by the insect. As the point presses the rostellar-gland there is the usual rupture of the thin membrane which covers, and keeps moist, the gland and its viscid secretion.

The gland now rests, like a thin, triangular flap, quite free, but still covering the small notch in the rostellum.

If the needle be withdrawn at once, nothing happens, but if delayed for a moment, the gland, becoming dry and more adhesive owing to exposure to the air, is clamped to the needle, and, as it is withdrawn with the attached pollinia, one may just catch the pretty action of the strap-like caudicle as it speedily curls, bringing the pollinia forward towards the point of the needle—not the slow movement of depression one notes in many other orchids, but a swift, spectacular, spring-like curling, which is doubtless caused by the contraction of the gland as it grips the needle. This



Pollination of *Prasophyllum Muellerei* Andrews by a Chrysometid Beetle (*Ametalla spinolae*)

sucker-like grip of the gland not only ensures its firm adherence to the head of a visiting insect but maintains the correct poise of the pollinia. Were they to remain, as withdrawn, vertical over the prothorax, they would be bent backward or broken as the insect enters the narrow opening in the next flower visited. In their present position they will enter *and touch the stigma*, thus pollinating the flower.

For the removal of the pollen masses there is no need for a preliminary touch on the stigma. Pressure on the rostellum is all that is necessary to set the floral apparatus in motion. The stigmatic secretion merely forms a medium for the germination of pollen grains, which cannot reach the flower unaided, but must be brought on the body of an insect collaborator.

Should the propitious moment pass without removal of the pollinia, one notes in certain species of *Prasophyllum* another remarkable piece of pollinary mechanism. The apex of the anther becomes deflexed, and, possibly consequent on this deflexion, a slower movement of the caudicle takes place automatically, and the pollinia are exerted without external aid. They remain exposed above the anther, or poised vertically, with the gland still held firmly in its rostellar notch.

The pollination of the South Australian species, *P. gracile*, has been clearly described by Dr. R. S. Rogers, M.A., M.D. (*Trans. Roy. Soc. of S.A.*, vol. xxxvii, 1913). In this paper Dr. Rogers shows that, following the curling of the caudicle and a complete rotation of the pollinia, they are frequently deposited on the stigma of the same flower.

This mechanical curling is seen in many Victorian species, but I have noted no instance in which the pollinia are carried beyond an angle of about 45°. In *P. elatum* they remain poised at about this angle in scores of flowers which have not been pollinated. In the Western Australian species, *P. Muellersi*, they are frequently held vertically over the apex of the high rostellum, but as the grains do not separate until the stigma is no longer receptive, there is little danger of self-fertilization.

It is possible that, by insects brushing against the now exposed pollen, there is here an added chance of cross-pollination, but with such an elaborate device for the removal of the complete pollinarium, I think it is only remotely possible that the plant is served by the less perfect method. Moreover, in general, pollination is not effected by the deposit of only a few grains. The greater part, if not the whole, of a pollinium appears to be essential. As, however, one note in hundreds of flowers that the pollinia have been neatly and cleanly removed, and that considerable portions of the pollinia are found on the stigma in a large number of instances, we may assume that pollination, in the circumstances described above, is the exception rather the rule.

A chapter might be written on the subject of glands in the genus *Prasophyllum*. Where they take a clearly defined departure from the usual shape, it is explained by a glance at the structure of the column, and the shape of the insect's body, with which it co-ordinates. Where the glandular plate is much raised, it facilitates connection between insect-body and the important rostellum. In *P. Australe*, for instance, an insect could enter the flower, and partake of the feast provided, without touching the rostellum, were it not for the erect margins of the plate, which form a platform, bringing body and rostellum in contact.

We have seen (vide previous issues of the *Victorian Naturalist*) that the pollination of *Cryptostylis* is effected by an ichneumonid, and that a small native bee serves the same purpose in *Diuris*. Certain species of *Prasophyllum* have efficient collaborators in honey-loving beetles. Dr. Rogers has seen small beetles (*Trogoderma adelaidae*) bearing pollinia removed from flowers of the South Australian species, *P. gracile*. While in the south-west of Western Australia I observed three species of beetles associated with three robust species of *Prasophyllum*.

Mr. F. Walton Rowe, of Kendenup, has witnessed the removal by a small beetle of the pollinia in the Western Australian species *P. Muellerei*. Last season he sent two of these beetles to me. Both had undamaged pollinaria adhering to the prothorax as seen in the accompanying illustration. They were identified by National Museum authorities as a well-known *Chrysomelid* beetle, *Amestalla spinulæ*, which Mr. J. Clark tells me is confined to South-western Australia.

Every part of a flower serves some purpose. In *P. Muellerei* we have a long, narrow, finger-shaped rostellum and a short anther. As the parts of an orchid are beautifully co-ordinated, we find, as we expect, an equally long caudicle to make connection between pollinia and tall rostellum. As the reproductive parts mature, the apex of the rostellum curves over, beak-like, drawing the pollinia almost out of their cells. This "beak" serves a special purpose. for in *P. Muellerei* there is no high plate, a platform to raise the beetle up to the rostellum, so the rostellum bends down to the beetle.

When the caudicle is "sprung" without external aid the pollinia are automatically exerted and remain poised almost vertically with the gland still *in situ*. The drawing of the beetle and pollinia was made a month after they were received in Victoria. It is thus evident that the pollen grains do not separate until the stigma is no longer receptive. These beetles, which are diurnal in habit, probably feed on plant tissues both in the adult and larval forms; but I believe that their visits to the orchids are made in response to the attraction of nectar.

Mr. W. H. Nicholls sent me the larva of an insect, bearing pollinia, which he had taken in a flower of *P. elatum*. The Museum authorities were unable to identify it, but Mr. Clark assures me that it is not the larva of *Anatalla spinolae*, which suggests that two species of *Prasophyllum* having much the same habit, are pollinated by different agents. I am inclined to regard this as a chance association of larva and orchid.

With so many perfect contrivances for the removal of the pollen-masses without detriment to the plant, we must conclude that the winged agent is more general. Every gardener knows the damage wrought by hungry larvae in search of plant tissues. Were they, in any numbers, to visit orchids, the reproductive parts of the flowers would only rarely escape their devastating inroads, and the purpose of the beautiful mechanism would be defeated. In *P. elatum* one frequently finds pollinia attached to various segments of the flowers. These were probably transferred from the bodies of insects (or larvae?) before the glands were securely set.

Where plants grow closely and sway against each other in high winds, the pollinia are sometimes withdrawn by the pressure of a segment on the rostellum. It is not suggested that all species of *Prasophyllum* are pollinated by beetles. It will later be shown that other winged agents share this important work. Their efficiency is evident in every species I have examined.

In fair seasons one finds an average of 70 per cent. to 80 per cent. of removals, with pollen on the stigma in as many as 40 per cent. of open flowers. Some Western Australian species give an even higher percentage. Even in dainty, small-flowered species, such as *P. Frenchii*, *P. fuscum* and *P. Braunei*, we find the same telling proof of the efficiency of their insect collaborators.

For specimens and many helpful notes I am indebted to Miss Rica Sandilands and Mr. F. Walton Rowe, of Kendenup, and Rev. E. Byant, of Kalgoorlie, W.A. In New South Wales, to Miss J. Henderson and Mr. C. Boase. In Victoria, to Mrs. Brooks, Maldon; Mrs. Rich, Rushworth; Miss Anderson, Wonthaggi; Miss Bullock, Doncaster; Mr. D. J. Paton, Kew, and Mr. Homann, Wonthaggi.

KEY TO ILLUSTRATION

1. A flower, enlarged, of the Western Australian species, *Prasophyllum Muellerei* Andrews, with the ovary straightened to show the short anther, the tall rostellum, and the long, transparent, strap-like caudicle which attaches the pollinia to the rostellar gland (R.G.). The anther has receded, fully exposing the pollen-masses.
2. Column, greatly enlarged, heart-shaped stigma below, long, narrow rostellum above. The rostellum has been flattened to indicate its length. The caudicle has "sprung", raising the pollinia nearly vertically over the apex of the rostellum. The gland, *in situ*, still covers its small notch.
3. Chrysomelid beetle, *Anatalla spinolae*, with pollinarium removed from a flower of *Prasophyllum Muellerei* (enlarged).

OUR RARER ORCHIDS

By W. H. NICHOLLS

(7) *Thelymitra azurea* Rogers.

This small, though very beautiful, Sun-orchid was originally discovered in South Australia in November, 1916; the locality being "between Mount Compass and Victor Harbour". In the following year (1917) the description appeared in the *Proc. Roy. Soc. of S.A.* (Vol. xli). It is by Dr. R. S. Rogers, M.A., M.D., who writes (24/4/24), "The plants were literally in thousands in a well-frequented place . . . but since then it has not appeared." This year (1932) the species was again found blooming in profusion. One plant was 22 inches in height and had 14 flowers on the raceme.

During November, 1932, I received a splendid specimen of *Th. azurea* from Miss Laura Banfield, of Ararat (a member of the Club). It was found in the Victoria Valley, near the Grampians, and had six flowers. Three specimens were collected.

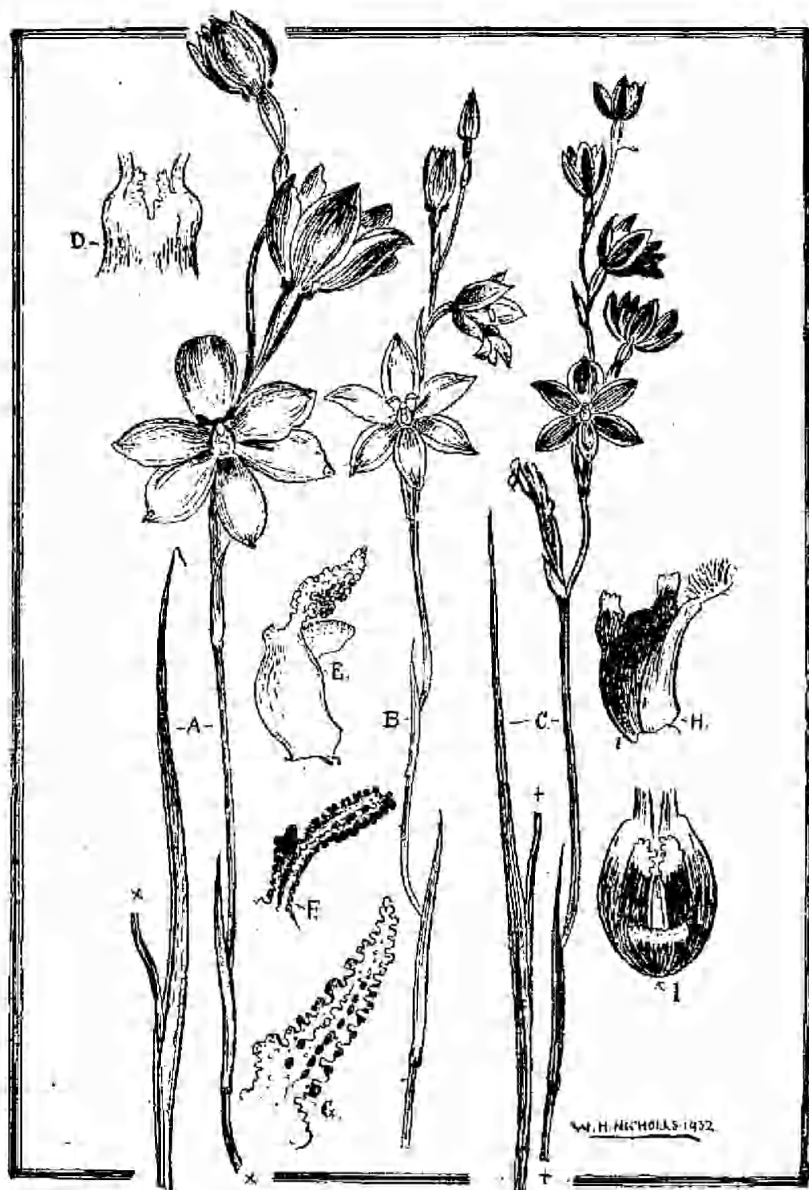
Dr. Rogers's description (abridged) is as follows:—"Plant, 4-16 inches high; leaf narrow—linear—often filiform; flowers in a raceme, 1-12, deep bright-blue (azure); one acuminate cauline bract (my specimen has two); column widely-winged, the hood between the penicillate appendages deeply tripartite, the lobes purple with denticulate tips, middle lobe shorter than, and imbricate over the lateral ones; hair-tufts purple, borne upwards and forwards on two lateral expansions of the column, stigma large." It is a close relation of *Th. ixioides* Sw.; but blooms later in the season. The strange, almost unique, column is exquisitely-coloured; in keeping with the attractive flowers.

South Australia, Victoria.

In Western Australia a very attractive form occurs, locally known as the "Shirt-orchid", because the perianth (blue) is conspicuously and regularly marked with dark purple longitudinal bands. The column suggests an intermediate form between *Th. azurea* Rogers, and *Th. ixioides*, Sw. However, it is recorded in Western Australia as the latter species.

(8) *Thelymitra Macmillanii* F. v. Mueller

The salmon Sun-orchid is one of the showy terrestrial species. It was named after Mr. Thomas Macmillan, a Melbourne horticulturist, who discovered the first specimen near Mt. Martha (Port Phillip). The original description appeared in 1865 (*Pragn.* vol. 5, p. 93). It must be regarded as a rare species, though in a few instances it has been found in considerable numbers. The blooms vary much in size (see plate). Usually the colour is salmon-pink; deep crimson flowers are, in some localities, the rule;



Thelymitra species

intermediate shades are deep-pink to salmon-pink on a yellow ground, the lighter colour showing as iridescent veins and "grains of gold".

Last season I was pleased to receive a large three-flowered specimen from Mr. A. B. Braine. The flowers were more richly-coloured than in any specimens previously seen: deep rose-pink, the base of the segments flushed with purple, the tips salmon. This specimen, probably the finest ever collected, was found by Mrs. R. Brooks near Maldon, Bendigo district (October 16, 1931).

Th. Macmillanii diffuses a faint, though rare, perfume, recalling the delightful rose-like fragrance of its close ally, *Th. antennifera* Hk., f. Bentham (*Fl. Australis*, vol. vi) writes: "The species requires further investigation, and may prove to be an abnormal form of one of the allied species, or possibly a hybrid". It is, however, a well-established species.

A brief description, based chiefly on Victorian specimens, is appended:—

Th. Macmillanii F.v.M. :—A very slender species, varying in height from 10-20 cm.; stem wiry, flexuose; leaf erect, narrow-linear, channelled; flowers 1-6 variable in colour (see notes above), 2.3-4.5 cm. in diameter; column brightly-hued, no dorsal crest, but at the rear a deep sinus; the wings yellow or red (or both), large, produced as lateral, very rugose appendages on either side of anther—margins very irregularly formed (see plate); anther large, pubescent, produced forward and above the stigma, apex blunt; stigma comparatively small, a prominent rostellum situated in the upper depression.

Fairly well-distributed throughout Victoria—including the *East*, from where it has been recorded only comparatively recently, (Yarram-Hedley) also in South Australia. Fl., September-October.

KEY TO ILLUSTRATIONS

Thelymitra species

- A. Large fld. spm. *Thel. Macmillanii* F.v.M. (Maldon, Victoria).
- B. Typical spm. *Thel. Macmillanii* F.v.M. (St. Arnaud, Victoria).
- C. *Thel. azurea* Rogers (Victoria Valley, Victoria).
- D. Head of column from above—*Thel. Macmillanii* F.v.M.
- E. Column from side—*Thel. Macmillanii* F.v.M.
- F. } Variations in the lobes—*Thel. Macmillanii* F.v.M.
- G. } These lobes are given to much variation of form.
- H. Column from side—*Thel. azurea* Rogers.
- I. Column from above (hair tufts not shown)—*Thel. azurea* Rogers.

(Note—Figures of flowering specimens drawn comparatively.)

THE MIGRATORY SKIPPER

(Badhamia exclamatoris Fabr.)

By A. N. BURNS, F.E.S.

This interesting butterfly belongs to the great family Hesperidae ("Skippers"). Representatives of most families of butterflies at certain times exhibit a migratory tendency, that is, a particular species may be observed flying in numbers in a general given direction for several days or even weeks; this tendency, however, is comparatively rare in the Hesperidae, and in Australia occurs in that family with one species only, namely, *Badhamia exclamatoris* Fabr.

This butterfly has a very wide range throughout the greater part of the Indo-Malayan region, and eastwards to Fiji. Yet it does not, so far, appear to have developed any geographical races. In Australia it occurs commonly in Queensland as far south as Brisbane, and more rarely on the northern rivers of New South Wales, with perhaps an occasional straggler as far south as Sydney.

I have noticed that while, in general, odd specimens are to be taken throughout the summer months, there are two well-defined periods when this butterfly appears, to a greater or lesser extent, in migratory flights. This applies particularly to that part of Queensland between Gladstone and Cairns, and over a strip of about 100 miles in width with the coast as one boundary.

At Brisbane in 1923, a flight occurred which lasted from January 18 until about February 8. The butterflies flew in a direction a little west of south, and except for occasional pauses to feed at some flower, seemed bound to pursue their flight in this direction. Both males and females occurred in almost equal numbers, and all specimens showed signs of travel in that they were slightly wasted, though the wings were not torn. Of nine specimens captured during two days of the flight, four were females and five males. Until this flight I had not seen any examples of this insect in Brisbane that season, nor did I observe any afterwards.

My next meeting with this skipper in numbers was at Westwood, which is thirty miles westward from Rockhampton on the main Longreach railway. From December 27, 1923, large numbers of this insect arrived, flying in a southerly direction, and so continued until the middle of January, 1924. These dates will be found to be approximately three weeks in advance of the time of appearance in Brisbane during the preceding summer. The butterflies did not present in general such a wasted appearance as those I captured in Brisbane almost a year before.

During my travels round the Westwood district I was greatly interested to note that in a bottle-tree scrub, some four miles from the Prickly-pear experiment station, where I was stationed, numbers of these butterflies were ovipositing on a large tree (locally

called yellowwood) which at that time of year was covered with young leaves. Within two weeks many hundreds of young larvae were to be found on these trees, each one sheltering in a leaf which it had folded together with silken threads. Very soon, as these voracious feeders grew, the trees began plainly to show signs of early defoliation.

Every tree visited presented the same appearance, and harboured many hundreds of larvae. Within two weeks from the time of first observing the young caterpillars, every yellowwood tree was completely stripped of its leaves, and fully-grown larvae were to be seen everywhere: on the ground, on fences, on the grass, and in fact on every shrub and tree near the feeding trees. Most of these larvae, however, must have attained their full development, because within a week pupae were to be found everywhere. Unlike the pupa of most Hesperid butterflies, this species is attached by the tail and a central girdle, and is enclosed within a folded leaf. The leaf is not rolled or tightly folded as is the case with most skippers. Pupae were found, in some cases, not enclosed within a leaf, but merely attached by the tail and a central girdle. They were to be seen on fence posts, occasionally on grass stems and twigs, and much more commonly in folded leaves on other shrubs.

The pupal period lasted about two weeks and by the first week of March butterflies began to emerge. By March 9, 1924, emergence was in full swing and by the 15th only an occasional straggler remained. This time the butterflies flew in a north-westerly direction, if anything a little to north of west. This led me to believe that during the winter and spring months this species had its life cycle in the far north, and on emergence about December flew southwards, to breed in southern central and coastal Queensland; the butterflies from that generation travelling north again, to breed.

Further observations were made at Mackay and Cairns (200 and 600 miles respectively from Westwood), in later years. At Meringa, which is some thirteen miles south of Cairns, these butterflies appeared flying south, though not in very large numbers, and specimens in good condition, during the second week of December, 1926, again a little in advance as far as time of year is concerned, of appearance at Westwood. Quite a number of isolated specimens remained throughout December, with occasional specimens during January, 1927. However, by February 27, 1927, freshly-emerged specimens were to be seen flying in a general northerly direction, and by the middle of March a conspicuous northerly migration had taken place.

Later observations, made at Mackay, which may be taken almost as a half-way locality, are also of interest, and seem further to bear out the idea that one generation breeds in the far north, while the summer one breeds around the Rockhampton-Gladstone area.

From March 1 to April 1, 1928, a large flight of *Badhamia exclamations* occurred, all the butterflies flying in a northerly direction. All specimens noted and captured were in good condition; and none showed signs of wear or travel. These were no doubt those which had bred around the Rockhampton district, returning northwards again. The explanation of specimens being noted at Meringa (near Cairns) over the period December to April is that probably some examples of both generations breed near Cairns; and furthermore, that Cairns is probably near the terminus of the northerly migration, hence accounting for the fact that there the northerly migration was not so great as at Mackay and Westwood.

The country in the Westwood district, where these butterflies breed, consists of open forest; i.e., ironbark and bloodwood interspersed with grass and low herbage; and belts of bottle-tree scrub. The latter contains such shrubs and trees as turkey-bush, *Casias*, *Capparis*, brigalow, quandong, emu-apple, yellowwood and bottle-trees (*Brachychiton* sp.). These scrubs may be termed "dry scrubs" when contrasted with the dense "rain forests" of the Cardwell-Cairns region.

That the far north or Cape York is suspected of being the northern breeding ground of this skipper may be inferred from the fact that the country north of Cooktown, also that inland from Cairns, is very similar to the "dry scrub" type of the Westwood district area. The winter climate and that of spring also, would, of course, be considerably warmer than that of the Westwood or Rockhampton districts.

At Westwood the following observations were made with regard to the life history of this butterfly. The eggs are laid, singly, on the young shoots of the food-plant. They are large, spherical, and pale yellowish in colour. Prior to emergence of the larvae they become darker. The fully grown larva measures about 2 inches in length, is cylindrical, and tapering towards each extremity. The whole of the dorsal surface is pale ochreous, in some examples almost yellow, and in others of a decidedly purplish hue. A wide black dorsal line runs along the entire length of the body. Interrupted transverse lines of a blackish colour and numbering two and three in the anterior segments, five in the central ones, and two in the posterior ones, run across the dorsal surface. A wide dark-chocolate coloured lateral stripe runs the body length; beneath this, minute black spiracles on a pale pinkish-brown ground, and numbering one to each segment, occur on segments four to ten. The ventral area is dirty white in colour; in a few specimens examined it showed a decided trace of pink. The head is hard and large, pale ochreous with curiously-shaped black markings across the middle of the face. These markings extend round the sides of the head, and the posterior one reaches round the dorsal surface of the head near the junction with the first body segment.

The pupa is attached by the tail and a central girdle, and gener-

ally enclosed in a folded leaf held together by a few silken threads spun during the larval stage. Length, including operculum, from 1 inch to $1\frac{1}{2}$ inches. Colour, dark brown, with almost black irregular markings. The thorax at the back is strongly produced outwards. Head wide and eyes prominent. Operculum about $1/16$ th inch in length, resembling a blunt tooth directed backwards over the head. The whole surface of the pupa is densely covered with bluish-white powder or "bloom". Pupae are almost invariably found on plants adjacent to the food plant. The reason for this latter character is very probably due to the fact that the larvae are so numerous on the food plants that they quickly defoliate them, and by the time these larvae are ready to change into pupae there are no leaves left on the feeding tree to furnish shelter.

Despite the fact that these larvae were so numerous in the summer of 1923-4, all through the Westwood district, the percentage attacked by parasites was comparatively small. From many larvae and pupae collected for breeding purposes, two species of Tachinidae (Dipterous parasites) were obtained. The number of examples parasitized would not exceed five per cent. of the total number kept under observation. This record, however, applies to one season only; and it is quite possible that the percentage of specimens parasitized might be much higher in other years.

A brief description of the imago of *Badhamia exclamantis* is as follows:—

Male above: forewing dark brown, paler near the base, a small narrow spot near the centre of the cell, pale yellow, hyaline; two (sometimes one) small elongate spots in the discal area also hyaline yellow. Hindwing dark brown, base paler. Cilia lighter brown. Male, beneath: forewing brown, apical areas paler, spots as above, but more indistinct. Hindwing brown suffused yellowish.

Female, above: forewing dark brown, basal areas paler, a narrow spot near centre of cell yellow hyaline; three very small sub-apical dots, an elongate spot, and a triangular-shaped discal spot, yellow hyaline. Cilia brown, paler. Hindwing brown, base paler, cilia paler brown. Beneath, as in the male, hyaline spots slightly more distinct. The antennae are very short and the eyes large and prominent; the forewings are considerably elongated towards their apices, and the hindwings have their outer margins indented just before the tornus.

During periods of very hot weather, these butterflies (like many other species) are fond of resting on damp sand along the margins of watercourses, and sucking up the moisture. Along one shady creek at the back of the Westwood Prickly-pear experiment station in the flight of 1923-4, when some exceptionally hot days were experienced, hundreds of these butterflies rose up from the moist sand as one walked along. All shady shrubs and trees had numbers resting, wings folded over the back, on the undersides of the leaves.

ORCHID NOTES AND NEW RECORDS

By W. H. NICHOLLS

The season of 1932 has been, in my experience, one of the best on record. Many interesting orchids have been found, including new species and varieties, and strange teretological specimens; also unusually fine specimens of common species. Hybrids—chiefly among the spider forms (*Caladenia*)—have been exceedingly abundant. One of the most interesting and beautiful finds is a large white "Spider"—almost a typical *C. Patersonii* R. Br.—with the added adornment of *conspicuous clavate tips* to the segments (Gorae, Murray Holmes).

Prasophyllum Frenchii F.v.M. has been found in the Devil's Garden, Grampians, by Miss Laura Banfield, of Ararat (a new south-west record). Unfortunately this famous Wild Garden is in danger of destruction. The extension, from Pomonal, of tobacco plantations is causing concern to nature lovers.

Thelymitra D'Altonii Rogers, with its spiral leaf, occurs in this area also. An additional locality is now Ararat, where it has been collected by the Rev. Clarence L. Lang. Mrs. Edith Rich sends a unique form of *Diuris maculata* Sm., not strictly an albino, but *whitish* with the usual distinctive markings (in the absence of the yellow ground colour), showing blue-black.

Caladenia reticulata FitzG. —A rare albino form was collected at Wonthaggi by Mr. E. Homann, of the Technical School, and an albino form of *Cal. angustata* Ldl. comes from the Grampians (Miss L. Banfield).

Several new species have to be recorded for Victoria, Western Australia, and Tasmania. These will be dealt with at an early date. Two are very important additions to Australian Orchidaceae. One represents the "missing link" between *Acianthus* and *Cyrtostylis* and proves the connection between *Acianthus* and *Cyrtostylis*, indicating the superfluity of the latter as a genus name. A large "Spider-orchid" has a unique labellum, the gland-beset lip of which is prolonged—like the other segments—into caudae.

Burnettia cuneata Ldl. is another new south-west record. Mr. J. B. Howie, of Vermont, writes: "A wonderful patch, discovered by chance, in a space (say) 30 yards by 15 yards. There must have been 300 or 400 plants"; locality "not far from Mount Rosca Creek and Tower Hill" (Grampians area). They were collected on November 2 (1932).

Prasophyllum gracile Rogers—a very typical specimen from Ararat, and several specimens of *Thelymitra luteo-ciliata* FitzG. from the Grampians, also Ararat. Both are new south-west records to the credit of Rev. C. L. Lang.

The strangest form of *Prasophyllum odoratum* Rogers I have yet examined came from Gorae (via Portland), collected by

Murray Holmes. The specimen was fairly typical in general appearance, but all segments were erect—flattened against the stem, as if pressed so. It was the natural position. All the individual flowers possessed truncate tips to very stout lateral sepals. Another specimen, of darker colouring, had some flowers minus petals. The dorsal sepal was really a petal, this segment being in no way different from a petal in a normal flower. All the flowers of this specimen had the extraordinary-looking lateral sepals, but at the tips were deeply quadrangular-truncate and bifid.

Pr. odoratum flowers as late as February in the Portland district. On February 24, 1932, five specimens were received (Murray Holmes). *Thelymitra fusco-lutea*, from Gorae, via Portland, December, 1932 (Murray Holmes).—An additional S.W. locality for this attractive species, *Caladema reticulata* FitzG.—Typical specimens from St. Arnaud, new for the north-west. (Miss Yvonne Aitken, November.)

Diuris fastidiosa Rogers.—The only locality where this species has been found is now traversed by a railway line, and blue-metal, etc., covers the exact spots. Very fine specimens of *Prasopphyllum odoratum* Rogers var. *album* Rogers, from Leongatha (Miss J. Anderson). One extraordinary specimen, with about 60 flowers, in a spike nine inches long, was of unusual interest. It had the appearance of having been turned on a lathe, so perfectly systematical and compact was the inflorescence. This fine form of var. *Album* is also abundant near Anglesea. (F. J. Bishop.)

Prasm. gracile Rogers.—This dainty species appears to be rather plentiful in a number of localities in New South Wales (Mr. F. Nubling), though apparently not listed in any publication concerned with the botany of that State. A very small form occurs in the Airey's Inlet district (Victoria). (Miss M. Sutherland, November, 1930.)

Prasm. Archeri Hk. f.—A very darkly-hued specimen from Smithton, Tasmania (from the Ven. Archdeacon Atkinson, M.A., December, 1932). The dorsal sepals and petals were vivid green, with very dark, broad, purplish, longitudinal bands.

The Sundews belong to the genus *Drosera*—a very curious and interesting class of plants, of the natural family Droseraceae. About 130 species are known, distributed over most parts of the world. Fifty species are indigenous to Australia, nine of which occur in Victoria. The Sundews usually inhabit marshy places, and obtain the nitrogen necessary for their growth by capturing and absorbing insects. Other insectivorous plants found in Australia and other parts of the world are Pitcher plants (*Nepenthes* spp.) and Bladderworts (*Utricularia* spp.), each with their peculiar insect traps.

NESTING OF THE EMU

The Lakes National Park—near the township of Paynesville—and neighbouring country, has been inhabited by Emus (*Dromaius novaehollandiae*) since white people first settled in the district, approximately 70 years ago; yet so far as I have been able to ascertain, very few nests have been discovered in these areas. However, young birds appeared from time to time.

It was in 1926 that I found the first Emu's nest I had seen, but not until 1932 was I able to continue my study of the nesting of the species. On June 15, among a dense growth of bracken-fern, I noticed a small, open space, with a pile of withered bracken fronds in the centre of it. Thinking that probably a fox had collected the rubbish to hide the remnants of a meal, I disturbed the heap with one foot. A huge, blue-green egg was revealed. There were three in the nest. After covering them again, I proceeded on my way, but the owner of the nest was not seen.

When I visited the spot again, on June 28, the Emu was on the nest, but left it when closely approached. The clutch had increased to six, and apparently incubation had begun. There seems to be a general belief among bird-men that the male Emu undertakes most of the brooding; personally, I can neither substantiate or disprove that belief, because of the great difficulty in distinguishing the sexes unless the two birds are together. Not once did I observe a second bird in the vicinity of the nest.

My third visit took place on July 13. The brooding bird rose from the nest when I was about twenty paces distant, and, uttering frequent hoarse grunts, made off, hesitatingly, towards some neighbouring scrub. Another egg had been added to the clutch, the number being seven. It was not until August 23—ten weeks from the date on which the nest was discovered—that I had opportunity to inspect it again. On this occasion I found the Emu exceedingly loath to leave the nest. From a distance of about fifteen yards I could discern the big bird lying as flat as possible, endeavouring to avoid detection. Upon my cracking some sticks, the long neck lifted gently; one glance toward me, and the Emu rose, and moved off. Obviously the poor bird was suffering acutely from cramp; it had the gait of a drunken man, and several times staggered against a tree. The clutch had been increased by one—a smaller egg than the others and showing less scoring on the shell. I noted, also, that one of the larger eggs possessed an aperture at one end and the bill of a young bird was visible. On revisiting the nest I found it deserted. Whether this was due to my appearance at a critical period, or an attack from foxes, was impossible to determine.

Although there may be much yet to learn in regard to the nesting habits of the Emu, my observations this season revealed several interesting facts. Opinions differ considerably as to the length of time occupied in the incubation of the eggs; some writers contend that it takes three months, others record it as eight weeks. The cause of such diversity of opinion is obvious. While quite three months would elapse between the laying of the first egg and the hatching of the last chick, yet the actual period required for the incubation of each individual egg is eight or nine weeks.

The laying of the eggs extends over a very lengthy period—in this case, approximately five. Until the bird begins brooding the eggs are kept concealed by a covering of bracken fronds, or other readily-obtainable material. Brooding begins before the full clutch is laid. That few Emu nests are found is partly attributable to the reluctance of the sitting-bird to reveal its presence until one is in close proximity.

Since the reservation of the Lakes National Park, and proclamation of sanctuary in that locality, it is gratifying to notice that the Emu is on the increase there.

DIVING PETREL FOUND NEAR LAKE LEARMONTH

The late Dr. J. A. Leach, in his *Australian Bird Book*, described how a Yellow-webbed Storm-petrel (*Oceanites oceanicus*) was found under a wire fence near Marshalltown State School, nine miles inland. A more remarkable record was brought to my notice by Mr. Arthur Perkins, head teacher at the State School, Windermere, a few miles west of Ballarat. He wrote on October 3, asking for help in the identification of a dead specimen of a bird that a boy had brought to school that morning, and which they thought must be the Diving Petrel. The description sent corresponded with that of *Pelecanoides urinatrix*.

Realizing the value of such a record, I wrote asking Mr. Perkins to forward the specimen, and also to obtain further particulars about the finding of the bird. The specimen arrived two days later, and the master and children had been correct in their identification. The specimen was handed over to the National Museum as a donation from the Windermere State School.

The bird was found by John James Palmer, aged 12, about two miles north of the school and two miles from the railway line. It was in a paddock about 400 yards from the road, and about 10 yards from a subdivision fence consisting of wire and gorse. The place is between Lakes Learmonth and Burrumbeet, and one mile south of Lake Learmonth.

The record is remarkable, because this small bird is not built for sustained flight. It has a chubby body, a very short tail, and very small wings which recall the "flippers" of Penguins. Indeed, the general form of the bird is that of a tiny Penguin. It seems to flutter over the waves rather than to fly; but it is an expert diver and practically "flies" under water, using its wings as the Penguins do their wings or "flippers".

How, then, could such a bird travel so far inland? What kind of weather prevailed over the area in the last week in September? Through the courtesy and interest of an officer of the Commonwealth Weather Bureau the following details were worked out. In the earlier part of the week, September 25 to 28, conditions were comparatively quiet, with moderate winds and a few very light showers. The charts for Thursday, 28th, and Friday, 29th, show the general state of the weather. On the 29th, a definite trough (line of lowest pressure) can be seen running NNE. through Adelaide. Fresh northerly winds prevailed over western Victoria.

At a height of about a mile above the earth's surface at Melbourne, the wind maintained, throughout Thursday, a velocity of 60 miles an hour in the same direction (northerly). As the trough line passed eastward over Victoria it brought a sharp wind change from north to west-south-west and south-west, accompanied by moderate general rain and by some thunderstorms in parts of the Mallee and northern country districts. At 9 a.m. on Friday, 30th, the chart shows the wind was definitely from west to south-west over western Victoria, and adjacent parts of South Australia. The thunderstorms of the 24 hours previous to 9 a.m. on the 30th would be associated with violent convection and wind currents. These would be a possible cause of exhaustion and injury to any birds coming within their influence.

The weather improved during Friday and by 9 a.m. on Saturday, October 1, fine, but cloudy conditions prevailed in western Victoria, with relatively light north-west to south-west winds. The south-westerly winds shown on Friday morning's chart were under 25 miles an hour. While these might account for a seabird flying inland, the disturbed conditions associated with the thunderstorms of Thursday seem the more likely explanation.

HERBERT W. WILSON.

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THE FIELD NATURALISTS' CLUB OF VICTORIA

The ordinary meeting of the Club was held in the Royal Society's Hall on Monday, January 9, 1933, at 8 p.m. Mr. V. H. Miller, Vice-President, presided over an attendance of about 60 members and friends.

DEATH OF AN OLD MEMBER

The Chairman spoke of the loss to the Club in the death of Mr. James Hill, of Murtoa, who had been a member for many years. Mr. Chas. Daley also spoke. Members then stood in silence as a mark of respect to the memory of our late member.

APOLOGY

An apology for his absence was received from the President.

NATURE NOTES

Mr. H. Stewart spoke of the abundance of birds, particularly Lyre-birds, at Mount Buffalo. The flora also was very beautiful, especially the Snow Gums. He stated that the Wild Flowers Act was being strictly enforced.

The Chairman stated that Lyre-birds were very plentiful in the Mallacoota district.

LECTURE.

A lecture was delivered by Mr. A. S. Kenyon, his subject being "Forests and Water". He stressed the necessity for preserving the upper catchments of the various rivers from the evils following upon grazing, and by means of lantern slides showed how the country was eroded by rain, and the valleys were filled with gravel and sand. The lecturer also showed what the State had done and was doing in the matter of irrigation. Views of many of the State's reservoirs were thrown upon the screen.

EXHIBITS

Mr. A. S. Kenyon.—*Eucalyptus uncinata*, showing three generations of seeds on the one branch; *Grevillea trinervis*, and *Eugenia Smithii*.

Mr. V. H. Miller.—Aboriginal stone axes.

Mr. W. H. Nicholls.—Water colour studies of Australian orchids:—A slender, pale blue form of *Thelymitra grandiflora* Br.

Thelymitra azurea Rogers (a new Victorian record). *Lyperanthus nigricans* Br., *Caladenia cornea* (showing its varieties), detail figures of *Prasophyllum elatum* Br., *Sarcochilus Hartmanii* F. v. M., hybrid *Caladenias* (Spiders).

Mr. Leo W. Stach.—Fossils collected at Thompson's Creek, south of Moriac Railway Station:—*Stephanotrochus Tatei* (Dennant), *Flabellum medioplicatum* (Dennant), *F. distinctum* (Ed. and H.), *F. fastigiatum* (Dennant), *Plachotrochus elongatus* (Duncan), *Tegulorhynchia coelata* (T. Woods), *Spondylus gaederopoides* (McCoy), *Glycimeris Cainozoica* (T. Woods), *Venericardia janjokkiensis* (Chap. and Sing.), *Torritella septifraga* (Tate), *T. tristata* (Tate), *Volutilithes anticingulata* (McCoy), *Cypraca platyrhyncha* (McCoy). Also larger fossils from Clifton Bank, Muddy Creek, Hamilton:—*Volva validicostata* (Tate), *Cypraca gigus* (McCoy), *C. erimia* (Sowerby), *C. dorsata* (Tate).

Mr. E. E. Prescott.—Cocoon of Emperor Gum Moth on fern (*Nephrolepis* sp.). The caterpillar of this moth was feeding on the same frond.

Mr. C. French, junr.—Giant Cockroach of Queensland (*Macropanesthia rhinoceros*).

Mr. F. H. Salau.—*Cryptostylis subulata*, from Heatherton district.

Miss M. L. Wigan.—Photographs taken at the R.A.O.U. camp at Colles' Bay, Tasmania, in November last.

Mrs. M. E. Freame.—Collection of shells, Whale's teeth, Sea-lions' teeth, and Sea-slugs.

Mr. H. Stewart.—Flora from Mount Buffalo, including:—*Gastrodia sesamoides* (Potato orchid), *Prasophyllum Suttonii* (Alpine leek orchid), *P. brevifolium* (Short-tipped leek orchid), *Prostanthera Walteri*, *P. rotundifolia*, *Eucalyptus coriacea*, var. *alpina* (Snow Gum).

VICTORIAN INSECTS

By C. FRENCH, JUNR.

Some new records of plants now attacked by our commoner species of insects.

I. "The Emperor Gum Moth" (*Antherea eucalypti*).

These insects formerly breed on the eucalypts, but are now found attacking Pepper trees (*Schinus molle*), Roses, Apple trees (fruit spurs), Queensland Box (*Tristania conferta*), Plane trees (*Platanus orientalis*), Dwarf Mallow (*Malva rotundifolia*), Liquidamber (*Liquidamber styraciflua*), Birch (*Betula alba*), Sunflower (*Helianthus*), Honeysuckles (*Lonicera*), Lilly Pilly (*Eugenia Smithii*), Ferns (*Nephrolepis*), Gum Myrtle (*Angophora intermedia*), Elm (*Ulmus campestris*), and Native Honeysuckle (*Banksia*).

THE OCTOPUS AND ITS ALLIES*

By JOYCE K. ALLAN

(Assistant in Conchology, Australian Museum)

Many stories are told of the enormous size of the octopus and its allies, and of their ferocious attacks on ships and sailors in olden days. Although there are probably giant forms in some of the seas, allowance must be made for exaggeration in most of these tales. It is hard to visualize, in these times, large sailing ships being dragged down by the clasping arms of a giant cuttlefish, and rescued only by the efforts of the crew in cutting off the creature's arms with swords and hatchets.

The question is often asked why the octopus, Argonauta, squid, cuttle, Nautilus and Spirula, embraced in the class *Cephalopoda*, should be in the same group as the Sea-snails, which they resemble so little externally. The answer is that, although in many ways the high standard of their development and intelligence approaches that of the vertebrates, the alimentary system, toothed radula, mandibles, gills and siphon are all true molluscan characters. Finally, the presence of a shell in many species, ranging from a thin, transparent, internal pen, in the Squid, to the large, well-developed, chambered, external shell of the Pearly Nautilus, definitely proves their relationship.

The fossil remains of shells and ink-sacs prove that cephalopods of gigantic size existed in prehistoric times, and that shell-bearing forms seem to have predominated. The Nautilus and Spirula can trace their ancestry back to the coiled shell of the ammonites, great numbers of which have been found. By the fossil forms of ink-sacs and pens, octopods, squids and cuttles can be traced to the belemnites. On account of the paucity of shelly matter in the last, we conclude that they were probably more numerous in the geologic past than their fossil forms indicate.

The modern cephalopod is a carnivorous, rapidly-moving animal, with a well-developed eye and a cunning intelligence. Without an external shell to protect it, it must rely on its own speed and alertness in escaping from its enemies and for hunting down prey. The Pearly Nautilus, the only one of this class to possess a permanent external shell, is a good example of how the presence of such a protecting shell can dwarf the intelligence of an animal. Through relying on this home, as it were, the Nautilus has had no need to fortify itself further with the cunning of the others or with the addition of an ink-sac.

All cephalopods are marine, and are found practically all over the world, from great depths to very shallow water on the sea-shores, or in the open sea miles from land. Shore forms are mostly nocturnal in habits, generally hiding during the day.

*Contribution from the Australian Museum.

When they wish to move about, cephalopods may walk with their bodies arched, using their arms as legs, or swim rapidly by the expulsion of water from a siphon or funnel situated in a cleft separating the head from the body. The addition of a fin-like flap on either side of the body in some genera assists in the latter mode of locomotion.

The power of camouflage is developed strongly, and, at a moment's notice, colour may be changed from the palest shade to the very darkest red, blue, brown or green. This colour change is brought about by pigments in the cells or chromatophores. There are usually two kinds of chromatophores, placed one above the other, and in close communication with the optic ganglion. A quick interchange of the general colours of the cephalopod is brought about by contraction of the walls of the cells, which contain numerous muscular fibres. When these contract, the pigment is distributed, but, when they return to normal, the pigment becomes concentrated in a much smaller area. A layer of smaller shiny cells gives the peculiar iridescence seen on most cephalopods. The ink-sac, when present, is a great asset to these animals. By clouding the surrounding water with a large quantity of brownish-black ink they are able to escape from danger.

Cephalopods have been eaten by humans since the time of the Greeks and Romans, who considered them great delicacies and worthy of every consideration in the method of serving. Large quantities are consumed annually in Mediterranean countries, by the natives of the South Sea Islands, and by the Chinese and Japanese, either as soup-meat, roasted, or boiled. In the foreign quarters of most big cities, especially American, they are immensely popular. Throughout the world they are used as bait, and regular, concentrated attacks are made on them by some fishermen for this purpose. The shells have always been used for ornamental or other purposes.

Cephalopods are symmetrical in shape with a rounded or cylindrical body, separated from a smaller head by a short neck and a cleft in which is situated the siphon. A large, highly-organized, and almost human-looking eye is on either side of the head. Surrounding the head are a number of arms, the insides of which are generally furnished with numerous sucking discs or hooks. A large mouth, with a strong, parrot-like beak, which is exposed when the animal opens it for food, is in the centre of the arms. Food is conveyed to the mouth by the long arms. The sucking discs and hooks on the arms enable the animal to cling firmly to rocks and other things.

The internal structure of the cephalopod is highly organized. The sexes are separate, that is, there is a distinct male and a female, and reproduction takes place by means of an arm specially modified for this purpose. The young are hatched from the egg fully formed, but much softer than the adult.

The class *Cephalopoda* is a division of the *Mollusca*, and is divided into two sub-classes: *Dibranchiata*, having eight or ten arms, with suckers, breathing with a single pair of internal gills, the body sometimes possessing fins placed laterally or posteriorly; an internal shell present or absent; and *Tetrabranchiata*, with two pairs of gills, very numerous arms without suckers, and an external shell large enough to hold the animal. The *Dibranchiata* are divided into two orders, *Octopoda* and *Decapoda*. The *Octopoda* have eight sessile arms and no shell whatever. The *Decapoda* have ten arms, eight sessile and two longer ones, usually spoken of as tentacular arms. An internal shell is present.

The *Octopoda* consists of the family *Octopodidae*, containing all the Octopods, and the family *Argonautidae*, the argonauts or paper nautili.

The *Decapoda* embraces the families of squids, cuttles, giant squids, dumpling squids, sea-arrows or flying squids, and *Spirulas*. The *Dibranchiata* are known as naked cephalopods, because of the absence of a shell or the presence of an internal one only.

THE OCTOPODS

The octopods grow to a great size and are very strong. It is said that specimens have been found with arms thirty feet in length. The eight arms of the octopus are united towards the base by a large web like an umbrella, and seem especially adapted for crawling over rocks or sandy sea-bottoms. The body is round and rarely has body fins. The eye is immovable, but a lid closes over it. A backward swimming movement is made by expulsion of water from the siphon. In an extraordinary manner the octopus is able to squeeze into the very narrowest crevice in the littoral zone where it mostly lives, although some are pelagic. By attaching itself by one arm to its hiding place, it is able to keep seven arms free to catch any crabs or other shell-fish that passes by. Empty shells are left strewn about outside its haunts, the relics of past meals.

As bait, octopods are very popular. In some parts a common method of fishing for them is to drop overboard earthenware pots strung together with cord. The octopods settle in these, cling firmly, and, when the pots are drawn up, are still in them; numbers are caught in this way. In the Mediterranean, fishermen throw a small weed, *fleahane*, which they dislike intensely, near their haunts, and this has the effect of dislodging them immediately.

Filipinos, lined up on the sand surrounding the reef, hunt the octopods by holding a lighted bamboo torch in the left hand. The light from the torch shows up the octopus in the shallow water, and the natives then spear it with a "bolo" held in the right hand. It is said by some that light fascinates octopods, which come of

the surface when they see the torches. In the Carolines, a holothurian, which is particularly repulsive to the octopus, is dangled in front of a likely haunt. If there, the inhabitant forthwith leaves, and is quickly speared by the native. The octopus can be very destructive to the lobster and crab industry, if present in large numbers in an area where these are fished for.

The female has been known to sit on her eggs, guarding them closely and resenting any interference until they are hatched. I have seen the small, blue-ringed octopus (*Octopus maculosus*), common in Sydney Harbour, sitting on about fifty small, white, pea-shaped eggs; and a large *Octopus cyaneus* in the aquarium at Taronga Park, Sydney, carefully nursed a large batch, aerating them repeatedly with water from her siphon.

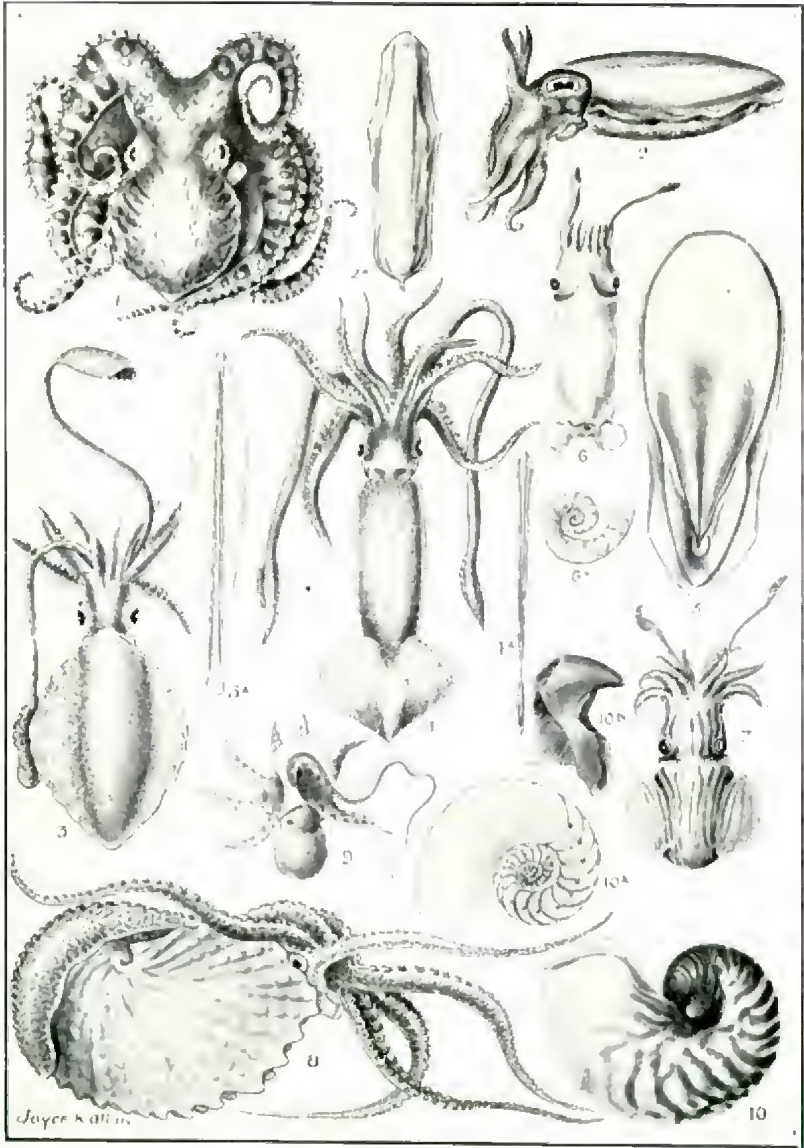
Though only a few species of octopods have been recorded from the different States of Australia, research will probably prove that there are many species still undescribed.

ARGONAUTS OR PAPER NAUTILI

Argonauts, found in all warm and tropical seas, are truly pelagic. They always arouse interest because their beautiful white fragile shell has proved to be not a true shell, but merely a cradle secreted by the female to hold her eggs; the male animal is much smaller than the female, and does not possess a shell at all. The young are hatched without shells, and after about twelve days the female begins to grow one. In the female the two dorsal arms are expanded into large, paddle-like webs at their extremities; the male arms are all pointed. The body of the female rests in the mouth of the shell, and its arms are clasped by the two web-shaped arms; there are no muscles connecting the shell with the animal. Shelly deposits are continually added and breakages in the shell mended. The eggs, compound clusters of capsules, are wedged in the shell far back until their increased size crowds out the female, who takes them with her firmly attached to her body, where they float in the water until they hatch out and the young live an individual life.

Empty shells are often found washed up on the shores round Australia, and during the spawning season, which is in the warmest months of the summer, they are found with the animal, in shallow water or cast up on the beach. Their life there, however, is short, as gulls soon devour the animals and their eggs, and the empty shells are carried away by the receding tide. Their usual home is in deep water, and a greater part of the Argonaut's life is spent walking on the sea-bottom, the female with head down and shell uppermost.

There are about nine living species of *Argonauta* known, many of these being closely related. In Australia about six species occur, two of which, *Argonauta nodosa* and *Argonauta argo*, are



Cephalopods

found at certain seasons fairly regularly round the Victorian coast.

The decapods differ chiefly from the octopods by the additional pair of long tentacular arms, long bodies always provided with fins, movable eyes, stalked suckers on the arms, and an internal shell, which lies loosely along the dorsal surface under the skin, and varies from the broad, chalky shell of the cuttle-fish to the thin, transparent pen of the squid. The sessile arms are shorter than those of the octopods, and the tentacular arms which arise between the third and fourth pair are used for catching prey beyond the range of the shorter arms. The longer arms are in some species retractile into large pouches. The decapods seem to live chiefly in the open seas, appearing periodically in shoals off coasts; they move with great rapidity, grow to a great size, and use their ink-sac freely if disturbed.

Squids and cuttles have many vernacular names given them by North Sea fishermen, such as ink-spewers, man-suckers, scuttle-fish, calamaries, etc. but in Australia are usually known simply as squids and cuttles, the latter being those with a broad white shell and fins running the length of the body, and the former having a narrow pen shell, with body fins placed well down towards the posterior end of the body. Squids and cuttles are used all over the world as food and bait. The ink from the ink-sac was used in olden days as sepia and Indian-ink of excellent quality.

LOLIGOS OR CALAMARIES

The loligos or calamaries are common round the coast of Australia, although few species are recorded. They have a world-wide distribution, and are very good swimmers. Their long bodies have variously-shaped fins placed well down posteriorly, the tentacular arms are partly retractile, and the mouth is sometimes armed with suckers, which assist the animal in holding food to the mouth. A slender pen, known in old specimens to become duplicated, extends the whole length of the back.

In the genus *Loligo* the body tapers behind, and is longer in the male than in the female. The rhomboidal or triangular fins are united behind. Two rows of suckers are on the short arms and four rows on the long. Their egg-cases, containing enormous numbers of eggs, are called by some fishermen "sea-nops", dolphins, porpoises, conger-cels, and sea-birds are their enemies, and their food is small fishes and molluscs. Dried specimens are sold in delicatessen shops in foreign quarters of big cities in America, and numbers, steamed and seasoned with pepper, salt and butter, are consumed by the poorer people of the Mediterranean.

DUMPLING SQUIDS

The dumpling squids are small animals with goggle eyes and small round fins placed dorsally. They usually live crunched in

corners or crawl about, but are able to swim rapidly when necessary, or move by a series of somersaults. They are considered very good eating. A species found commonly in New South Wales (*Sepioloides lineolata*) is pearly white, with longitudinal bands of bright blue on the body. It is about two and a half inches long.

FLYING SQUIDS OR SEA-ARROWS

Flying squids or sea-arrows are well known to sailors, as they often rise from the depths of the sea like flying-fish, and hurl themselves on boat decks. Frequenting usually the open seas, they appear at times in large shoals, attacking with disastrous results the mackerel and herrings. Numbers of them are found stranded on beach after moonlight nights, generally believed to be attracted to the shore by the light of the moon and left there by the outgoing tide. In some countries fishermen catch them by tying lights to the bows of their boats and rowing ashore, with the sea-arrows following, or by lining the shore with fires.

Flying squids are used for human consumption and as bait for cod fishing, and their enemies are the albatross, dolphin, cachélot, and larger petrels. Their bodies are especially adapted for swift flight and for cleaving the water. Various species of these are found all round Australia, including Victoria.

GIANT SQUIDS

Giant squids are the largest of the living cephalopods, and may be only big specimens of loligos or flying squids. Few specimens are caught, and they are believed to live in great depths, only coming to shallower water to die. One specimen caught off the American coast was said to have tentacular arms thirty feet in length and a body seven feet in diameter. They apparently have great battles with sperm whales, as arms of these Squids, with enormous suckers, have been found in the stomachs of whales. The much-sought-after ambergris used for perfume is a substance said to be produced through an over indulgence on cephalopod diet by the whale. Its musky smell is similar to that noticed in some squids.

CUTTLE-FISH

Cuttle-fish are the best known of all the decapods, if not the animal, at least the shell, which is found washed up on all beaches regularly. Lateral fins run the whole length of the body on either side, and the elongated tentacles are expanded at the ends. The shell is a whitish, calcareous, broad plate, and has many uses. It forms a good ink-eraser and polishing powder, and was used in olden days in the formula for tooth paste, and by medical men as an anti-acid and absorbent. The burnt shell was long ago used as a pearl face powder for women, and the French later added a touch of carmine, and so originated French "rouge". Nowadays the shells are mostly kept for birds to peck at, although re-

cently commercially-minded people have been carving and painting typical Australian plants and animals on them, varnishing them over and selling them.

On the Sydney beaches alone, fourteen different kinds of cuttle bones from these animals may be found. One large species has a shell quite twenty inches long, and is recorded also from Victoria under the name *Amphisepia apama*, or the Large Melbourne Cuttlefish.

The animals are used for food and bait, and in Newfoundland, the home of the cod-fishery, a greater part of the fishing is done with cuttles.

SPIRULA

The most interesting of the decapods is surely the little Spirula. It is the only genus of this sub-order to possess an internal coiled shell, which is placed vertically in the posterior part of the body. The shell is well known, as it is washed up in large numbers on most beaches. It is pearly, and is separated into whorls, connected with a *siphuncle* running along the inner wall of the coiled shell.

The animal is practically unknown to most people; complete specimens are rarely found, and the known species are few. Several specimens have been found on the Victorian coast, in Australia generally, and in New Zealand.

The animal is much larger than the shell. It has large eyes, ten short arms with suckers, and the tentacles are not expanded into clubs at the ends. The shell is clasped by mantle lobes, and between these lobes is a posterior sucking disc peculiar to the Spirulas, by which the animal is able to attach itself to any object, thus leaving the arms free to catch prey.

Spirulas inhabit warm seas, living in deep water. A complete specimen, dredged by the Danish expedition under Professor J. Schmidt, which visited Australia a few years ago, is now in the Australian Museum collection.

PEARLY NAUTILUS

The order *Tetrabranchiata* is represented by only one living genus, *Nautilus*, the Pearly or Chambered Nautilus shell, but about six hundred fossil species are known. The animals, which have not the intelligence of other cephalopods, are protected by a large shell, the last big whorl of which they occupy. They have no ink-sacs or suckers on their numerous arms, and although possibly able to swim, their movement is generally a creeping one. The animal is attached to the shell by muscles.

The well-known shell has a pearly under-surface overlaid with cream and bands of reddish-brown. The whorls are few, small except the last one, and are separated by a concave pearly septum, through the centre of which runs a membranous tube, the *siphuncle*. As the animal grows, the body moves forwards, and a pearly wall is made half an inch or more from the last, by a

secretion from the mantle of the animal. The siphuncle runs through all the septa.

Numbers of Nautili are seen in calm waters following storms, floating on the surface with their tentacles spread before them. Generally, however, they crawl below in warm and tropical waters. Air, admitted by the siphuncle to the shell chambers, is supposed to give the Nautilus the buoyancy which keeps it afloat. The animal is practically the same colour as the shell it inhabits. It feeds on crabs and lobsters, and is abundant round the Philippines, Fiji, New Hebrides, and New Caledonia, where it is collected for the shell and animal. The most important fisheries are in the Philippines, but even there no systematic fishing is undertaken for it. It is more or less a by-product of deep-sea fishing.

Nautili are caught in bamboo traps, "bobos", set for other purposes in deep water, but, attracted by the smell of the bait, usually partly-cooked crab or crayfish, they enter the traps, and are found there when the traps are brought up. In some islands the animals are caught by spearing them or by diving for them. Empty shells are sometimes found in shallow water.

When properly prepared, the animal of the Nautilus makes a good dried meat for soups, and is also eaten boiled or roasted. The shell is used extensively for ornamental purposes, the pearly surface being very suitable for mother-of-pearl inlay work, lamp-shades, vases, spoons, buckles, and similar articles. The demand for this shell is increasing in the Philippines, and shell shops are established there for the sale of manufactured articles from it. The Chinese in the Philippines buy the Nautili and export them to China for manufacturing buttons and other articles. In India richly-carved drinking cups are made of the shells, and in most native regalia of the South Seas are found portions of the pearly parts of these shells.

EXPLANATION OF PLATE

- Fig. 1. Blue-ringed Octopus (*Octopus maculosus*).
 " 2. Sydney Cuttle (*Solitosepia plangon*).
 " 2A. Bone of Sydney Cuttle.
 " 3. Squid (*Sepioteuthis australis*).
 " 3A. Pen of Squid.
 " 4. Flying Squid (*Nototodarus gouldi*).
 " 4A. Pen of Flying Squid.
 " 5. Bone of Large Melbourne Squid (*Amphiseptia apama*).
 " 6. Spirula (*Spirula spirula*).
 " 6A. Internal Shell of *Spirula spirula*.
 " 7. Dumping Squid (*Sepioloidea lineolata*).
 " 8. Argonaut or Paper Nautilus (*Argonauta nodosa*).
 " 9. Male Argonaut Animal.
 " 10. Pearly Nautilus Shell (*Nautilus pompilius*).
 " 10A. Transverse section of Pearly Nautilus Shell, showing septa with connecting siphon.
 " 10B. Half-beak of Pearly Nautilus (*N. pompilius*).

FURTHER NOTES ON THE POLLINATION OF
DIURIS PEDUNCULATA R.Br.

By EDITH COLEMAN

When my paper on the Pollination of *Diuris pedunculata* was published (*V.N.*, Dec., 1932) I had submitted to Mr. Edmund Jarvis fifteen bees taken in, or emerging from, flowers of this orchid. Six further specimens were sent to him, and, in a letter dated November 25, 1932, Mr. Jarvis wrote: "I have now received from you, between the dates September 19 and November 11, twenty-one specimens of the bee *Halictus languinosus*, the majority of which carried pollinaria attached to the vertex of the head, in addition to from one to five glands of pollinaria previously transported. All were of one species, and, with the exception of the bee taken by you in the dandelion flower, all were males. The male, which is distinguished by the possession of a creamy, triangular blotch on the apex of the clypeus, has thirteen jointed antennae. In the female (the specimen taken in the dandelion flower) this blotch is absent, and its antennae have twelve joints. Both sexes are black, with the vestiture white on the body and yellowish on hind tibiae and tarsi."

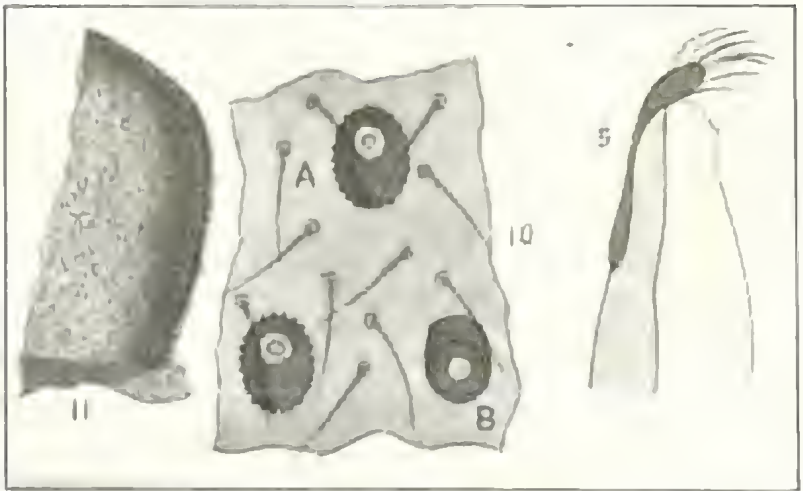
Mr. Jarvis has kindly sent me three further sketches, which are here reproduced. These, and his notes during the course of our correspondence, on the activities of the little bee, bear so closely on a theory which I am presently advancing concerning the motive for the visits to *Diuris pedunculata*, that, with his consent, I am quoting certain passages in his letters before dealing with the pollination of another species of this genus.

The following is his reply to my query concerning the ability of *Halictus languinosus* to reach nectar secreted around the receptacle of the flower in *D. pedunculata* by piercing the tissues:—"Sketch 5 on the plate (*V.N.*, Dec., 1932, p. 182) suggests, I think, that maxillary lacinia may serve to effect this purpose; while Fig. 9 on the present plate, illustrating the toothed, distal portion of one of these maxillary lacinia, enlarged to about seventy times, strengthens this theory. An inspection of the two specimens of *H. languinosus* you sent me, which had not been able to escape from flowers of *D. pedunculata*, revealed that both the maxillae and labium (lower lip) were stretched to the fullest, as though an attempt had been made to reach some desired substance, the trophi as a whole (including the fragile, sensitive lingula of the labium) being firmly held.

"In *Nomia*, *Crocisa*, *Osmia*, and many other genera of *Aphidae*, the lacinia are not toothed or otherwise specialized. Perhaps the bees included in such genera take little or no part in the pollination of orchids. Some of the British orchidae, however, as mentioned in your letter of October 2, are known to be pollinated

by species of *Andrena*, a genus in which the laciniae of the maxillae are, so far as I am aware, of simple structure, although this may not, of course, apply to all species of that genus. The proboscis of a bee is an extremely complicated organ, formed conjointly by the labium and maxillae, which are often highly modified in structure to suit the habits of different species of *Aphidac*. Those who have studied the mode of action of this proboscis are of opinion that bees obtain nectar by a process of capillary attraction, and not by licking or sucking, which is commonly thought to be the case. After reading your suggestion that insects are lured to the orchids by scent, it occurred to me that the behaviour of *Halictus languinosus* might indicate an immediate response or reaction towards chemotropic influence.

"In 1915 I carried out experiments against the Queensland 'grey-back' cockchafer (*Lepidoderma albobirtum* Waterh.) by ex-



Part of an antenna (H.P.) of *Halictus languinosus* Sm.

Drawn by Mr. E. Jarvis

posing in canefields, at night time, different aromas resembling those emanating from leaves, bark, etc., of favourite food plants of this beetle, in the hope of discovering a lure that could be used for trapping them. . . . Its olfactory sense resides in the lamellae, or plates, forming the club of its antenna, which are closely covered with pori, or pits, each containing a central peg-shaped body, usually tipped with a short seta and connected with an olfactory nerve.

"Having examined an antenna of *H. languinosus* under high magnification, I was not surprised to discover that the surfaces

of joints Nos. 4 to 13 were furnished with approximately 1,000 or more of unusually large olfactory pori, of shape indicated on Fig. 10 of the present plate, the greater number consisting of a slightly sunken ovate area with beaded edge, measuring 0.05 mm. in diameter, (a) from which projected near one end an olfactory, peg-like body. The other pori (b) were smaller in size and of somewhat barrel-like form, the top peg occupying a central position, and being sunk below the rim of the circular opening, which had a diameter of 0.03 mm. The basal ends of these peg-like bodies probably communicate with olfactory nerves in much the same manner as those occurring in antennae of scarabaeid beetles.

"Despite the suppositions and theories surrounding problems of this nature, the true explanation still remains undiscovered and mysterious. Possibly the so-called chemotropic reactions, believed by some scientists to be blindly manifested by certain insects, may ultimately be found to result from the operation of some force or forces quite unknown to us at present, and akin, perhaps, to that of wireless."

The small bee, which is the subject of these interesting notes, and which I believe to be the only insect capable of removing the complete pollen masses from the orchid *Diuris pedunculata*, is only about $\frac{1}{4}$ inch long by $\frac{1}{2}$ inch in wing-expanse (7.60×14 mm.). Mr. Jarvis expresses his indebtedness to Mr. H. Hacker, F.E.S., the Queensland specialist on bees, for his identification of *H. languinosus*.

(To be continued)

EXPLANATION OF ILLUSTRATIONS

- Fig. 9.—Sketch of maxillary lacinia of *Halictus languinosus*, showing spine-like terminal hairs. X about 70.
 Fig. 10.—Rough sketch of two forms of olfactory pori from antenna of *H. languinosus*. X about 260.
 Fig. 11.—Rough sketch of portion of upper surface of thirteenth antennal joint of *H. languinosus*, showing olfactory pori highly magnified.

Translation inadvertently omitted from description of *Prasophyllum pyriforme*, in December *Naturalist*:

Plant robust, terrestrial, 30-40 cm. high; spike rather loose, 12 cm. long. Flowers 30-40 on a spike-like raceme, pale green, shortly stalked, ovaries long, slender; floral bracts wide, adpressed, about 3 mm. long. Leaf sheathing, lamina 10-14 cm. long. Dorsal sepal 8-9 mm. long, ovate-lanceolate, base concave, apex deflexed; lateral sepals 8-10 mm. long, connate, acuminate, falcate, apices free; petals linear, nearly as long as the dorsal sepal, apices obtuse. Labellum pear-shaped, 5-6 mm. long, conspicuously veined, apical half-erect, base slightly concave; narrowly clawed, lamina traversed by two narrow, scarcely raised, glandular lines, merging and becoming swollen towards the apex; margins membranous, entire. Column short, wings bilobed, the basal lobe expanded into a fleshy tooth which exudes pink or reddish-brown. The flowers are larger than those of *P. inscium* and *P. Frenchii*, and the apices of the segments are less acute.

DESCRIPTION OF A NEW CALADENIA (ORCHID)

By EDITH COLEMAN

Caladenia integra, sp. nov.

Caladenia integra Coleman, sp. nov. Planta terrestris, hirsuta, 35 ad 38 cm. alta. Foliolum hirsutissimum, late lanceolatum, 10-11 cm. longum. Caulis erectus, duae bracteae conspicuae 1-3 cm. longae. Flos solitarius, magnus. Segmenta perianthii albida viridia, linea rubra distincta. Sepala late dilatata, deinde angusta, apices clavati. Sepalum dorsale erectum, obscure incurvum, 5 cm. longum. Sepala lateralia circiter 6 cm. longa. Petala anguste lanceolata 3 cm. longa, circiter 3 mm. lata. Labellum trilobatum, tremulum, breve unguiculatum, lobi laterales sub-erecti, fuvum viride, apex ruber; nervatum, margines integres, apex obscure denticulatus; calli clavati, basi longi, deinde breves et confertissimi, ad apicem rarensens. Columna incurvatisima, in dimidio superiore late membranaceo dilatata, in dimidio inferiore margines crenulata; basi non bicalliosa. Anthera lata, obtusa mucronata.

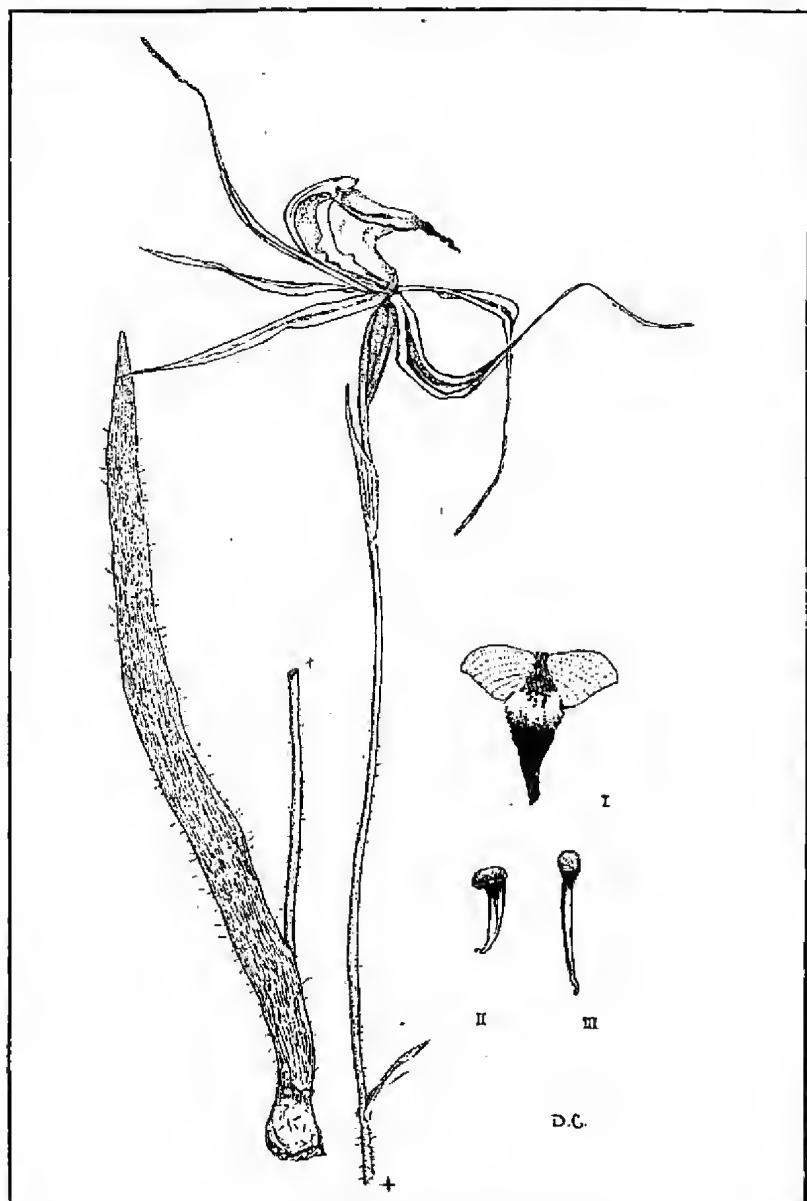
A hairy terrestrial plant, 35-38 cm. high. Leaf broadly lanceolate, very hairy, about 10-11 cm. long. Stem erect, with two conspicuous bracts about 1-3 cm. long. Flower large, solitary; perianth segments cream and green, the central portions longitudinally suffused with red; sepals widely dilated for nearly half their length, the apices clubbed; dorsal sepal first erect, then slightly incurved, about 5 cm. long; lateral sepals about 6 cm. long, spreading, then crossing; petals narrowly lanceolate, about 3 cm. long and 3 mm. broad in widest part, narrowing to acute points. Labellum three-lobed, tremulous on a short, narrow claw; lateral lobes nearly erect; colour tawny-green, delicately veined with red, apex deep, velvety maroon; margins entire, the apex obscurely dentate; calli clubbed, tall at the base, short, fleshy and crowded for less than half the length of the lamina, diminishing into two irregular rows, a few only extending as far as the middle lobe. Column much incurved, widely winged in the upper half; margins of the lower half crenulate. Without the conspicuous yellow basal glands of *C. dilatata*. Anther broad, blunt, mucronate.

18/1/33.—Miss Sandilands has just informed me that *C. lobata* has not been recorded from Tunney, Aurora or Kendenup, and that she discovered specimens of *Caladenia integra* at Aurora in 1929.

Locality.—Western Australia. Tunney, September, 1930, and September, 1931. Miss Rica Sandilands. Kendenup, September, 1931 and 1932. Mr. F. Walton Rowe.

The new species has affinities with *C. dilatata* R.Br. and *C. lobata* Fitz., but differs from both in the absence of fringes to the labellum, the shape and position of the calli, the column wings and colouring. From *C. dilatata* it differs in the absence of yellow glands at the base of the column. The labellum is exquisitely tremulous on a claw, shorter than that of *C. lobata*, which it resembles in the curve of its column and the tilted position of the flower. A cross between the above species is suggested, but no intermediate, linking forms have been noted. With crosses, such as *Caladenia tessellata* Tate and *Pterostylis Torreyana* Ewart and Sharman, one usually finds a profusion of forms unlike each other, exhibiting features distinct from those of the parents, as well as certain definite parental characters. All of the specimens discovered (about twenty) exhibit similar characteristics. The range of *C. integra* is not restricted as one so frequently notes in hybrids. This season eleven specimens were found at Kendenup and a station four miles north of Kendenup, and others at Aurora, thirty miles north.

Both *Caladenia dilatata* and *C. lobata* are rare in the districts mentioned. The specific name refers to the entire margins of the labellum.



Caladenia integra Coleman, sp. nov.

(i) Labellum (flattened).

(ii) Callus from central group.

(iii) Callus from the base of labellum.

THE TOUCH OF A MUTILLID

By TARBTON RAYMENT.

When one concentrates on a small bank of earth, say, a few feet in length and a foot or so in height, certain tiny forms of life soon come under observation. If the naturalist include the nests of earth-digging bees in his survey, then it will not be long before a few ant-like creatures crawl into the field of observation.

I was watching a large colony of *Halictus raymenti* Ckll.; noting the arrival of the laden mothers. In between times, when the busy traffic seemed to wane, I noticed an insect that appeared, at first glance, to be an ant, searching the ground and systematically examining the portals of the bees' homes. Presently she walked down a shaft, and was hidden from view. I had perforce to wait until she reappeared before effecting her capture.

When I had her under my lens, I noticed that she was without wings, and had numerous long, rather spiny hairs on almost every part of her body. By these signs I know her for a Mutillid; putting her eggs on the young of bees; rearing her children on the life-juices of the baby honey-gatherer. That, broadly, is the story of these "hairy ants".

But let us look at her a little closer—she has not any wings, for only the male Mutillid is equipped for flight. Now this apterous state is also characteristic of certain wasps in the family Thynnidae, common examples of which may be found on the tea-trees, the wingless females being carried about by the males. Another of these rather spectacular creatures is the "blue ant", *Diamma bicolor* Wwd., of our garden paths. The popular name for this lustrous purple Thynnid is as misleading as "hairy ant" is for the Mutillid. True, in each case the antennae are carried, the compound eyes being small, and the three simple ones, ocelli, are absent. Morphologically, then, the bee, the wasp, the Mutillid, and even the true ant, have much in common, though all wasps have straight hairs, and ants almost none at all.

It has long been recognized by those who "name" insects that one of the most reliable characters separating bees from wasps are the beautiful, feathery or plumose hairs of the former. All honey-gatherers have them, but wasps do not. Well, the Mutillidae also possess this peculiar type of hair, and so one is justified in placing them between ants and bees in the evolutionary scale. I may with propriety go further, and draw attention to the spiny shin of the Mutillid, and the spinose ones of bees in the genera *Euryglossa*, *Melittosmithia*, *Crocisa*, and the subspinose shins of *Megachile*. Note the form of the strigil of the Mutillid. Many of the wasps, and also various flies, are ornamented with patches of appressed, silvery hairs that glisten with the sheen of metal; well, the Mutillids, too, have them; but, so far as I know, only a

solitary Australian bee owns such a lustrous decoration, and that one, *Phenacolletes minus* Ckll., is so exceedingly wasp-like that Professor Cockerell had the greatest difficulty in determining its position.

The masters of the science agree with Dr. R. J. Tillyard that the Mutillidae are not "flower-haunting" insects, but surely this requires some qualification, for while I have never observed the females on blossoms of any kind, yet I have frequently captured males on the flowers of tea-tree. The species caught in these circumstances are *E. elegans* Wwd. and *E. subelegans*, sp. nov. It is claimed that plumose hairs are specially adapted for holding pollen, but should the female Mutillid not visit any flowers, then the plumosity may have some other function; or one may postulate the degeneration of a pollen-gathering insect that has become an idle parasite in the nests of flower-loving, industrious bees. Westwood, comparing the Mutillidae with the Thynnidae, suggested that their economy would be similar, the males frequenting flowers and the females digging in the soil. I should prefer to say, *traversing* galleries in the soil in search of prey.

The leaf-cutters, *Megachile*, have their chief pollen-holding brush on the belly, and every hair is twisted into a long, beautiful spiral; but this is not unique, for the large carpenter-bee also has such spirals intermixed with the ordinary plumose kind. All these characters are not the result of mere chance. The strigils of *Stilpnosoma*, *Megachile*, *Trigona* and *Apis* have a smooth nalis. The yellow face-marks of *Microglossella* persist through almost all the genera, right up even to the social bees. But I could go on detailing such likenesses. Many Australian *Halicti* have a pollen-brush on the belly, though the hairs are not spirally twisted, but curled, like the feathers of the ostrich.

The wings, too, reveal affinities. For example: the small earth-digging bees (*Halictus mosembryantheni* Ckll.) have a very variable wing-neruation, and I have a specimen exhibiting four cubital cells, one of which is a trapezium suggesting the cell in the wing of a Cryptine genus. In the Chloralictine group, the third cubital and the second discoidal cells are only faintly indicated, so that the wing resembles those of many other Hymenoptera. These are not accidental happenings; they are evidences of the ancestral characters of the order.

The *Halicti* have a small flat brush on the apical end of the basitarsus, and though a similar adaptation is present on the shin of *Anthophora* and several others, I have never been able to discover its function. Reasoning from the position and shape of the brush, it should be useful for the insects' toilet, but the actions of the hind legs are performed so rapidly that accurate observation is impossible.

In some of the lower genera, such as *Microglossella* and *Tur-*

nevella, the pterostigma, or wing-mark, is developed almost to a half-circle, but in *Paracolletes* it is small; in *Xylocopa* it is even smaller, while *Bremus* and *Apis* have almost none at all. *Respenia*, which is close to *Nomia*, has developed a second pterostigma on the smaller, posterior wing.

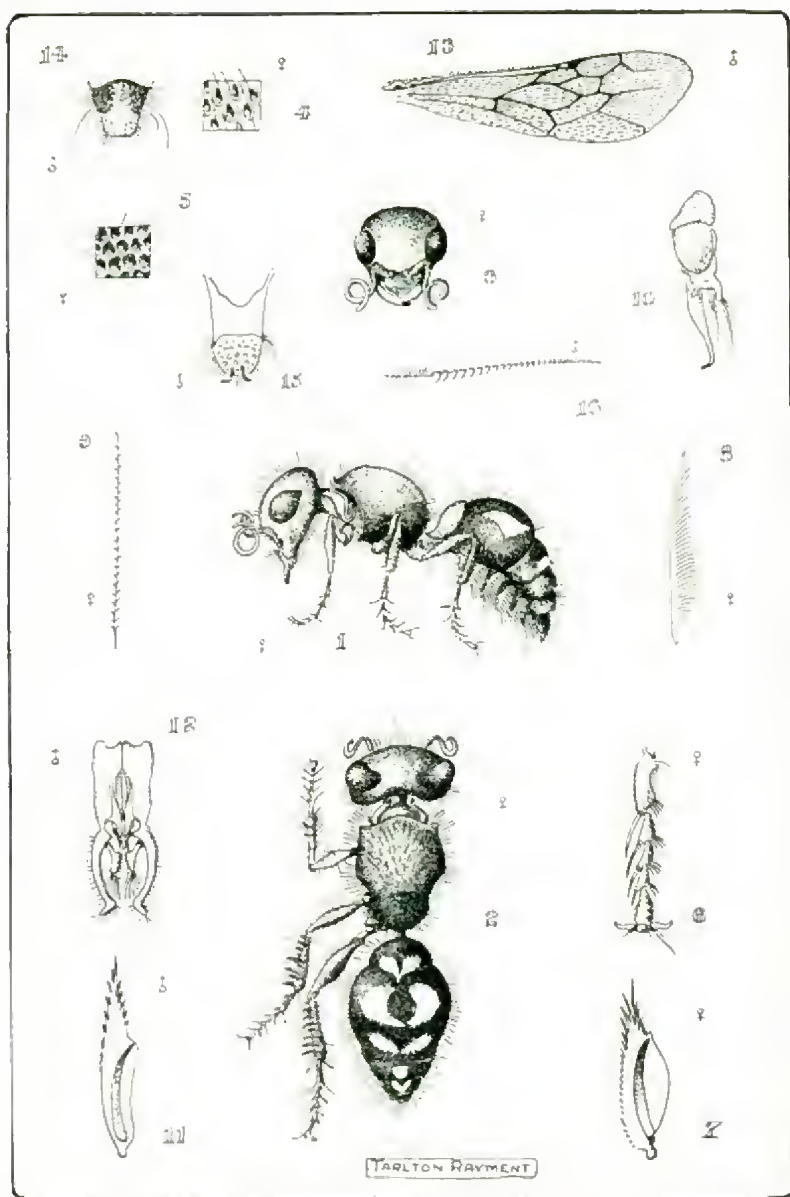
Nomia, too, exhibits peculiarities of structure on the hind legs, which are sometimes thickened or even hollowed out. Now this remarkable development seems to reach its zenith in the legs of bees in the genus *Goniocolletes*, which has great excavations and hooks, the purpose of which is utterly beyond my comprehension. *Hylcoides*, too, has hooked tibiae.

The lower edge of the clypeus—the plate just over the mouth—of *Megachile* is often ornamented with nodules or even spines, and I have a bee-like wasp—undetermined—with similar structures. The compound eyes of *Melitribus* are very close together on the vertex, but in the drone of the bee-hive, *Apis*, the eyes are holoptic; that is, they meet on the top of the head.

But one must cease; this out-cropping here and there of certain specific anatomical developments, as though to demonstrate their common origin, has a parallel in the behaviour of the creatures. Evolution is silently directing all life; not only the physical features, but also the mental qualities, are slowly but constantly growing. To deny the discernment of the lower animals, and to assert that bees are only "reflex machines", is utterly unscientific, for such a contention endeavours to limit the processes of evolution to mere morphological structure, and entirely overlooks the fact that brain functions, and that the functioning has limits imposed by the evolutionary level already attained.

Even where no brain is evident, the elements of it must be present, otherwise we should have to postulate that something came out of nothing. That, however, is more difficult than believing the elements of brain to exist, even though we be unable to detect them. It is wrong to assume that man alone has the power to reason, my retriever dog repeatedly exhibits reasoning powers; and at one time I rode an Arab pony that possessed much intelligence. Both the dog and the horse performed many actions that were in accord with my own logic.

It is often asserted that man owes his dominating position to his sagacity in making and using "tools of trade", and that if any of the lower animals ever acquire an analogous power man's empire will be seriously threatened. I venture to assert that the wasp, *Animophila*, already has the ability to use a tool, for I have observed her, here in Australia, to select a suitable stone, and then proceed to ram down loose soil just as a human being would do. Reputable naturalists in America record similar behaviour for American species of this genus.



Mutillids

TWO NEW AUSTRALIAN MUTILLIDAE

By TARLTON RAYMENT

Family MUTILLIDAE

Ephutomorpha cockerelli, sp. nov.*Female*.—Length, 4.2 mm. approx. Black.

Head large, shining, coarsely punctured; frons with some black hair; clypeus dull-reddish; vertex with white hair; compound eyes small, blackish; genae polished, coarse, deep punctures, white hair; labrum dull-red; mandibulae bidentate, reddish-amber, black apically; antennae short, curled, dull-reddish, submoniliform.

Prothorax more or less reddish-brown; mesothorax rugoso-punctate, black, the disc suffused with red, black hairs, with a few white ones intermixed; abdominal dorsal segment one amber, with a fringe of silver hair; two black, with maculae of silver hair; others black, polished, with more or less hair showing a silvery sheen; ventral segments reddish, and fringed with silvery hair.

Legs reddish, the femora and tibiae suffused with black, all the tibiae with long, fine spines, most numerous on hind legs; tarsi reddish; claws dark-red; hind calcar amber, finely serrated; strigil of anterior leg with a convex velum and a spined malus.

Locality.—Sandringham, Victoria, December, 1929 (Rayment).
Type in the collection of the author.

Allies.—*E. ferruginata* Wwd., which is much larger.

At nests of *Halictus raymenti* Ckll.

Species dedicated to Professor Cockerell.

Ephutomorpha subelegans, sp. nov.*Male*.—Length, 9 mm. approx. Peacock blue.

Head darker, polished, rugose-punctate, white hair; frons with black hair, clypeus polished; vertex with black hair; compound eyes small, black; genae rugoso-punctate, iridescent-blue, white hair; labrum dark-blue, white hair; mandibulae bidentate, blackish, with amber tips, white hair; antennae black, long, submoniliform, scapes with white hair.

Prothorax polished, sculpture and colour of mesothorax; mesothorax polished, rugoso-punctate, iridescent, black hairs mixed with white; abdominal dorsal segments darker, polished between the punctures, which are not so close, white hair, black hair on apex; ventral segments similar, but with more white hair.

Legs darker, suffused with blue, coarse punctures, white hair, tibiae more or less nodose; tarsi blackish, amber at apical ends of segments; claws dark-reddish; hind calcar white, finely serrated; tegulae black, polished; wings suffused with a blackish tint; nervures black; cells as shown in diagram; pterostigma blackish; hamuli eighteen, slender, close set.

Locality.—Sandringham, Victoria, November, 1932 (Rayment).

Type in the collection of the author.

Allies.—*E. elegans* Wwd., which is of a brighter blue, larger, with coarsely-punctured blue tegulae like the mesothorax.

On flowers of *Leptospermum scoparium*.

EXPLANATION OF PLATE.

1. Lateral view of female Mutillid (*Ephutomorpha cockerelli*, sp. nov.).
2. Dorsal view: note the absence of simple eyes or ocelli and wings; observe the short, curled antennae.
3. Frontal view of the head-capsule, revealing the short clypeus.
4. Sculpture of the abdominal dorsal segments.
5. Sculpture of the mesothorax.
6. Tarsal segments of the anterior leg of the female.
7. Strigil of the anterior leg.
8. Plumose hair from the abdomen.
9. Plumose hair from the femur.
10. Lateral view of the genitalia of *E. elegans* Wwd.
11. Strigil of anterior leg of male.
12. Ventral view of genitalia of *E. subelegans*, sp. nov.
13. Anterior wing of male.
- 14-15. Dorsal and ventral views of apical segments.
16. The hamuli or wing-hooklets are fine and close together.

THE ECHUCA PUBLIC PARK.

Naturalists have never realized the beauty and extent of this wonderful natural river park in the town of Echuca. I would suggest that the Club take a personal interest in this park, as, so far as I know, it is the largest natural area of really undisturbed land, reserved for park purposes, adjacent to any large Victorian town.

The gates are at the end of one of the main streets, and inside there is a small area of shrubs and lawns, with a unique Red Gum arch trophy, indicating the value of the Red Gum industry to the district. Just beyond the arch there is a fine obelisk to the memory of Henry Hopwood, the founder of Echuca. Continuing along the drive, we pass the sports ground and tennis courts, and then we are in the primeval Murray River forest. The drive continues through the "bush" until the Campaspe River is reached, then we come to the junction of the Campaspe and the Murray—a most beautiful scene of river and red gums. We drive along the banks of the Murray, and finally reach the entrance gates, after a distance of three and a half miles!

The land is the typical undulating country that is found along the Murray, and the vegetation of Red Gums, Cypress Pines, various Acacias, including Myall, and other indigenous trees, is very beautiful, being truly primeval. There are very few foreign plants to be seen. But, unfortunately, the park, consisting of many hundreds of acres, is not rich in flowering shrubs or small herbaceous plants. There are avenues of Cypress Pines unequalled in the State; these could be made beautiful with an undergrowth of native shrubs; and I am sure that the Echuca people, Mr. de Hugar, of the Technical School especially, would gladly receive and sow seeds of Australian shrubs if forwarded to them. The Echuca people are very fortunate in having this lovely park. It could easily become a wonderful tourist attraction, equalling the King's Park at Perth.

E.E.P.

THE BANDED GREENHOOD

(Pterostylis vittata Ldl.)

By W. H. NICHOLLS

This interesting orchid is not regarded as a common plant, at least in Victoria, though in certain districts (chiefly coastal) it often is fairly abundant.

The colour of the blooms varies considerably—more than in any other member of this genus with which I am acquainted. Greens, reds, pinks, browns and greys are often mingled in the markings. Occasionally two or three of these colours only are represented; then, again, specimens with flowers of one shade only may be found. The flowers vary in number, from one to nine usually; fourteen is the record. The stem-leaves also vary—almost as much as one could imagine in a greenhood of this type.

In Victoria the typical form blooms during May and until as late as November. Favouring sheltered positions at the base of trees and shrubs, the plants vary from a few inches to about fifteen inches in height. The labellum, which rests upon a concave platform, formed by the petidant, conjoined lateral sepals, is remarkably sensitive. Radical leaves vary from ovate-oblong to oblong-lanceolate, the rosettes appearing during the flowering season and later; sometimes they are observed as a lateral growth at the base of the flowering plant. One specimen sent from Aircy's Inlet (Vic.) had several stem-leaves fasciated, the result being bifid tips. I have noticed in the upper angle of the column wings of *Pt. vittata* the presence of numerous clavate hairs; this detail is not mentioned in any published description of the species.

Pt. vittata has a close ally in *Pt. longifolia* R.Br.; but here the flowers are much smaller and always greenish. *Pt. vittata* is (generally speaking) a rufous-hued form. The common type is widely distributed throughout southern Australia. Lindley's specimens were collected in Western Australia, the description appearing in *The Botanical Register*, Vol. 25, Swan River appendix 53 (1839). (*No illustration.*) The first published plate of this species appears to be that in Dr. R. S. Rogers' *South Australian Orchids* (1911).

The keen interest now displayed in the study of Australian orchids has revealed two interesting variations in this species. One differs materially from the type; the other has very small flowers, beautifully green. Both fully deserve a varietal name.

(1) *Pt. vittata* Ldl. var. *subdifformis* n. var.—*Planta robusta circa 18 cm. alta; racemi flores magni; rubri ut badi; erecti vel sub-erecti; labelli-appendix incurva.*

Plant rarely exceeding 18 cm. in height; leaves varying in shape from obovate to lanceolate, about 2-5 cm. long; flowers 1-6 (the majority of my specimens have two flowers) in a terminal raceme:

in a more or less upright position, deep red-brown; larger and more strikingly banded than those of the typical forms; galea 1.5-2 cm. from base to apex; conjoined sepals 2-2.5 cm. long, consistently broad and concave; occasionally the sepals are cleft to the middle or a little beyond; labellum-appendage somewhat reflexed, or erect with the point directed *inwards*, as opposed to the forward-inclined point, usual in this species. Growing in gravelly soil among rocks.

Western Australia.—Boyup Brook: Miss E. Corker, July-August.

(2) *Pt. vittata* Ldl., var. *viridiflora*, n. var.—*Planta sub-robusta, circa 15-27 cm. alta; racemi flores multi minores quam typus; virides inflexi; labelli-appendix longa, proreus.*

A semi-robust plant, about 15-27 cm. in height, leaves obovate to lanceolate, sometimes as many as twelve below the inflorescence; flowers somewhat smaller than those of the typical forms, 2-9 in a declined position, greenish or with prominent dark-green striae on a translucent white ground; galea about 1 cm. from base to apex; conjoined sepals barely exceeding the length of galea; labellum appendage long, directed forward. Growing in coarse, gravelly soil.

Western Australia.—Boyup Brook: Miss E. Corker, July-August.

The first specimens of these two varieties were forwarded to me by Lieut.-Colonel B. T. Goadby, of Cottesloe Beach, Western Australia.

LYREBIRD RECORD.

This record is now becoming known internationally, Mr. Herschell has received numerous letters from people in England, France, Germany, Austria, and Italy, to whom records had been sent. In every case amazement is expressed at the wonderful song of the Lyrebird. Furthermore, the British Broadcasting Corporation has asked for permission to broadcast the record, and Mr. Herschell has referred them to his London agent, with instructions not to put any obstacles in their way.

In a letter to the Secretary of the Royal Australasian Ornithologists' Union, the Assistant Secretary of the Smithsonian Institution, United States National Museum, Washington, D.C. (Mr. A. Wetmore) writes:—"Last summer I saw the record of the Lyrebird song advertised in *The Emu*, and wrote immediately to secure a copy, which arrived recently, and which I have enjoyed very much indeed. I am looking forward to a meeting of the Baird Ornithological Club, a group of those interested in birds here in Washington, where I may use this record for their entertainment. It has been most interesting to me to have it, and I have enjoyed hearing the strange notes of this curious bird very much indeed."

LIST OF PERIODICALS RECEIVED, 1932

- Commonwealth of Australia—
Council for Scientific and Industrial Research—Journal, Pamphlets,
Bulletins, Year Book.
- New South Wales—
Proceedings of Linnæan Society of New South Wales.
Journal and Proceedings of Royal Society of New South Wales.
Australian Museum—Magazine, Records, Annual Report.
Technical Museum, Sydney—Bulletin.
Australian Zoologist.
Fisheries of New South Wales—Annual Report.
Agricultural Gazette of New South Wales.
Sydney University Reprints.
Australian Naturalist.
Australian Science Abstracts.
- Victoria—
Proceedings of Royal Society of Victoria.
Microscopical Society of Victoria—Journal.
R.A.O.U.—*The Emu.*
Royal Zoological and Acclimatization Society of Victoria—Annual
Report.
Forests Commission of Victoria—Annual Report.
Geelong Naturalist.
Melbourne Walker.
- South Australia—
Transactions of Royal Society of South Australia.
South Australian Naturalist.
South Australian Ornithologist.
Records of South Australian Museum.
- Queensland—
Proceedings of Royal Society of Queensland.
Department of Agriculture—Journal.
Queensland Museum—Memoirs.
Queensland Naturalist.
- Western Australia—
Journal of Royal Society of Western Australia.
Western Australian Naturalists' Club—Journal.
- Tasmania—
Royal Society of Tasmania—Papers and Proceedings.
Tasmanian Naturalist.
- New Zealand—
New Zealand Institute—Papers and Proceedings.
Auckland Institute and Museum—Records, Annual Report.
Canterbury Museum—Records.
- Great Britain—
Kew Bulletin.
Journal of Entomology and Zoology.
Journal of Queckett Microscopical Club.
United Empire.
Entomologists' Monthly Magazine.
Geological Magazine.
- Canada—
Nova Scotian Institute of Science—Proceedings.
Vancouver Museum—Art Notes.

United States of America—

- American Museum of Natural History—Bulletin.
 Smithsonian Institute—Annual Report.
 University of California—Publications in Botany and Zoology.
 Boston Society of Natural History—Proceedings.
 Buffalo Society of Natural History—Bulletin.
 Bingham Oceanographic Collection—Bulletin.
 Field Museum of Natural History.
 Missouri Botanic Gardens—Annals.
 Public Museum of City of Milwaukee—Bulletin, Year Book.
 New York Botanic Gardens—Bulletin.
Ohio Journal of Science.
 Ohio Biological Survey—Bulletin.
 Academy of Natural Science of Philadelphia—Proceedings, Year Book.
Journal of Cellular and Comparative Physiology.
Philippine Journal of Science.

Foreign—

- Revista do Zootech e Vet.*
Mems e Est. do Mus. Zoologico da Uni. de Coimbra.
Boll. del Lab. di Zoolog. Gen. e Agr.
Boll. del Lab. di Entomol. di Bologna.
Inhalts zu. mit aus dem Zool. Mus. in Berlin.

NATURE IN NORTHERN VICTORIA.

Owing to the bountiful rains experienced during the winter and spring months, Nature has given us of her best this season. Plant growth has been lavish, and bird life is abundant. Along the river road from Mildura to Merbein the trees of the "Eumong," *Acacia stenophylla* A. Cunn., have never shown a finer growth. The decorative drooping trees, with long, very thin phyllodes, are growing well, while at the present time the long chain-like seed pods are in great abundance. The trees must have been very beautiful when in flower. This was a favourite tree of the late Mr. H. B. Williamson. This tree deserves more notice from horticulturists than it has yet received.

Among the Mallee scrub, that glorious royal blue flowered shrub, *Halgania cyanea* Lind. (it surely deserves a more suitable name than "Rough Halganian") sent its beautiful flowers peeping everywhere. It was a splendid sight.

But the most interesting of all was the wonderful masses of "Drumsticks," *Craspedia globosa* Benth., that are seen in the clay-pan areas and along the roads, especially in the Echuca districts. They occur literally in tens of thousands. The long grey foliage, shining in the sun, the four to five feet tall grey stems, standing erect, each supporting proudly an inch wide globe of rich yellow flowers, all make a very fine feature in the floral landscape. The flower heads keep well for months. I throw out a suggestion to any of our members who have friends in the north to remember the "Drumsticks" for our next Spring Show. We could do with large numbers of them.

Of great interest, too, were the birds, especially the Straw-necked Ibis, *Threskiornis spinicollis* Jameson, well known as the farmer's friend. They are there to-day in tens of thousands, feeding on caterpillars, over many miles of country. In one place at Barnawm I saw them so abundant in the pastures that the place looked like a well-stocked poultry farm.

E.E.P.

The Victorian Naturalist

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No. 591

THE FIELD NATURALISTS' CLUB OF VICTORIA

The ordinary meeting of the Club was held in the Royal Society's Hall on Monday, February 13, 1933, at 8 p.m. Mr. V. H. Miller, Vice-President, presided over an attendance of about 100 members and friends. An apology for his absence was received from the President.

REPORTS

The following reported on excursions:—Mr. A. D. Hardy, Yan Yean; Mr. F. S. Colliver, Beaumaris; Mr. Chas. Daley, McVeigh's; Mr. G. N. Hyam, Oakleigh and the Botanical Gardens.

ELECTION OF MEMBERS

The following were elected:—As Ordinary Members: Mr. G. Jones and Mr. A. G. Green; and as Country Member: Dr. T. J. Ick-Hewins.

NATURE NOTES

Mr. F. Chapman gave a short talk, illustrated with lantern slides, on the progress made in Maranoa Gardens.

Mr. M. E. Bill mentioned an albino female Lyrebird which he had seen at Basalt Hill.

LECTURE

The lecture for the evening was delivered by Mr. C. E. Bryant, his subject being "Bush and Birds". A fine series of lantern slides (coloured) illustrated his remarks. Views taken in little-known parts of Victoria at the last three annual camps of the Royal Australasian Ornithologists' Union, were included.

EXHIBITS

Mr. J. W. Audas.—Cotton capsules, improved Bancroft var., cultivated by Mr. J. T. Audas, at Barberton, East Transvaal, South Africa.

Mr. F. S. Colliver.—Large specimens of *Ostrea manubriata* from Beaumaris; *Voluta heptagonalis*, cast, from Murray Cliffs, at Morgan, South Australia; *Nautilus* sp., Morgan (this specimen was sent to the exhibition as a fossil crayfish); and portion of the old Red Gum stump from the bed of the Yarra River, found during the building of the Spencer Street Bridge; depth, 63 feet in river bed.

Mrs. Freame.—Sting-ray, Squid, together with eggs and beak, Cuttle bones and an Octopus.

Miss A. F. Smith.—Mollusca from the Great Barrier Reef, including *Arestorides argus*, *Trochus niloticus*, *Haliotis asinina*, *Cassia cornuta*, *Ericusa konyoniana*, *Mitra* sp., *Comus* sp., *Turbo* sp., *Tellina* sp., *Scala scalaris*. Also coral specimens, orchids and *Pandana* seeds.

Mr. I. Hammet.—*Melaleuca hypericifolia*, *M. halerita*, *Beckia virgata*, *Goodenia ovata*, *Swinsonia alba*.

Mr. E. E. Prescott.—*Carpobrotus Pulliense*, black; a new and rare succulent from Gawler Ranges, South Australia; belonging to the *Mesembrianthemum* group of plants, and named after Dr. R. Pullenc, of Adelaide. The specimen is a growing plant. Also *Ceratopetalum gummiferum*, the New South Wales Christmas Bush.

Mr. H. Stewart.—*Eucalyptus callophylla rosea*, and *Grevillea linearis*: both garden grown.

Mr. A. R. Proudfoot.—*Casuarina quadrivalvis* (She-oak), seed cones and seeds from a tree in Hopkins Park, Hopkins River, Warrnambool.

MESEMBRIANTHEMUM OR MESEMBRYANTHEMUM?

On page three of Supplement four to the *Census of the Plants of Victoria*, not dated, the change from *Mesembrianthemum* to *Mesembryanthemum* has been made. I doubt whether the change will be adopted, firstly, because nurserymen all over the world have become so accustomed to the former spelling that to alter thousands of trade lists would be very difficult indeed; for this genus is largely grown as a garden plant the world over.

Secondly, as at least two of our Victorian species possess succulent fruits, these must now be included under the new genus of *Carpobrotus*. Likewise, the "Hottentot Fig," so commonly grown along our railway embankment, known as *Mesembrianthemum edule*, is now correctly known as *Carpobrotus edulis*.

Again, owing to its biennial, non-creeping habit, and its central arrangement of the seeds, the African "Ice plant," so common now in the Mallee, and known as *Mesembrianthemum crystallinum*, now becomes *Cryophytum crystallinum*.

Regarding the spelling of *Mesembrianthemum* and the suggested change, I quote from "*Mesembrianthemum and Some Allied Genera*," by H. M. L. Bolus (Capetown, 1928):—"As early as 1648 we find Robart giving the total of *Mesembrianthemum* species known as fifteen, and in 1689, when Herman wrote, this was increased to twenty-three. Herman, by the way, spelt the name with an "i" in accordance with the derivation from the Greek *mesembria* = middle of the day, *anthemum* = flower. Linnaeus, in 1753, changed the "i" into a "y"—an interchange permissible in a Latin name, but not in a Greek one—and the result is that those who logically adhere to following Linnaeus' standard continue to perpetuate the erroneous "y," while others prefer to adopt the more correct spelling."

Thus it would seem that the well-known spelling with an "i" should have priority, as it precedes the "y" by over one hundred years.

E. E. Prescott.

NOTES ON CERTAIN SPECIES OF *CALADENIA*

By H. M. R. RUPP, M.A.

These notes are prompted by the valuable "Review of Certain Species of *Caladenia*", by Mr. W. H. Nicholls, in this journal, February and March, 1931. Australian orchid students are greatly indebted to Mr. Nicholls for this fine piece of work.

I was particularly glad to notice the definite conclusions reached in regard to the distinction between *C. testacea* R. Br. and *C. angustata* Lindl., because for several years I had been urging recognition of the fact that the latter, known in Victoria as *C. testacea*, was irreconcilable with Brown's species.

Mr. Nicholls's descriptions and figure of *C. carnea* R. Br. var. *pygmaea* Rogers, are very interesting, and, if he has correctly interpreted this variety, I must own that I have failed to do so ever since its inception. Accompanying these notes is a sketch of a very diminutive *C. carnea*, of which I have specimens from Longley, Tasmania, and Hawkesbury River, New South Wales. I have always identified this form

with var. *pygmaea*, but it is emphatically not the form described and figured by Mr. Nicholls. This latter form is known to me, and I have excellent specimens from King Island (Archdeacon Atkinson) and one from the Grampians (Mrs. G. Perrin). It appeared to me sufficiently distinctive in character to rank as a species, and I expressed that opinion to Archdeacon Atkinson. The dwarf form figured with these notes, on the other hand, could not possibly be separated from *C. carnea*; it is a diminutive

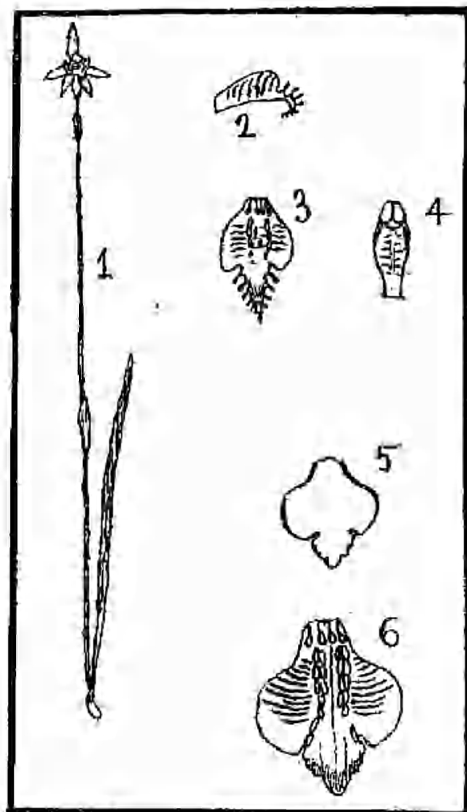


Fig. 1

of that and nothing else. If Mr. Nicholls is right, then we have two "pygmy" forms of *C. carnea*, both well established, but quite distinct.

In regard to *C. carnea* var. *gigantea* Rogers, Mr. Nicholls shows a labellum different from that most commonly found in New South Wales, where this beautiful orchid occurs in myriads in peaty soil along the coast. I have figured here the labellum usually seen in specimens of the plant in this State. It will be noted that it is relatively very much broader and shorter, and the apical part of the mid-lobe is not fringed, but merely slightly crenulate. In one Queensland specimen in my herbarium it is fringed; in sixteen others from New South Wales and Queensland it is not.

I have measured this orchid up to 36 cm., so it even exceeds the dimensions given by Mr. Nicholls. I may say that in New South Wales and probably in other States, the type form of *C. carnea* is sometimes found equal to var. *gigantea* in dimensions: the flowers of these large specimens are usually pale-pink and honey-scented, and the labellum conforms strictly to type.

It may be advisable here to notice another diminutive *Caladenia*, associated, in my opinion, with *C. alba* R. Br. It is abundant on the margins of swamps on the heathlands behind Seal Rocks lighthouse in New South Wales, and may well be found farther south. Dr. Rogers, to whom I sent dried specimens in 1923, connected it with *C. carnea*, but in the fresh state it seems to me entirely a diminutive *C. alba*. The labellum is white with an orange tip and two rows of calli: no bars on labellum or column: sepals and petals white. It may be that it is identical with Dr. Rogers's *C. carnea* var. *aurantiaca*, and until this point is cleared up, I prefer not to name it, but I have called attention to it with a view to its further investigation.

Mr. Nicholls does not record *C. tutelata* Rogers, from New South Wales. In 1923 I sent a specimen from the Alum Mountain, Bullahdelah, to Dr. Rogers, who determined it as this species. Only two were found: one is in the National Herbarium at Sydney, and one in my own collection.

Of *C. deformis* R. Br., Mr. Nicholls remarks: "Widely distributed in all States except Queensland." I can find no record of this species ever having been seen farther north in New South Wales than Molong, and not as far as Sydney on the coast. I have only found it once myself in this State—a single specimen at Molong.

C. latifolia R. Br.—Does any reader of these notes know of a definite record of this species from New South Wales or Queensland? It is included in Moore and Betche's *New South Wales Handbook* ("Cape Howe"), and in Bailey's *Queensland Flora* ("Southern localities"), but beyond these statements I can find

no evidence of its occurrence. I have myself repeatedly searched for it along the New South Wales coastline, north and south, without finding any trace of it.

These notes will, I hope, be considered as a small tribute by way of supplement to the excellent review by Mr. Nicholls which suggested them.

KEY TO ILLUSTRATION (FIG. 1)

1. *Caladenia curuca*, a dwarf form; supposed by the writer to be var. *pyramica*. Plant, natural size.
2. Labellum, side. (Enlarged).
3. Labellum, front. (Enlarged).
4. Column, front. (Enlarged).
5. Outline of common N.S.W. form of labellum of *C. curuca*, var. *pyramica*, natural size.
6. The same enlarged, to show details.

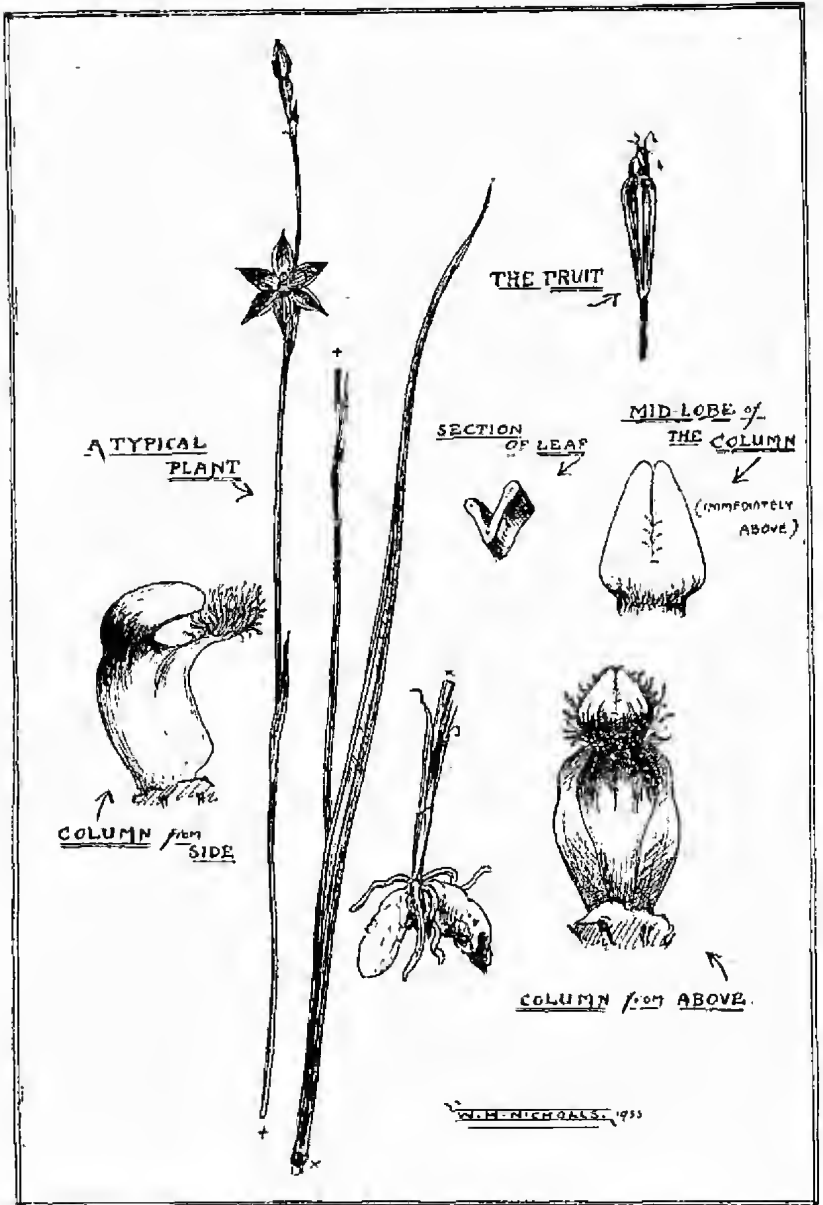
MELBOURNE'S PIONEER FLOWER PAINTER

[The following biographical sketch of Melbourne's pioneer flower painter was written for *The Naturalist* by her nephew, Mr. George H. Charsley, of "Woodthorpe", Harpenden, England. A copy of the rare book, *The Wild Flowers Around Melbourne*, was acquired recently by the National Herbarium.—Editor.]

Fanny Anne Charsley was a daughter of the late John Charsley, of Beaconsfield, in Buckinghamshire (he was coroner for South Bucks), and a sister of the late Edward Charsley, of Melbourne, solicitor. Born at Beaconsfield on July 23, 1828, she was one of five sisters, who were all successful amateur painters in water colours.

In 1856 Miss Fanny Charsley accompanied a married sister and her husband to Melbourne, and while residing there executed a set of water colour drawings of wild flowers. She returned to England in 1866, when her drawings were published in book form, under the title *The Wild Flowers Around Melbourne* (London, 1867). The book contains thirteen large quarto lithograph (or zincograph) plates of excellent drawings of the flowers, coloured with perfect accuracy. The botanical names and classification of the flowers were added by Baron Ferdinand von Müller; and, in recognition of the botanical value of the book, a new Australian flower was named after the artist, viz., *Helipterum Charsleyae* (see *Fragmenta Phytographiæ Australiæ*, No. LXVI).

In 1889 Miss Charsley and her surviving sisters removed to Hove, in Sussex, where she died on December 21, 1915. After her return to England, she painted a large number of beautiful pictures of English wild flowers, which are carefully preserved among the present members of the family.



Details of *Thelymitra Holmesii*, n.sp.

A NEW SUN-ORCHID

By W. II. NICHOLLS

Thecymitra Holmesii n. sp.

Planta terrestris, gracillimum 15-48 cm. alta; folium lineare, triangulare, canaliculatum; bractea caulinea 2, parvae, vaginantes, subulatae; flores 1 vel 9, parvis, circiter 1.5 cm. in diametro; ovaria gracilia, perianthii-segmenta oblongo-lanceolata; sepala subviridia; petala purpurea, venosa; columna circiter 4 mm. alta, basi purpurea, lobus medius magnus, cucullatus, flavus; lobi laterales penicillati longi, anthera apice obtusa; stigma quadrangulare.

A very slender plant 15-48 cm. high; leaf narrow-linear, triangular, deeply-channelled; stem wiry; stem-bracts 2, usually closely sheathing, subulate; flowers 1-9, about 1.5 cm. in diameter; outer segments of perianth, greenish-purple; inner segments violet, longitudinally veined; oblong-lanceolate; column erect, about 4 mm. high, violet, with a very large yellow cuneate oblong hood, apex obtuse, dilated posteriorly, deeply cleft, lobes not dilated; lateral penicillate lobes of column directed forward; hair-tufts long and loose, white or yellow; stigma not relatively large, somewhat quadrangular, a prominent rostellum in the upper, depressed margin; anther with an obtuse point, situated behind the stigma, its base adnate to the column, near the base; fruit comparatively large.

This plant approaches most nearly to *Th. pauciflora* R. Br., but is sufficiently distinctive not to be easily mistaken for that well-known, though variable species. The flowers, in the new species, are very neat and of a violet colour. The large hood of the column alone separates the new species from all other described forms of its genus.

I have named this plant after Murray Holmes, a youthful and energetic orchidologist, who has added much to our knowledge of the orchids of south-western Victoria.

Victoria: Gorae (via Portland), Murray Holmes.

BEAUMARIS EXCURSION

About 35 members and friends attended the excursion to Beaumaris. Conditions were favourable, as a very low tide gave a wide stretch of shingle to be searched over. Several sharks' teeth were found, all being of the commonest species, *Isurus australis* Ag. Other typical fossils of the Beaumaris beds found included the Common Heart Urchin, *Lovenia forbesi*; the Biscuit Urchin, *Monostychia australis* var. *Loveni*; and a number of fragments of whale bone; also numerous examples of mollusca, as *Ostrea*, *Mastra*, *Leda*, *pectin*, *Placmanomia*, *Valuta*, *Turritella*, *Tylospira*; and several examples of bony shells. Other interesting specimens found included sea urchins, starfish, and egg cases of the Port Jackson Shark, *Cestracion philippi*, containing the young alive.

F. S. COLLIVER.

NEW RECORDS OF PLANTS ATTACKED BY INSECTS

By C. FRENCH, JNR., Government Biologist

No. 2: "The Painted Apple Moth" or "Painted Acacia Moth,"
Orygia (Teia) anartoides.

This insect is becoming a very serious orchard and garden pest in Victoria and elsewhere, its natural food plants being Acacias (Wattles), principally *A. decurrens*, *A. dealbata*, *A. Baileyana*, *A. normalis* and *A. pycnantha*. It is very destructive to the fruit spurs, fruits and leaves of apple, cherry and other fruit trees. It has also been found on Eucalypts. It attacks many kinds of garden plants, viz. — Roses, geranium, pelargoniums, pansies, asters, carnations, the tree lucerne, and other plants.

In the glasshouse and fernery or bush-house, the Painted Apple Moth often is numerous and does much damage to maidenhair and other ferns; is particularly destructive to rex begonia and orchid leaves. In the vegetable garden it causes considerable damage to cauliflowers and cabbages.

Two years ago a fine plant of the beautiful creeper, *Kennedyia Comptoniana*, growing at Burnley Gardens, was almost denuded of foliage by the tufted larvae of this moth, while recently (also at Burnley) they have been fairly plentiful on the leaves of the Lombardy Poplar (*Populus pyramidalis*), and a dwarf variety of *Thuja occidentalis*. Fully 150 larvae were found on the latter plant.

A NATIONAL LOSS

By CHAS. DALEY

There are few ornithologists or nature students in general who have not heard of the famous Rothschild collection of birds, at Tring, in Hertfordshire, England, part of the extensive zoological collection made by the second Baron Rothschild, and visited by scientists from all over the world. The ornithological section was specially complete, educative, and interesting.

Australian ornithologists, in common with others throughout the British Empire, will be surprised and sorry to know that this unique and comprehensive collection, with its wonderful series of bird specimens, its rare and beautiful forms from every part of the world, was purchased as a memorial by the family of the late Mr. Harry Payne Whitney, an American scientist, and presented to the American Museum of Natural History, to which during last year it was safely transported. It seems that in October, 1931, Baron Rothschild wrote to a trustee of the American Museum, saying that he had reluctantly decided to offer for sale

the greater part of his bird collection. Negotiations at once ensued and the purchase was made, all birds, except some specially exempted, being included. The great undertaking of transplanting the largest collection of birds ever conveyed from one place to another, consisting of 280,000 specimens in 1815 cases, listed on 740 foolscap pages, was successfully carried out without a hitch.

Britain's loss is undoubtedly America's gain, and New York, instead of Tring, will in future be the magnet of attraction for workers in ornithological research. Perhaps the loss sustained by the non-retention of this magnificent collection in England may be more closely brought home to Australians by the knowledge that one among the many collections making up the great total acquired by the American Museum is the Mathews collection of Australian Birds of 45,000 specimens which formed the basis of the twelve-volume monograph on Australian birds published by Mathews. Another section is the valuable Sir Walter Buller Collection of New Zealand Birds.

It is to be hoped that the acquisition of so wonderful a gift by the American Museum, the transfer of which will be a serious deprivation and inconvenience to European workers, will stimulate that great institution to give every facility possible in the way of access, observation, and study, to workers in ornithology the world over, who may be able to avail themselves of it.

THE UPPER YARRA

By CHAS. DALEY, B.A.

I have no recollection of a previous excursion being held in this attractive area. On January 28th eighteen members proceeded there, five to camp, thirteen to stay at the hotel, known for so long as McVeigh's, and picturesquely situated on a flat between the Yarra River and Walsh's Creek, not far from where the Upper Yarra track diverges from the ascending forest road to Woods Point.

From Warburton it is a delightful drive above the course of the Yarra, visible through the luxuriant vegetation along its winding way. Very beautiful sylvan vistas open out, and ever present, and intensified by recent rain, was the commingled fragrance distilled from Peppermint gum, Sweet Briar, and Sweet Bursaria, the latter along the river's banks in full bloom with profuse creamy flowers.

The winding, verdure-clad road is cut around the hills of Silurian formation characterizing this part of the Yarra basin, and mainly consisting of grey, yellow, and blue sandstones, mudstones and calcareous breccias. Some fine sections of these are disclosed in the cliffs. At Reefton, an old mining place, operations have apparently been renewed.

Approaching the bridge at McVeigh's, introduced trees, such as poplars, elms, sycamores, rowans, etc., with fruit trees grow luxuriantly, and give the old building an attractive setting, enhanced by the invitation given by the onward road, and the welcome of the sparkling river.

After lunch we had choice of many delightful rambles, and could enter into the spirit of the poet who sang:—

I know not where the white road runs, nor what the blue hills are;
But a man can have the sun for a friend, and for his guide a star;
And there's no end of voyaging when ever the voice is heard,
For the river calls and the road calls, and oh! for the voice of a bird."

Responding to the call of the river, after lunch we took the leaf-strewn track leading to the Falls and over the Baw Baws to Erica and Walhalla. Past the viaduct we followed it for about five miles before reluctantly retracing our steps. The vegetation was green, fresh, and fragrant, but very few plants were in flower. The most striking feature was the unusual profuseness of the brightly-blue berries of *Dianella tasmanica*, Tasman Flax-lily. At a distance of some yards from the track, the brilliant berries standing out on slender, almost invisible, stems against the green background appeared a work of artistic jewellery. On one plant alone there must have been a hundred berries. Not so attractive but also numerous were the green apple-berries of *Billardiera scandens*.

On Sunday morning, in delightful weather, we took the high, well-graded Woods Point road, rising for about six miles to the Divide. Up this we wandered for five miles before returning for dinner. Occasionally small intrusive veins or an outcrop of quartz appear in the road cutting, but the formation is unpromising in regard to being auriferous in character.

The views of deep fern gullies and empurpled forest-clad hills from the road are enchanting, and the bush foliage in varying shades of amber and green was a relief and attraction to the eyes. On the stumps of trees cut down along the road, the young, delicate, soft twigs and leaves of renewed growth were a revelation in beautiful tints from apple-green to wine-red. After lunch the track up Walsh's Creek allured us, and the afternoon was pleasantly spent in following its sinuous course.

As with all the neighbouring streams along the moist se'vage was the Ruviate flora of the mosses, smaller ferns, lycopods, grasses, sedges, rushes, etc., above which grew graceful Tree Ferns, Alsophilas, Dicksonias, occasionally a King Fern, with their associated flora of Musk, Snow Daisy Bush, Christmas Bush, Hazel, Senecio, Pomaderris, Tree Everlasting, Bursaria, Sandfly Zieria, Urtica, Elderberry Panax, White Elderberry, Small-leaf Bramble, Supple-Jack, Clematis, and Coprosma or Prickly Currant-bush, with shining red fruits. Blackwood, Black, Silver and Early Black Wattles also freely fringed the streams.

In the next flural tier rising from the streams was a thick scrub of *Acacia linearis*, Golden Goodia, Prickly Pultenaea, Cassinia, Hill Banksia, Silky Hakea, Holly Lomatia, Alpine Grevillea, etc. Over all were the sheltering gums, Common Peppermint, Messmate, Manna Gum, Swamp Gum, with the stately white columns of the White Mountain Ash (*E. regidum*) here and there conspicuous. Mountain Grey Box and Silvertop favoured the higher hill slopes.

On Walsh's Creek we saw Gang Gang Cockatoos, also several Rufous Fantails, among the most graceful and beautiful of our birds. One, evidently nesting, exerted all its seductive wiles to lure us from the danger zone. The Yellow-breasted and Red-capped Robins were seen. A Lyrebird called from a fern-valley. Kookaburras and Magpies were vociferous on Sunday morning. The tinkle of Bell-miners sounded on the air. Perhaps the most numerous birds were the Bell-Magpies or Streperas. Insect life was not very noticeable; and only traces of marsupials—wallabies and wombats—were seen. Some visitors obtained a few trout in the streams.

On Monday we had purposed to essay an inviting bush track leading over the ranges to the Cumberland, but rain intervened, so in a partial stoppage we went along the old Warburton road instead, by the side of aqueduct and river. Here we found the Common Heath (*E. impressa*) growing very freely in all shades of its colouring.

Heavy rain precluded further walking, and in the afternoon the party returned to Warburton and Melbourne. Walsh's Creek would be very enjoyable in the springtime. The excursion was very enjoyable and a repetition early in October would be welcome. The camping facilities are excellent.

EXCURSION TO THE BOTANIC GARDENS

There was an attendance of about 35 members and friends at the excursion to the Botanic Gardens on February 11. Mr. F. Pitcher, who was to have been the leader, was unavoidably absent, but kindly sent copies of a list of Victorian plants to be seen in the gardens. Mr. G. N. Hyam acted as leader, being assisted by Mr. J. W. Audas later in the afternoon. The object of the excursion was the inspection of the Australian section. At this period there are not many plants in bloom, but good examples were seen of the great variation in shade of the bloom of *Eucalyptus ficifolia* and *E. calophylla*. Various species which particularly lend themselves to garden cultivation were noted, and a comparison of the various Eucalypts and Angophoras were made.

A general circuit of the gardens was undertaken, and we noted the fine specimens of *Callitris*, *Melaleuca* and Eucalypts in other parts of the grounds. Members generally would like to see a greater number of our smaller shrubs and plants acclimatized there, particularly in view of the approaching centenary, when many foreign visitors may be expected.

This excursion was especially interesting to those who had taken part in the visit to Oakleigh Golf Links on the previous Saturday. At Oakleigh the trees and plants are mostly grown without cultivation, and in the Botanic Gardens they are grown under garden conditions. Most varieties, particularly trees, seem to flourish under either condition—a testimony to the adaptability of our flora.

G. N. HYAM.

EXCURSION TO OAKLEIGH

Over 50 members and friends attended the excursion to the Metropolitan Golf Links, Oakleigh, on February 4. The primary object was to see the famous scarlet Flowering Gum Tree (*E. ficifolia*), which grows immediately in front of the Club House. This tree is now 43 years old, has a limb spread of 40 feet, and is about 30 feet in height. Every year it is completely covered with masses of bloom which almost entirely hide the green foliage. It is said to be the finest specimen of this variety of Eucalypt, and is probably one of the best known trees on account of frequently published photographs and paintings, and its use in connection with Commonwealth publicity overseas.

Unfortunately, we were a week too early to see the bloom at its maximum, and it is worthy of record that the peak blooming period is from February 11 to February 20. It is interesting to note that this period never varies, in spite of the vagaries of the weather from year to year. This regularity is confirmed by records kept by the Golf Club for more than a decade.

After paying our tribute to this fine tree, a Currajong tree was planted by Mr. V. H. Miller on behalf of the Club, as a token of appreciation of the activities of the Metropolitan Club in the direction of planting and preserving the native flora.

A tour round the links was undertaken under the guidance of Mr. Shaw, the manager, and a member of the Golf Club committee. The fairways have been planted with many species of *Eucalyptus* and *Acacia*, as well as other Australian trees and shrubs. Those doing particularly well were *Tristania conferta* (Queensland Box), in bloom. *E. Lehmannii*, many examples of *E.*

ficifolia and *E. calophylla* (in bloom), *Thryptomene*. Geraldton Wax Flower, Callistemons, and many plants indigenous to the district. Acacias were numerous and healthy and include *A. normalis* (in bloom), *A. cultriformis*, *A. dealbata*, *A. podalyrifolia*, *A. pruinosa*, *A. Howittii*, *A. Jensenii*, *A. longifolia*, *A. baileyana*, *A. saligna*, and others. The presence of such a variety of watties suggests that a spring excursion should be undertaken to these links.

The approach to the 10th green is a remarkable example of the possibilities of the use of Australian trees for landscape work. The blending of the various tints of the foliage being particularly attractive. Birds are abundant and well protected by the Club, which has a list of 60 species that frequent the links. It was gratifying to note the absence of scales, galls, and other insect pests so frequently seen on cultivated native trees in the city and suburbs. This is, no doubt, due to the number of birds and their rigorous preservation. A delightful afternoon was brought to a close by the Metropolitan Club entertaining the whole party at afternoon tea.

G. N. HYAM.

DEVELOPMENT OF THE MARANOVA GARDENS

By FREDK. CHAPMAN, A.L.S.

In 1922 the Camberwell Council acquired from Mr. J. M. Watson a plot of land, 6½ acres, adjoining Beckett Park, where 70 native trees had been planted by its owner. At the time of purchase a stipulation was made that the gardens were not to be opened to the public until after Mr. Watson's death, which took place in 1926. Since that time the development of the Maranoa Gardens as a reserve for Australian and New Zealand trees and shrubs has been in the hands of the Beckett Park Committee.

A few years ago the committee asked me to get in touch with other specialists and to have the native plants tentatively labelled. After waiting for ways and means of carrying this out, the Beckett Park Committee provided a sum of about £10 for labels, and two standard sizes were decided upon after consultation with the Director of the Botanical Gardens, Mr. F. J. Rae. By an additional fund to be provided by the Camberwell Council, the whole of the trees and shrubs will soon be furnished with legible labels, of which there are already more than 50 attached. Another member of the Beckett Park Committee, Mr. E. A. Vidler, has been very helpful in co-operating with myself in preparing the lists of names for the label writer, and when difficult cases of naming have arisen, the staff of the Botanic Gardens and the Herbarium have rendered valuable assistance.

It is proposed, in the near future, to develop a grouping of small beds near the centre, and from these a series of paths will lead off into the forest land at either end of the block. Thus it is hoped by the gradual removal of the non-Australian plants, and the addition of others, to make this native floral collection second only to the Botanic Gardens of Melbourne, and an informative and educational centre for all who appreciate the marvellous flora of Australia.

The nature of the soil, a sandy loam, with a deep subsoil of the denser Silurian mudstone, makes this area an ideal one for the majority of Australian trees and shrubs. Many magnificent trees are putting on strong growth, and most delightful vistas are being formed by the judicious pruning of the trees where the limbs are interfering with one another or have become injured. A great deal of work has been done by the members of the Committee before mentioned to improve the collection.

From the adjoining Beckett Park, 380 feet above sea-level, there can be obtained a remarkably fine view of the surrounding country, and it is indeed one of the best view-points around Melbourne.

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THE FIELD NATURALISTS' CLUB OF VICTORIA

The ordinary meeting of the Club was held in the Royal Society's Hall on March 13, 1933, at 8 p.m. The President, Mr. J. A. Kershaw, presided over an attendance of about 100 members and friends.

DEATH OF AN OLD MEMBER

The President spoke of the loss to the Club in the death of Mr. W. Thorn, of Hawthorn, a member of 30 years' standing. He was also a member of the St. Kilda Foreshore Committee, the Town Planning Association, and the Committee of the Wilson's Promontory National Park, his chief interest being in forestry.

CONGRATULATIONS

The President reported that an old member, Mr. F. Pitcher, had just celebrated his Golden Wedding, and on behalf of the members wished Mr. and Mrs. Pitcher many more years of health and happiness.

CORRESPONDENCE

A letter was received from the Mitcham Naturalists' Club, enclosing a list of their lectures; and also a letter from the Entomologists' Club, inviting members to an Exhibition Conversazione, to be held at Latham House on April 6.

REPORTS OF EXCURSIONS

Black Rock, Miss J. W. Raff; Cave Hill, Mr. F. A. Singleton; Mooroolbark, Mr. B. Blackburn (by letter).

NATURE NOTES

Professor Agar asks for specimens of living sinistral Freshwater Mollusca, other than the genus *Physa*.

LECTURE

The lecture for the evening entitled "Silurian Graptolites and Plants," was given by Mr. R. A. Keble, F.G.S. He stated that Victoria had possibly the oldest undoubted land plants, and that there was no doubt as to their age, as graptolites were preserved on the same slab of shale. He believed that we should yet find land plants of still greater age in Victoria. Lantern slides and specimens illustrated this valuable paper.

DONATION

Mr. A. S. Blake presented to the Club two volumes of Baron von Mueller's work on Acacias. He was thanked by the President.

LIST OF EXHIBITS

Mr. Chas. Daley.—A series of graptolites, from Bendigo.

Mr. E. E. Pescott.—Three aboriginal chipped axes (flint) from the Western District; collected March, 1933.

Mrs. Freame.—Several marine worms.

Mr. H. P. McColl.—Galls and abnormal growths on Eucalyptus.

Mr. J. A. Kershaw.—Case of Australian moths, embracing the genera *Hypsa*, *Eupracticis*, *Epiconia*, *Ochrogaster*, and others.

Mr. H. Stewart.—*Acacia pruinosa*, *A. retinodes*, both garden-grown.

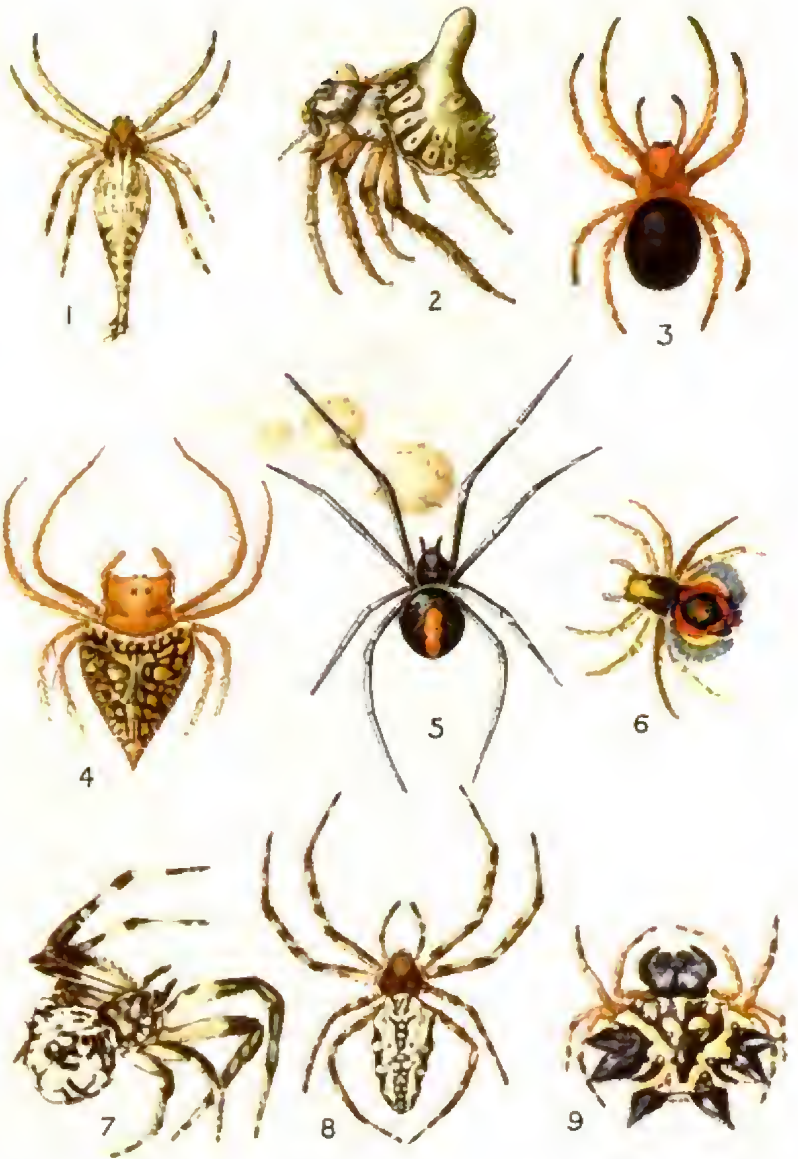
Mr. F. S. Colliver.—A series of Silurian fossils from Cave Hill, Lilydale, consisting of Mollusca, Crinoidea, Coelenterata, etc. Also a number of Dendrites (manganese ore, *Psilouclane*) commonly called fossil ferns, from the same locality.

Mr. F. A. Singleron, on behalf of Melbourne University Geological Department.—Silurian plants: *Hostinella* sp., from North Road Quarry, Waltham, and from Mooroolbark Road, Lilydale; associated with *Spirifer lilydaleusis*; *Zosterophyllum australianum* Lang and Cookson, from Mount Pleasant and Hall's Flat Road, Alexandra; an undescribed genus and species from railway cutting near Alexandra, with *Monograptus galacensis* Lapworth from the same cutting; the same genus of plants with *Monograptus* on the same slab, from Warburton-Woods Point Road, about 17 miles from latter.

EXCURSION TO MOOROOLBARK

Fifteen members and friends attended this excursion, on March 11. A pleasant, though not particularly successful, afternoon was spent. Herbage was dry, and a rather strong north wind was blowing, consequently there were comparatively few insects on the wing. Representatives of the following Orders were noted:—Odonata, damsel-flies; Orthoptera, cockroaches and short-horned grasshoppers; Hemiptera, plant bugs, corcid galls, scale and lerp insects; Coleoptera, longicorn beetles, some larvae of which were extracted from a dying Wattle, a pin-tailed beetle, *Mordella leucostica* Germ., and sundry weevils; Hymenoptera, two species of saw-fly larvae, a wasp belonging to the Fam. Eucharitidae parasitic in the nests of bull-dog ants, probably *Melagca rufiventris* Asm., a wasp belonging to the Encyrtidae, probably an egg-parasite, and several species of ants; Neuroptera, green and brown lacewings and their eggs; Diptera, a robber fly, galls caused by Dipterous flies, and March flies which were inclined to be a nuisance; Lepidoptera, various species, including a nice specimen of that very handsome moth, *Thalaina clara* Walk.

B. BLACKBOURN.



1 The Tailed Spider, *Arachnura higginsii*. - 1½. 2 The Turret Spider, *Dolophones turrigera*. - 4. 3 The Red-and-black Spider, *Nicodamus bicolor*. - 2½. 4 The Triangular Spider, *Arcys clavatus*. - 3½. 5 The Red-back Spider, *Latrodectus hasseltii*. - 1. 6 The Gliding Spider, *Saitis volans*. - 4. 7 The Death's-head Spider, *Celenia excavata*. - 1. 8 The Enamelled-back Spider, *Araneus bradleyi*. - 1½. 9 The Spiny Spider, *Gastercantha minax*. - 4.

THE COMMON AND CONSPICUOUS SPIDERS
OF MELBOURNE

By L. S. G. BUTLER

In submitting these notes, I wish to state that the details on the life history and habits are from memory, therefore any errors that occur must be pardoned. Great difficulty was found in giving these spiders popular names. If those chosen are generally adopted it will tend to popularize the much-neglected study of spiders. Other than a few odd notes buried in journals, this is the only popular work ever published on Australian spiders.

I freely acknowledge the assistance of Mr. C. Oke, of St. Kilda, Mr. V. V. Hickman, B.A., B.Sc., the Tasmanian arachnologist, and the Rev. E. Nye, of Wesley College.

THE MELBOURNE TRAP-DOOR SPIDER, *Anane butleri*

This spider belongs to the family *Aviculariidae* which contains the true trap-door builders, and the large bird-eating spiders (*avicula* = a little bird) of other countries. But this species does not make a door. Authentic proof of a true trap-door spider being found within the metropolis would prove interesting. At Mornington one of the wolf-spiders makes a burrow and covers it with a loose circular wafer of sand grains and silk; but this is not the beautiful door, which is hinged and fits so perfectly, and is very difficult to find even when it has been seen open at some other time.

A. butleri was originally found on the banks of the Merri Creek, at Clifton Hill, and later noticed in numbers burrowing in the garden paths at St. Kilda. It prefers a soft or sandy soil for its burrow, which is under half an inch in diameter, and nine inches deep. The opening at the surface is never closed with a door, but sometimes a fine web barricades the entrance. In the winter it is sealed with earth. Flood-time does not trouble this spider, the burrows having been observed under water for more than a week.

The Melbourne Trap-door Spider is about five-eighths of an inch in length, and is of a heavy build; two spinnerets project at the back like two little tails. Colour, black or dark pitch brown; eyes eight, close together in a group. A larger spider, of probably the same genus, has been noticed in the Sherbrooke Forest.

The Sydney Trap-door Spider, *Atrax robustus*, which has been held responsible for the deaths of several human beings, is not known to occur near Melbourne. Owing to these fatalities, the public is taking an interest in spiders, and numerous specimens are being received for identification.

About 150 species of *Aviculariidae* have been recorded from Australia. A positive method of identifying a member of this family is by the four book-lungs which show through the skin,

on the under side of the abdomen, as patches of a lighter shade; they are somewhat of a triangular shape with a slit at the rear. Also, the fangs, when lifted with a needle from their base, project downwards and do not meet pincer-fashion. If the fangs meet pincer-fashion, and there is only one pair of book-lungs, it is proof that the specimen is a true spider and not a trap-door species.

THE CRIBELLATE SPIDERS

The next group to be dealt with is that of the cribellate spiders (*cribellum* = a sieve). The sieve plate is found in front of the spinnerets. There is also a comb on the second last joint of the hind legs. The cribellate spiders can be recognized by the webs. The foundation lines are of smooth silk, and the snaring lines are teased and frayed by the little comb and laid in a zig-zag fashion.

THE SHEET-WEB SPIDER, *Amaurobius robustus*

It would be difficult indeed not to be able to find this spider on any house, fence, or outbuilding in Melbourne. The web is a coarsely woven sheet that tapers to a funnel-shaped retreat. This type of web must have inspired the author of "Will you walk into my parlour, said the spider to the fly." The retreat is the spider's parlour, and is built over any convenient hole, especially around the windows of weatherboard houses. The Sheet-web Spider is not a roamer but keeps inside its parlour, that is why we never see it in our dwellings. Any old barn or shed that has been long standing will reveal, on the roofs and walls, old and new webs of this species.

Amaurobius (= living in the dark) is seldom seen, but it sometimes can be coaxed out by placing a living fly on the web. Wasps often tease at the web of this spider, trying to capture it, to be stored as "paralysed provender" in their clay nests. It does not fear the wasp, but rushes out and tackles it by raising its front legs, and snapping its fangs at the enemy.

Do not confuse the web of this sheet-web builder with that of any of the *Agelenidae*. The web of *Amaurobius robustus* is coarse and of a zig-zag texture, while those of *Agelenidae* are even and fine, finer than any texture produced in our muslin or silk factories.

Amaurobius robustus is a handsome black, or rather, a very dark gun-metal coloured spider, about three-quarters of an inch in length. The body and legs are heavily built. The eight eyes are in two even rows, well spread across the front of the head. Use a strong hand-lens when searching for the sieve-plate and comb. The egg-bags are made inside the retreat and the young keep with the parent at first, migrating before they have attained any size.

THE HUMP-BACKED SPIDER, *Uloborus congregabilis*

This little cribellate spider is very common in the hills near Melbourne, and, as the second name implies, it is of a social nature

and forms large communities. The individual web is about three inches in diameter and of the cart-wheel form. It differs from the true cart-wheel web of the *Argiopidae* in having the circular or spiral lines of silk teased out, and not having these lines covered with minute sticky globules.

In the Fern Tree Gully district almost every house has these webs in masses in the odd corners, and especially among the wooden frames that support water tanks. The webs often occupy a space of six feet or seven feet. On close examination, the cart-wheel webs can be seen; and on still closer investigation these small inconspicuous spiders are detected huddled up on the webs. As many as thirty spiders have been collected from one of these communal webs. In the summer the small, irregular-shaped egg-bags can be seen attached to the web.

(*Uloborus* = wood-boring, deadly bite?). These small spiders do not inflict a deadly bite on human beings. All spiders have poison glands with a duct leading to an orifice near the tip of the fang, and all spiders are deadly to their prey, but very few will ever attempt to bite a human being, even when handled. This species measures one-quarter of an inch in length. Colour, dark brown of a dusty hue. It has a decided hump on its back; and, when at rest on the web, its long forelegs are stretched well out in front. If a spider be noticed in this posture, it is sure to belong to the family *Uloboridae*.

A smaller form has been collected at Eltham, also on the walls of the power house at the Buchan Caves, Gippsland.

THE SMALL HOUSE-SPIDER, *Oecobius narvus*

This species (*Oecobius* = a house-dweller, *narvus* = active), though common, generally escapes notice. It is very small, being only one-eighth of an inch in length. It should be present in every house of any age in Melbourne. Examine the corners of the plastered walls inside the house. It will not prove difficult to find webs about an inch long in these corners, especially if they be covered in dust. Probably the webs will be unoccupied, but they will help one to locate the newer and inconspicuous webs. This web is not for snaring, but is simply a "tent" or covering under which the spider can be seen resting. Oft times it roams away, absenting itself for a few days, but invariably returns to its little home.

True to name, this spider is very active for its size, and in its wanderings may be seen and recognized by its quick and agile movements. A powerful lens is needed to reveal the six eyes which are situated exactly in the centre of the head. Also notice the head, or, strictly, the cephalothorax, which is wider than long. Both of these features are rare in spiders. Colour, pale fawn, size about one-eighth of an inch in length. If carefully examined, it

will be noticed that this little spider is crab-shaped. The egg-bag is very small and attached to the web; it contains seven or eight eggs.

There are very few members of this family, as only five different forms have been recorded, and this species is the only one known in Australia. Possibly it has been introduced by the agency of commerce, as it is found all over the globe.



The Small House-Spider, *Oecobius navus*. + 8

All of the following species belong to the true spiders. They vary greatly in shape, size and colour, but are consistent in having only two pairs of book-lungs; fangs that meet like pincers; and in lacking the little comb and sieve plate.

THE PILL SPIDER, *Theridion tepidariorum*

(*Theridion* = a little animal.) This common spider can be collected under branches, shelves, or in the interior angles of out-buildings. It does not seem to favour the interior of houses. It spins a web of irregular, but open, formation. The webs are as irregular as they can be, spun in any and every direction without any attempt at design or order, and occupying about a foot of space.

This spider can easily be recognized by its shape, which is globular. On being disturbed, it folds its legs tightly to its body and drops to the ground, breaking its fall by spinning out a silken

line, which later assists it to regain its original position on its web. When on the ground it stops there for a considerable time, shamming death. It is in this position that it looks nearly spherical, which accounts for boys calling it the "pill" spider.

Size, under a quarter of an inch; colour, dark, greenish-grey. There are numerous details, which need a microscope to show them. One interesting feature, a certain type of toothed hairs on its hind legs, proves the connection of this species with the Red-back Spider.

THE RED-BACK SPIDER, *Latrodectus hasseltii*

Latrodectus (= secretly biting) is the well-known Red-back Spider. Much has been written concerning this dreaded species. It is still a moot point whether it is the most poisonous spider in Australia. As stated previously, all spiders are poisonous. It is not wise to handle the large trap-door kinds, but the writer has handled Red-backs. While they were walking over his hands they made no attempt to bite. The conspicuous red stripe down the centre of its back seems to account for this spider's unpopularity.

The bite of a large or a Red-back Spider should be treated as a snake bite, and a doctor summoned to prescribe an opiate to deaden the pain. A spider's bite can be intensely painful. There is little danger of death, but the genus *Latrodectus* has a bad reputation throughout the world, and this cannot be without foundation.

A scorpion's poison is much more virulent than that of a Red-back Spider, and many soldiers in Egypt were stung by scorpions without fatal results.

The Red-back can be found in old tins and boxes, under logs or bark lying on the ground, especially at rubbish tips which are undisturbed. Shape, globular; colour, dark brown with a red stripe placed longitudinally down the centre of the back, length, about one-half inch. This species belongs to the same family as the Pill Spider, and its web is of a similar nature to that of the latter species. It will seldom be found unless searched for, as it is not a roamer, but keeps to its irregular web under shelter.

This spider should not be confounded with the Red-and-black Spider, *Nicodamus bicolor*, but this is one of the most common mistakes made by naturalists even.

THE WATER LOVER, *Tetragnatha valida*.

(*Tetragnatha* — four jaws; *valida* — lusty, active). This water lover is common along the banks of creeks and other similar places. It will not be found in houses or gardens. To be sure of finding this and similar species, a visit should be paid to our hills and the cart-wheel web looked for on the banks of creeks.

The web will be found between low growing bushes that partially overhang the water. The occupier is usually seen in the centre of the web, with its two front legs stretched well forward and the hind ones well to the rear.

The name "four jaws" is entirely wrong. "Long jaws" would be better, but they are not jaws; it is the base of the fang or chelicera that is long. The chelicera projects well forward, the abdomen is long and cylindrical, and when this spider is stretched out on the web it is not unlike a small twig in the centre. Length, about one-half of an inch; colour, brown and yellow fawn.

This genus is well represented in Victoria, and many of the species can be found; some of them are much larger than *T. valida*.

The habit of building their webs over water, swamps or damp places is world wide, and it would be interesting to know why the members of this family prefer these situations. No doubt there are always plenty of insects hovering about the creeks and swamps, but why do not other snarers build their webs in similar places?

THE SATIN-BANDED SPIDER, *Argiope acmula*

Acmula (= excelling) is a handsome spider, which can always be found in the autumn among the low-growing myrtle bushes in the Cheltenham district, especially at that favourite collecting spot opposite the Cheltenham Benevolent Asylum.

This is one of the most beautiful of our Australian spiders. It builds a cart-wheel web some ten inches in diameter, about a foot from the ground. In the centre, where the spider lurks, a distinct flat ribbon of silk is made in the form of a zig-zag. Possibly this is to strengthen the centre of the web, beside supplying a central platform for the owner.

To capture this beautiful specimen, one needs to be quick, as it will drop to the ground at the approach of danger. It will stay there, huddled up and shamming death. Unless the eye follows its descent, it will be found difficult to locate the spider.

Although this spider has been recorded from all parts of the continent, the writer has found it only in the locality mentioned. Even among the hundreds of spiders sent for his collection, only one example of *A. acmula* has been received from another district. April is the month during which the webs of this spider may be noticed at Cheltenham.

Length, about five-eighths of an inch; colour, brown, with silvery white, red and fawn bands of satin across the abdomen.

THE ENAMELLED-BACK SPIDER, *Aryaneus bradleyi*

This spider builds a cart-wheel web, and is found in many districts near Melbourne. It is very common in the hills, and has been collected in numbers at Sassafras. It builds its web between the bushes and in odd corners, such as those of fences

and posts, also the open doorways or windows of outhouses or stables. It is seldom seen in our suburban gardens.

Many of these cart-wheel web builders hide away in the daytime, and locate themselves in their webs only at nighttime. In some cases a line is spun from the centre of the web and held taut by the hind legs from the spinner's hiding-place. This telegraph wire signals any vibrations that may be caused by the entanglement of prey in the web. In this way a constant watch is kept. The Enamelled-back Spider retains its position in the centre of the web both night and day. If disturbed, it quickly departs from its central position, and hastily climbs to the outer zones of the circle, leaving the web by the supporting guy ropes. Its web is about eight inches in diameter, and is neatly made. It is never left in a half-made or untidy state.

A. bradleyi is five-eighths of an inch in length, the male very much less. The abdomen is broad and long, tapering to the rear. The species can easily be distinguished by the back of its abdomen having a beautiful pattern of a mosaic type in dark brown and a creamy yellow. Sometimes there is a suggestion of white or red in the pattern. The main feature to look for is the surface of this pattern. It has a high polish, equalling the polish of our enamels; hence the name, Enamelled-back Spider.

Eyes, eight in two rows of four. The claws of the cart-wheel spiders are worthy of notice. A microscopic mount of this object is well known. Two large claws have beautifully-even combs, a third and smaller claw is also visible. These combs help the spider to grip its web. The legs have a natural oily covering, so that they will not become entangled. If a leg is detached and the oil dissolved away, it will readily stick to the snare.

THE LEAF-CURLING SPIDER, *Araneus wagneri*

Although this spider is common in our gardens and the bush, its handiwork is far more familiar than the spider itself. By a description of its web, it can be identified, as no other spider in Victoria builds a similar retreat.

A. wagneri belongs to the master spinners of the family *Argiopidae*. All of the spiders in this family that spin form an orb or a cart-wheel web. The genus *Araneus* is well represented in Australia, having just over one hundred representatives. Most of these spiders hide in the daytime. Some mimic the surroundings of their hiding places so perfectly that even the trained eye has difficulty in locating them; others retreat into nooks and crannies. The Leaf-curling Spider builds into its web a dried, curled leaf, and with its silk lines this retreat. In our suburban gardens dried gum leaves are not always procurable. This spider, determined to find a retreat, has been known to place empty snail shells or the cap of an acorn in the centre of the web. In each case they have been placed with their openings underneath, which affords pro-

tection from the rain. The leaf is situated at or near the centre of the web, and if it be taken out and pulled apart the spider is sure to be revealed. It measures under one-half an inch in length; colour, fawn, with greenish-fawn markings.

It would be interesting to know how the leaf is placed in the web. Possibly it is attached by a silken rope and hauled from the ground. If collected dry, this leaf would have to be chosen for shape. These details and thousands of others need to be studied and recorded. We are ignorant concerning them. T. H. Savory prefaces his *Biology of Spiders* with these lines by F. Nausen:

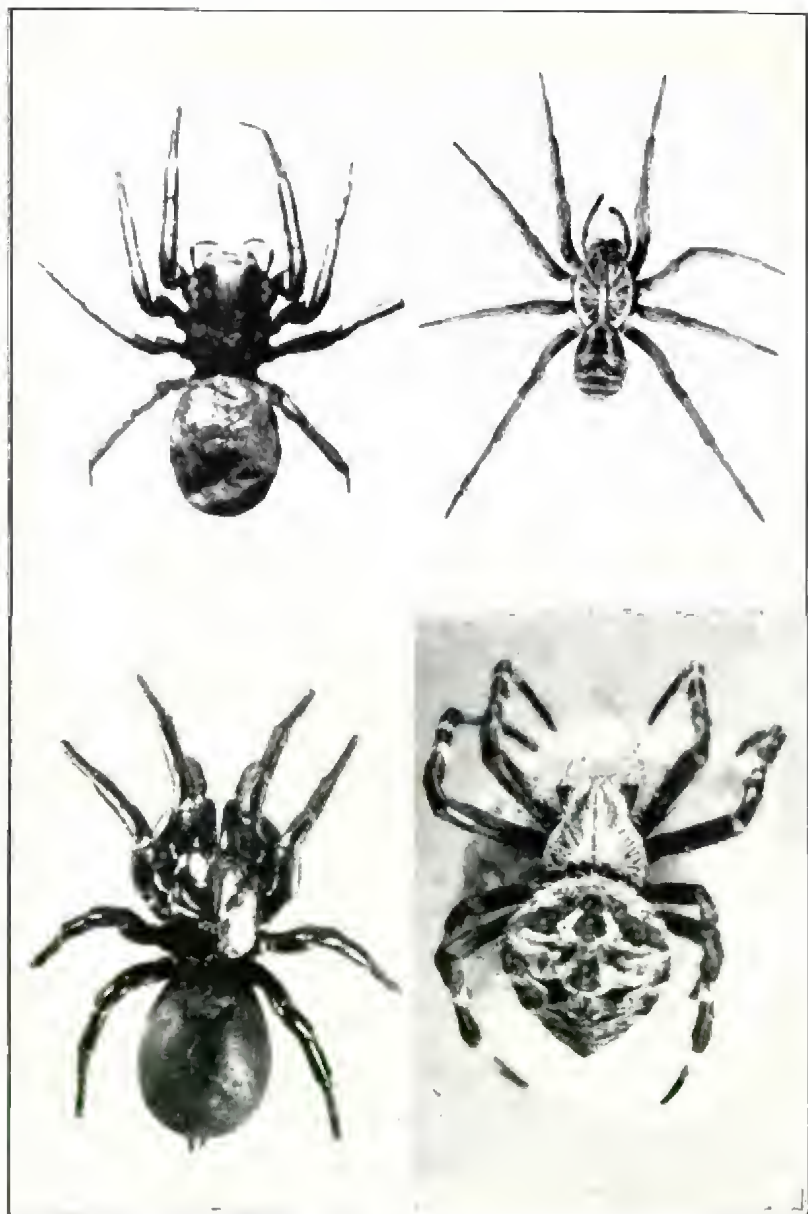
"Man wants to know, and when he ceases to do so he is no longer man."

THE CART-WHEEL WEB SPIDER, *Araneus productus*

Orb or geometrical web is the correct term for these webs, but as the term cart-wheel aptly fits the case, and is so commonly used, it has been adopted in this popular paper. It is difficult to choose a common member of this genus. *A. productus* may be the most common form that is found near Melbourne. The body measures about five-eighths of an inch in length, and is globular in shape. With its legs well spread, the spider would cover a circle one and a half inches in diameter. The under side of the abdomen has a long, spear-shaped appendage, which is attached near the front, and lies quite flat and free for about half of the length of the abdomen. Colour varies from light to dark brown.

This spider is common in gardens. Dusk is the time to see it building its web. Many of these cart-wheel webs are rebuilt each evening, so that an opportunity for observations often occurs. A few of the guy ropes are generally left over from the night before, but these can be relaid by the spider spinning out into the breeze a length of silken rope, which will catch against an opposite support. This is pulled taut and fastened, and the spider runs up and down this line, leaving a trail of silk to strengthen it. The next operation is to lay the spokes of the wheel or the radial lines. This is quickly done, and the lines are brought to a common centre. The final work is forming the circular or, rather, spiral line. This is the snaring line, and starting from the outside it gradually works to the centre. It is attached to each radial spoke, and is covered with a sticky substance. When fixed in position, each section is twanged by the spider's hind leg. This causes the viscid substance to break up into minute globules, which, under the microscope, prove to be as even as a necklace of beads. This peculiar phenomenon has been repeated by scientists in the laboratory using very fine fibres of quartz covered with oil.

The method of making the cart-wheel web varies considerably with the species, but little has been recorded of our Australian forms.



1 The Sheet-web Spider
Amaurobius robustus. - 1

3 A Trap-door Spider
Atrax venator. - $\frac{1}{2}$

2 The Wolf Spider
Lycosa ramosa. - $\frac{1}{2}$

4 One of the Garden Spiders (*Araneus* sp.?)
making its egg-bag. - $\frac{1}{2}$

The *Aranei* make egg-bags of various shapes, one examined by the writer contained about 2,000 eggs.

THE TAILED SPIDER, *Arachnura higginsi*

The difficulty of finding a common name for this spider was easily overcome, as the writer has been so often asked, "What is the name of the spider with a tail?". It has no tail in the strict sense of the word, but the abdomen is long and tapers to a point, giving somewhat the appearance of a tail.

This is another of the cart-wheel spinners belonging to the family *Argiopidae*. Other than the tapering abdomen, the most interesting feature about this spider is its egg-bags. A common mistake is to call the egg-bag a cocoon. Although they are both of silk, a moment's reflection will prove which are the egg-bags. Most spiders make an egg-bag that looks the part, but not so *A. higginsi*. This spider weaves a bag somewhat the shape and colour of its maker. Altogether, three are made and placed in a line at the top of the web. At a position at one end the spider stands on guard, and it is difficult at first to distinguish spider from egg-bag. Many spiders adopt this method, even to greater perfection. One noted in Launceston, Tasmania, attached small particles of debris to its egg-bag, which in colour and shape perfectly resembled the builder which was resting above it.

The Tailed Spider is of a fawn colour with lighter patches at the front of the abdomen. At this position the abdomen is divided into two protuberances, which nearly touch each other. The tail ends with slight enlargements. These are not the spinnerets; they are in an unusual position at the centre of the abdomen. This species has been collected occasionally in the suburbs of Melbourne, but it is generally sporadically distributed.

THE SPINY SPIDER, *Gastercantha minax*

(*Gaster* = the stomach, *cantha* = spine, *minax* = threatening, surly). This spider is found in many districts around Melbourne, but seldom in gardens. It is one of our most conspicuous spiders, and at certain periods, common; on the other hand, it often is difficult to find. It builds a cart-wheel web where in the centre the spider is always located. Nothing seems to disturb it as it is so easily captured. Many orb-weaving spiders build their webs always at the same angle. The vertical position is most favoured, but this placid species builds it at any angle.

The Spiny Spider can easily be identified by the black spines that project in a stellar shape from the lateral edges of the abdomen. The back is embossed with a black and white pattern, the whole having an enamelled finish. The legs are of a reddish brown. There is a less common variety which differs only in colour. It is all black, including the legs.

Many nature lovers consider this to be our outstanding spider, but to the specialist there are many spiders of an ordinary appearance that possess some extraordinary and remarkable anatomical features. The wonderful thing is, that every year, in the course of collecting, more and more of these uncommon spiders may be found, proving that Australia possesses untold wealth for an arachnologist.

THE TURRET SPIDER, *Dolophones turrigera*

Turrigera (= bearing a tower) is one of the rare and remarkable spiders that occur around Melbourne. Possibly it may be plentiful in other parts, but it is a rarity for Melbourne. It is found when beating bushes with a canvas net. A net is the most prolific method of collecting; without it, many of the rarities would remain undiscovered. An old umbrella is even better for shaking bushes into, and, if one rib be removed, it can be placed against the trunk of a tree at that part. This will capture all spiders that try to escape by dropping to the ground.

By these methods *D. turrigera* was captured. This spider has an abdomen of unusual shape; a cylindrical tower stands upright from the centre. On the back is an inconspicuous mosaic pattern. Colour, brown. Length, about five-eighths of an inch. The Turret Spider belongs to the orb-weaving family, *Argiopidae*, but it is doubtful whether it spins a web. Nothing is known of its habits.

THE TRIANGULAR SPIDER, *Arcys clavatus*

This pretty spider also is an uncommon species. Sometimes it is found on the leaves of young Eucalypts. Length, about one-half an inch; colour, body and legs, pale orange tan; a pretty black and white mosaic pattern on the back of the triangular-shaped abdomen. Here is another spider of whose life-history and habits we are entirely ignorant. Once this spider has been examined it will not be forgotten, the shape of the abdomen is distinctive.

THE DEATH'S-HEAD SPIDER, *Celaenia excavata*

Although there are other popular names for this spider, Death's-head has been accepted owing to its general use. *C. excavata* (*Celaenia* = black, *excavata* = hollowed out) is fairly rare, but as it looks so uncommon it is sent in numbers to the National Museum. It is of a most unusual shape and generally keeps huddled up with its legs folded close to its body. In this position, it reminds one of a miniature skull. It is generally found in our gardens on leaves or twigs, especially on fruit tree twigs when the leaves have fallen. The colour is brown, and a dirty cream, the outer skin is very rough and crinkled. Length, about five-eighths of an inch.

The spherical egg-bags are dark brown, the same colour as the spider, and nearly the same size. Usually, five are made, three-eighths of an inch in diameter. They are caught together by a few untidy silken ropes, and the female keeps guard over them. The young hatch out and soon disperse by ballooning. Many spiderlings migrate in this way. A silken strand is spun out into the breeze; when this sail has sufficient buoyancy away the spider goes. Ballooning prevents the young from murdering each other and becoming cannibals. On one occasion, in Mr. Charles Barrett's garden at Elsternwick, thirteen egg-bags were counted, all being the work of one female Death's-head. About three months was spent on this effort, the mother keeping guard always.

This species builds no snare, and seems never to bother about food; it just remains huddled at its post. Many observations of the Elsternwick specimen were made, even in the early hours of the morning, always with the same result. It is difficult to understand how it obtained nourishment to amass enough substance for its task of egg-bag making.

Dicrostichus magnificus is an Australian spider that spins out a short line ending with a sticky globule. Insects are attracted to this and snared. This little fishing line is then pulled up, when the prey is removed and eaten. In this strange manner the spider obtains its food. It may be that *Celaenia* also adopts this method of fishing for its food.

SMALL BLACK-AND-WHITE CRAB-SPIDER, *Cymbacha similis*

This spider (*Cymbacha* = head foremost, *similis* = similar) is about the most common representative of the family *Thomisidae* which contains nearly all the small crab-spiders. Many of these spiders hide among the flowers. When insects visit the flowers for nectar, they are pounced upon by these pretty little spiders. Some of the crab-spiders are brightly coloured, and seem to choose flowers that match their colouration. So complete is the camouflage that it is difficult to detect the spiders.

The little Black-and-white Crab-spider is never found in these situations, but is common at times under the loose bark of the gum trees. It spins neither web nor snare, but is a hunter. It is black, but a pattern of small white markings ornaments its body and legs. Measuring under a quarter of an inch in length, it needs some searching for, but a keen collector will find many of these little animals whose gait resembles that of a crab.

Thomisidae is a large family. About one hundred and twenty species have been recorded from Australia. They vary greatly. One genus, *Stephanopsis*, is common, and its members are recognized by their hairs, which are flat, thick, and broad at the end, giving the spider the appearance of being covered in small warts. Under a hand-lens the spider looks grotesque.

THE GIANT CRAB-SPIDER, *Delena cancerides*

(*Cancer* = a crab, *delena* = destructive?). To a collector the Gum-tree Spider, *Clubiona robusta*, is the most common species in Australia, but to the average country resident or bush Rambler the Giant Crab-spider is better known than any other kind. It is often found on the walls of dwellings in the evenings, searching for flies or other prey. If noticed by the householder there is the usual hunt with a handy weapon until the spider is dispatched. Any large spider usually receives the name of "tarantula" no mat-



The Giant Crab-spider, *Delena cancerides*, guarding its egg-bag. + 1

ter in what country it is found, but Australians have adopted a crude and ugly word, "triantelope", for *D. cancerides*. A word of protest is given here, and a request made that the common name, "Giant Crab-spider" be used. Even its peculiar sideways gait should suggest the suitability of this name for the big spider. It was originally named in 1837. Some of the early French boats must have taken away specimens, as it was described in France in that year.

For separating the sexes, the following detail will apply to any spider. When immature, difficulty will be found, but in the adult forms it is quite simple. Examine a fully grown spider, notice the four pairs of walking legs, and in the front there appears to be a fifth pair which are shorter. These are not legs, but palps or

feelers, known as pedipalps. If the pedipalp ends with a small claw the spider is a female. The male pedipalp does not taper off at the end, but it possesses a sexual organ at the extremity, which is bulbous or club-shaped. Even to the unaided eye, the sexes of very small spiders are easily distinguishable.

As is the case with most spiders, *Delena* kills and eats her husband, once she has no further use for him. The phrase, "They lived happily ever after", does not apply to spiders! At least five weeks after this period the eggs are laid. Females were collected at Fern Tree Gully, and after being isolated in glass-topped boxes for five weeks, the eggs, which proved to be fertile, were laid and enclosed in the egg-bags. The making of the egg-bags was not observed, but the method may be the same as that of a species of *Aranous*, which the writer has noted. The eggs are laid covered with a syrupy substance which keeps them in one mass, later it dries up on to the surface of the eggs, which are then separated. In the meanwhile the mass of eggs is covered with strands of silk, and eventually the egg-bag is formed. The bag of *Delena* is about three-quarters of an inch in diameter, one-quarter of an inch thick, and lenticular in shape. The silk cover is of a tough, papery texture. This spider does not make an inner, soft, downy blanket.

The females of many species die and leave the young to forage for themselves, but *Delena* guards the egg-bag, carrying it nestled against the under side of the body. Three weeks later the young are out of the eggs and the egg-bag is alive with movement. The young, which number about one hundred, make no attempt to cut through the walls of their silken house till one week later, when the first moult takes place. This moult occurs inside the bag and after it the spiderlings make their way out by piercing the wall. The young climb all over the mother and seem not to be anxious for food. These spiderlings do not migrate by ballooning, but keep to their original birthplace under the guard of the fond parent. The writer has repeatedly noticed families living together, the young being about half-grown—at a guess, about five months old; they number about twenty. To what age these Giant Crab-spiders live has not been recorded. Text-books state that some spiders live for five or six years.

As the spider grows it finds its inflexible outer skin too small for expansion. When casting the old skin, the growing *Delena* takes a firm grip on the bark with its claws. Expanding and contracting the body, it splits the outer skin down the back, and the body, covered in a new skin, emerges. After numerous tugs, the legs also are freed of their old skin. This process takes about one hour. The new, soft skin expands, then hardens. In this manner the spider grows. If before moulting the spider is minus a limb, a new one has been formed by regeneration and is visible after

moulting. It may be stunted in size, but if there are any subsequent moults the organ may regain its normal size.

Little is known of the habits of the Giant Crab-spiders. They move about at night and hide under the loose bark of gum trees all day. They readily adapt themselves to our dwellings. It is wonderful into what small places these giant spiders can crawl. It is the depressed shape of the body that enables them to occupy such narrow quarters. A large specimen in captivity which was missing was found at last in a pyramidal cavity seven-eighths of an inch at the base, three-quarters of an inch high, and by four inches in length. The opening was of the full length, but very narrow, about one-sixteenth of an inch, which could be sprung to the limit of one-quarter of an inch. The Giant Crab-spider builds a "fence" between the bark and the trunk of the tree. This silken structure is only built at the egg-laying period.

In Tasmania, *Delena* was found under loose stones. Such a habitat for the species was only once observed on the mainland—at Mornington (Vic.), where a female and her half-grown family of twenty were sheltering in small crevices between a few bricks.

These spiders are hunters, never spinning either a web or a snare. At night they wander about. For some unaccountable reason, they are repulsive to most people. They are harmless; there are no records of one biting a human being; although they have poison glands and formidable fangs. Once only has the writer known this giant spider to be pugnacious. It certainly had been teased before it stood up and fought the forceps.

Many other species may be mistaken for *Delena*, but there is only one known member of this genus. *Delena concerrides* has a very flat cephalothorax or front part of the body, it is rather smooth with little hair and the hard skin or chitin shows in a tan colour with a partial gloss; the jaws or chelicerae are nearly black. The other spiders which somewhat resemble *Delena* have a more convex and hairy cephalothorax, of a grey-brown colour.

THE HAIRY GIANT CRAB-SPIDER, *Isopeda robusta*

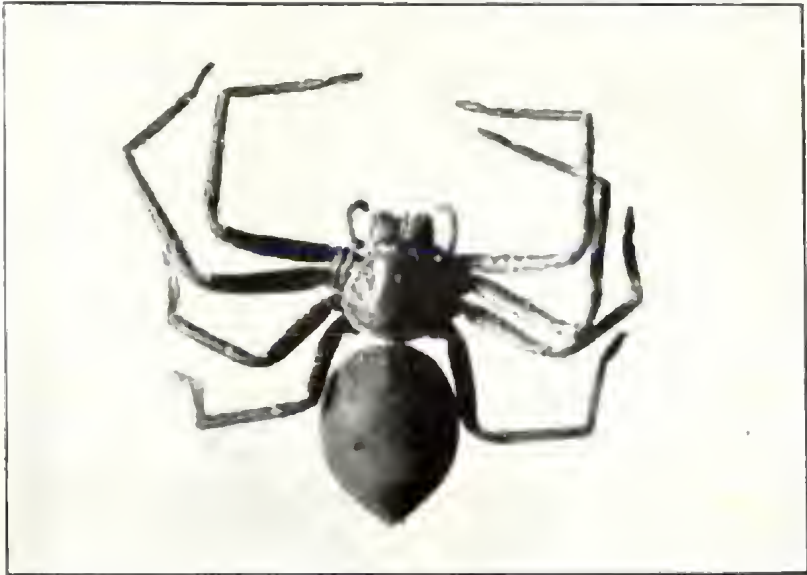
(*Isopeda* = flat, *robusta* = strong.) While there is only one *Delena* more than thirty species of *Isopeda* are known. But it is far easier to find *Delena*, as it outnumbers all the many species of *Isopeda*. Few persons will separate *Isopeda* from the commoner form. *Isopeda robusta* is possibly the most common of this group, whose members, in habits and life history, resemble *Delena*.

THE NURSERY BUILDER, *Olios diana*

(*Olios* = small, *diana* = goddess of hunting.) This spider has often been mistaken for a half-grown Giant Crab-spider, but it looks more naked, fresher, and is of a brighter fawn or flesh-like colour. It is sparsely clothed with hairs and can be recognized

by two large black markings with white spots on the under side of the abdomen. The eight eyes are small, black, and arranged in two straight rows of four. Close examination shows white markings among the spaces between the eyes.

Olios can be collected on shrubs by beating with a net. It is never found under the loose bark of trees. Its nest is one of the most interesting pieces of spinning work found in the spider world. It is an inverted hemi-spherical silken dome about one and five-eighths of an inch in diameter. This cupola is built and attached



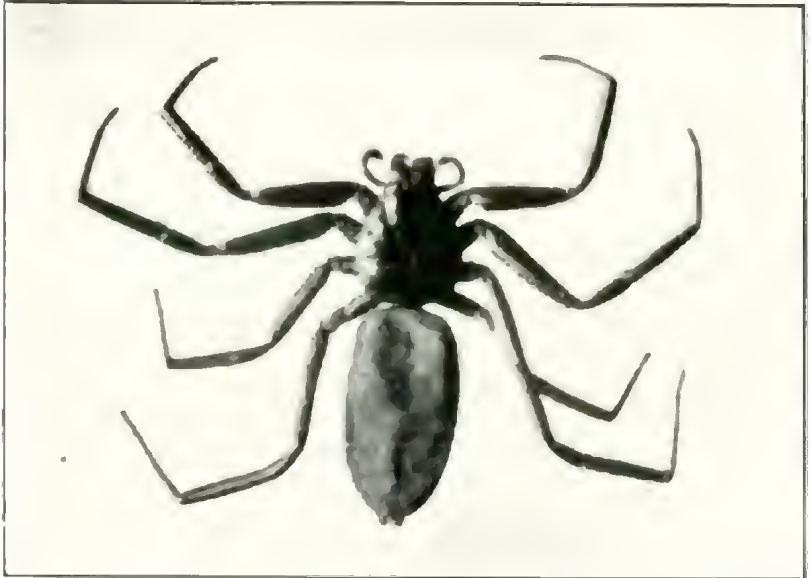
The Nursery Builder, *Olios diana*. + 2

to the ground. The outside is covered with a few gum leaves, debris, sand and earth. The leaves disguise the spherical shape of the nest as they are attached only for portion of their length. Inside the cupola it is beautifully lined with silk, and beneath it the mother spider guards her somewhat spherical egg-bag. When the spiderlings appear they find the protection of a silken lined nursery.

Wasps use paralysed spiders as provender for their larva, and one of the largest spiders that is used for this purpose is *Olios*. It has been seen being dragged along the sandy soil among Tea-tree at Carrum. The wasp appeared to have little difficulty in moving its bulky burden and at a remarkable speed for a creature so comparatively small.

THE SMALL FLAT CRAB-SPIDER, *Hemicloca plumea*

(*Hemicloca* = half τ , *plumea* = downy, covered with down.) This and similar forms are found under the bark of gum trees. Superficially they appear to belong to the same family as the Giant Crab-spiders and *Olios*. They are Drassids whose other members are not crab-spiders. Their extraordinary feature is their flatness. Many of them do not seem to be thicker than a visiting card. They might just have passed through the rollers of a mangle.



The Small Flat Crab-spider, *Hemicloca plumea*. + 4

Bearing in mind the extreme flatness of this spider, it should not prove difficult to identify it. Length, about three-eighths of an inch; colour, tan and tawny tan. This species never spins a web or a snare so it must hunt for its prey. Although fairly common, nothing is known of its habits or life history.

THE GUM-TREE SPIDER, *Clubiona robusta*

Clubiona is found only on Eucalypts; and may be collected on almost any tree that has plenty of hiding places under the loose bark. It is the most common spider in Victoria. Its silken covering or "tent" is built across the upper edges of a concave flake of loose bark. An opening is left at the end. On the floor of the retreat the female makes her egg-bag of simple form. The eggs are laid in one mass and a soft, downy blanket of silk covers them.



1 The Tailed Spider, *Arachnura higginsii*, making its egg-bags. + 1

2 The Hump-backed Spider, *Uloborus congregabilis*, and its egg-bag. - 2

3 The Death's-head Spider, *Celaenia excavata*, guarding its egg-bag. - 1

4 The web of the Leaf-curling Spider, *Araneus wagneri*. + 1

An outer sheet of silk protects all. Although called an egg-bag, it is not truly a bag, but a covering. The mother guards the eggs, and when disturbed does not leave her home freely. The young seem to prefer the same habitation, for when collecting, many immature forms are found under the bark.

Length, about five-eighths of an inch, medium build. Front part of the body smooth chitin of a rich brown or tan hue. Abdomen slightly tapering to the rear and of a lighter colour with central markings down the entire length, resembling somewhat the outline of a fern leaf. There are many varieties that closely resemble each other; twelve species have been recorded. Another genus, *Chiracanthium*, closely resembles *Clubiona*, but in the former, the jaws or chelicera are longer and project more forward.

THE RED-AND-BLACK SPIDER, *Nicodamus bicolor*

Time after time this spider has been confused with the Red-back poisonous spider. It is easily distinguished, as *Latrodectus hasselti* has a red stripe down the abdomen, or rear portion, whereas *N. bicolor* has a black abdomen, and the front portion of the body red. The legs are red and tipped with black.

This is a small spider about one-quarter of an inch in length. It is common under bark, stones, and logs; and seldom roams from these positions. It seems to lead a placid existence. When captured it does not appear to be in the least disturbed. Although the life of *Nicodamus* appears to be dull and uninteresting, it may eventually give an interesting life history. As each year passes many new and, at times, extraordinary facts concerning common spiders are being published.

Six members of this genus have been recorded; they closely resemble each other, but *N. bicolor* is the most common species found around Melbourne.

DADDY LONG-LEGS, *Pholcus litoralis*

(*Pholcus* = squint-eyed, *litoralis* = pertaining to the seashore.) There are many Daddy Long-legs, but this popular name belongs rightly to *Pholcus litoralis*. An outdoors life has no attraction for this spider, which is always found inside houses or outbuildings. Long, straggling webs near the ceilings betray its presence. Old webs, which collect the dust, are the bane of the housewife.

The snare is built irrespective of any design or order and on it the spider rests, waiting for its prey to be entangled. Hanging upside down does not seem to cause it any discomfort, as the Daddy Long-legs prefers that position in its web. When a fly or any other prey is snared the spider shakes its web further to ensnare it; when disturbed it becomes greatly alarmed and violently shakes the web by gyrating its body. Possibly this is

meant to frighten away intruders. This strange habit is confined to this spider. Some of the cart-wheel web builders shake their webs, but it is a slow motion movement compared to that of *Pholcus*.

Daddy Long-legs builds an egg-bag with the thinnest covering of silk and carries it about in its wanderings. Sometimes, when the spider is feeding, it is attached to the web. When finished it is readily taken back and attached to its body by a silken strand from the spinnerets. Daddy Long-legs is known to all by its long and extremely thin legs. Its small body measures one-quarter of an inch in length. The spread of the leg would fill a three and a half inch circle.

THE WHITE-TAILED SPIDER, *Lampona obscena*

(*Lampona* = bright tailed, *obscena* = boding ill.) Its common name does not describe this spider quite correctly, but has been adopted because the following question has been so often asked, "What is the name of the black spider with the white tail?" The abdomen bears no resemblance of a tail; it is cylindrical and not tapering, and the posterior end is a dirty-white colour.

Regarding the habits of this species, nothing is known. Although occasionally collected on gum trees, one need not go out of doors to find it. "A black spider on the wall" nearly always proves to be an example of *L. obscena*. The male is about one-third smaller than the female, whose body measures approximately five-eighths of an inch in length. Although the body is lightly built, the legs are strong and robust



The White-tailed Spider, *Lampona obscena*
(male). + 2

and are well spread, making the spider appear much larger than its actual size. It is not very common, but a resident in the suburban area is sure to see at least half a dozen specimens in the course of a year on the white, plastered walls of his house. It is fairly active, and not disposed to fight, for when captured it does not try to defend itself.

Owing to the bad reputation of spiders in general, the white-tailed species usually meets with an untimely death—is killed on sight by the householder.

The family *Drassidae* contains the genus *Lampona* and seventeen species of this genus have been described from Australia. This family contains many spiders of an ordinary appearance. The eight eyes are arranged in two straight rows of four, and there are only two claws on each leg.

THE LARGE BURROWING WOLF-SPIDER, *Lycosa ramosa*

(*Lycosa* = wolf, *ramosa* = branching). Owing to its burrowing habits this spider often is mistaken for a trap-door species. Often when the presence of a trap-door spider near Melbourne has been reported, investigation has resulted only in the finding of the Burrowing Wolf-spider.

L. ramosa is a large burrowing spider, found in great numbers on the flats at Torquay. The openings of its burrows can be noticed about twenty feet apart. The burrow measures three-quarters of an inch in diameter and ten inches in depth. The entrance is lined with silk.

In other countries many of the wolf-spiders build a conical turret of small stones, twigs and other debris, around the entrance to the burrow. This type of entrance has not been found in Australia, but it is possible that it will be. Fabre, in his *Life of the Spider*, says: "Take a stalk topped with its spikelet and rub and move it at the orifice to the burrow. Attracted by the bait, the spider comes with measured steps towards the spikelet." By this method the spider can be enticed to the top of the burrow. Many of the burrowing spiders will not respond to this artifice, but *L. ramosa* never fails. It always responds, being inquisitive. The quickest method of dislodging it from its burrow is to insert a long blade or a screwdriver down in the earth at such an angle that a sharp blow will drive it through the burrow and block the tenant's retreat.

Many of the females of *Lycosidae* can be seen at the entrance to the burrow with the hind legs holding the egg-bag above, and carefully turning it over and over so as evenly to distribute the warmth that radiates from the sun. When the young hatch out they clamber on to the mother's back, and if dislodged, quickly reascend, running up the legs and sides of their parent.

Numerous experiments have been made with the Wolf-spider's spherical egg-bag, which is always attached to the female's spinnerets. It does not seem to retard the spider's movements to any great extent, although evidently in the way. The mother is very stupid, and a clumsy imitation of the egg-bag will deceive her. If the real egg-bag be placed among substitutes, the female often will pass to an imitation, even when the genuine article is close at hand.

Although this spider looks formidable, it is not disposed to fight, but defends itself when attacked in its burrow. The writer had a specimen brought to him by a boy; it made no attempt to escape or bite the hand that held it. The Wolf-spider is a hunter, never spins a web or a snare, but comes out at night in search of its prey.

Lycosa ramosa is three-quarters of an inch in length; both the body and legs are heavily built. The colour is greyish-fawn. A decided pattern, in a darker shade, adorns it. Eyes, eight; two medians, large and on top of the head; posterior pair farther back. Front line of four, small, and close together, looking forward. These are the eyes that can be seen shining in the burrow, like cat's eyes in the dark. The spider has two claws, protected with a pad of hairs.

THE SMALL ROVING WOLF-SPIDER, *Lycosa godeffroyi*

Most of the detail given concerning *Lycosa ramosa* will apply to this spider, which is plentiful on lawns and among the flower-beds of the garden. The females are conspicuous, especially when they have their silken egg-bag. This spherical bag is attached to the spinnerets by a few silken ropes. These spiders do not burrow, but rove about, and at times hide under any available cover on the ground, such as stones, pieces of bark, etc.

Length, about three-eighths of an inch; colour and pattern, similar to those of *L. ramosa*, only slightly darker. Eyes similar; in fact, all of the *Lycosa* have their eyes arranged in the same grouping. Members of this family are often mistaken for trap-door spiders, but are easily separated from them. First, the fangs meet pincer-fashion; second, only one pair of book-lungs are present; and, finally, no trap-door spider has the front line of eyes, small, close together in a straight line, and looking forward.

GREY-AND-BLACK JUMPING SPIDER, *Ocrisiona melancholica*

(*Ocrisiona* = jagged, *melancholica* = melancholy.) This is a jumping spider; it belongs to the *Attidae* (= move suddenly).

These spiders form a large family, which the average arachnologist rather neglects. A satisfactory classification of the jumpers has yet to be worked out, which makes the determining of species rather difficult. Many quaint and uncommon forms have been described from Australia.

They are the only spiders that jump. Members of this family can readily be recognized by their eyes. Four enormous eyes, looking forward, are spaced across the front; the others are farther back. But even with this optical equipment, these spiders have but poor sight.

Jumping spiders are seen on bushes, fences, and other similar places. They move about rather quickly, stopping every second to raise the front of their bodies and look around, at the same time vibrating their little pedipalps in an up-and-down movement. This movement is rather conspicuous, as the pedipalps, which are in front, are covered in light-coloured hairs. Before a leap is taken a silken line is made fast; when the jump is made, this thread is spun out so as to guard any uncertain foothold when the spider alights. Frequently when it leaps upon the top of its prey, both fall into space. This does not alarm the spider, as it calmly sucks the juices of its prey while hanging supported by a life-line.

The silk of the spider comes from the spinnerets as a liquid, and on contact with the air instantly and definitely solidifies into a strand of marvellous strength. To watch this silk pouring from the spinnerets, and to try to imagine it a liquid before coming into contact with the air, makes the marvel the more difficult to believe.

Jumpers hide between the cracks in or under the loose bark of trees. They build a little "tent" across the upper reaches of the coneave shape of the bark, leaving an entrance at the end. It is here that the female lays and guards the eggs. The eggs are not enclosed in a bag, but are covered in a silken sheet.

At Blackburn, males and females of the *Attidae* were found living in tubular retreats, which were built among the leaves of a bush. To all appearances, the spiders were living happily; but the life of the wedded male is very uncertain in the spider realm.

O. melancholica is a grey-and-black spider, three-eighths of an inch in length. It has a grey, irregular stripe down the centre of the back. It loves our grey paling fences, as its grey colour affords it protection, while many opportunities for a retreat are offered where the palings overlap. Jumpers are so fond of this habitat that, on a sunny day, every such fence in Melbourne would furnish a specimen or two.



The Grey-and-black Jumping Spider,
Ocrisiona melancholica. + 7

THE GLIDING SPIDER, *Saitis volans*

Saitis is one of our amazing spiders. It belongs to the *Attidae*, and is rare, but well distributed, around Melbourne. Length, well under one-quarter of an inch; eyes as in other *Attids*; colour, dark brown; top of abdomen, royal blue with scarlet markings.

Folded under the abdomen are two chitinous flaps which, when the spider is jumping, are extended like the wings of a monoplane. These flaps assist it to glide through the air. At rest, the flaps are folded and hidden so well that their presence would hardly be suspected.

This spider, being rather small, could easily be overlooked, but a collector would be sure to come across a specimen occasionally when beating bushes with a net. Very few of the jumpers are of any size; they average about one-quarter of an inch in length.

For taxonomic work, the essentials are a good collection of both spiders and descriptive literature dealing with the group. If your interest be of a popular nature, books such as Fabre's *Life of the Spider, Spiderland*, by Ellis, Savory's *Biology of Spiders*, and Warburton's small handbook are obtainable; but if you aim at a more technical study, the first knowledge to be acquired is its morphology. Comstock's *Spider Book* contains practically everything in this direction. The volume on Arachnida in the *Cambridge Natural History* is useful, while many other works have a few pages devoted to this detail on anatomy.

To classify, first sort out the specimens into their families and sub-families respectively. References can be made to (a) *Systema Araneorum*, by Alexander Petrunkevitch, M.A., Ph.D., D.Sc., Professor of Zoology in the Yale University, published in the *Transactions of the Connecticut Academy of Arts and Sciences* (Vol. 29, January, 1928), (obtainable from the University Press, price \$4.50). This work contains a key to all families and sub-families, and a list of genera, alphabetically arranged, under each sub-family. It is in English. (b) Simon's *Historie Naturelle des Araignees*. The text is in French, while the keys are in Latin. This work contains keys, descriptions, and references to all genera known at the time of its publication.

From 1865 to date, the Zoological Society of London has published an Annual Record of the scientific works published on zoology; each group is printed separately. All the volumes must be examined, and a list made of the group under study. This has been done for the Australian Araneae by Rainbow in the *Australian Museum Records* (Vol. IX., No. 2, 1911, pp. 107-319). It will need supplementing with the species described since 1911. The chief work on Australian spiders is by L. Koch, *Die Arachniden Australiens*, 1884-9, a rare and expensive German book. Modern Australian workers have published descriptions in the scientific societies' journals. All these works are in the Melbourne Public Reference Library.

MIDDLE SILURIAN LAND PLANTS*

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

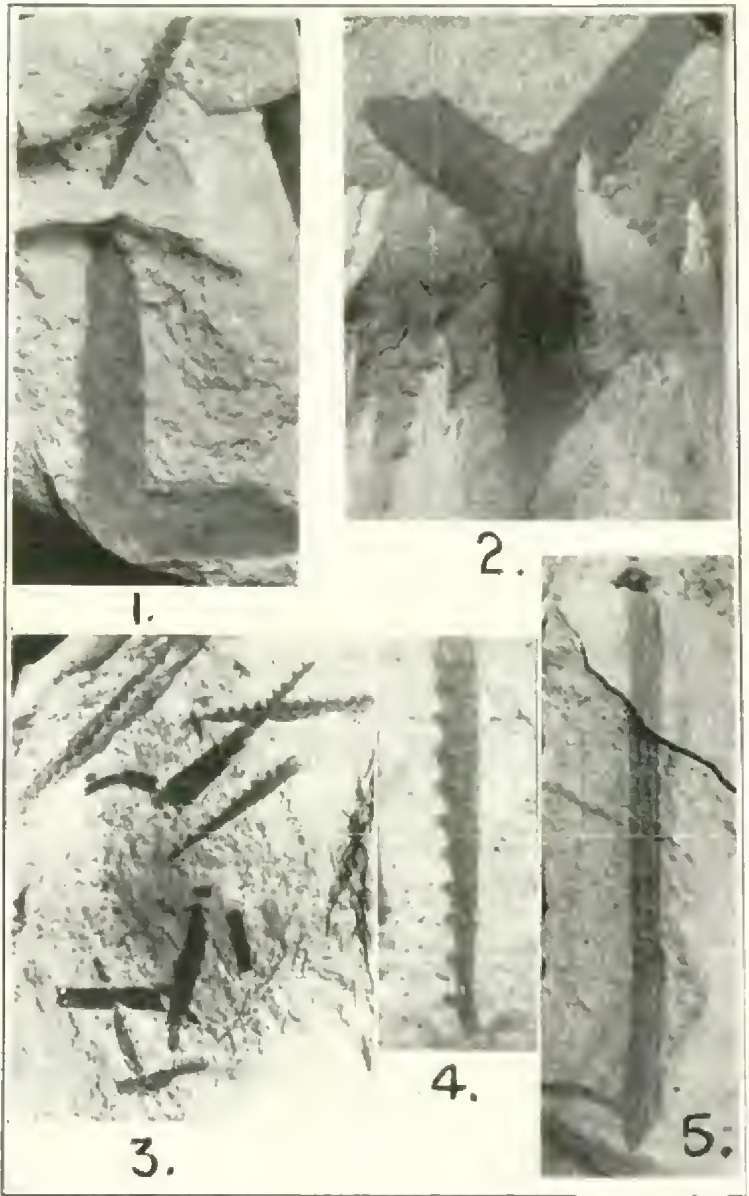
Palacontologist to the National Museum, Melbourne

In 1859 Sir William Dawson,^{4 5} erected the genus *Psilophyton*, and then, or in 1871, described several species of the genus. Owing to their poor state of preservation, Dawson's specimens were regarded with considerable doubt. The recent work of T. G. Halle⁶ on Lower Devonian plants from Norway, and Kidston and Lang⁷ on the Devonian *Rhynia* from Aberdeenshire, Scotland, has generally confirmed Dawson's work.

Dawson's inference that *Psilophyton* was a vascular plant was confirmed by Halle in his investigation of *P. ornatum*, and it has been more recently pointed out by Kidston and Lang that other forms of the genus were vascular. Their work on the Rhynie flora, particularly *Rhynia* in regard to its morphology and habit, confirms in a striking way Dawson's observation in 1859. To emphasize the complete reversal of former opinion regarding Dawson's *Psilophyton*, Seward¹⁰ believes that *P. princeps* Dawson agrees very closely with *Rhynia* in habit and its grosser anatomical features. Newell Arber⁸ thought *Psilophyton* and *Rhynia* to be generically identical, and Kidston and Lang⁷ placed it with *Asterorylon* one of their Rhynie genera. They included the Rhynie plants in the series Psilophytales, including the type genus *Psilophyton*.

The Psilophytales comprise the plant forms regarded by Halle as the "remains of the very oldest land flora at present known". Newell Arber, in 1921, believed that "the question of the geological age of the floras known from various parts of the world as vital", and it is with this aspect of the problem that this contribution deals. Assuming for the present the correctness of Dr. A. H. Church's³ hypothesis as to the great migration of the vegetation of the ocean to the surface of the land, any record that will push back the existence of land plants nearer to the period of migration will be of considerable interest. Dawson, in 1871, stated that *Psilophyton* occurred in the Upper Silurian, Halle recorded it from the Silurian (Lower Ludlow) of the Island of Gothland, and Chapman¹ in 1912 recorded Psilophytales from the Monograptus beds near Walhalla. Chapman² again, in 1924, stated "that he found the predominant graptolite, supposed to belong to the Walhalla plant beds, to be a form related to *M. cf. jackeli*, Perner of the *M. priodon* type". Newell Arber⁸ in 1921 states that "attempts have, it is true, been made in some cases to establish a pre-Devonian age, particularly in Bohemia and Germany. These views are, however, we believe, now almost entirely abandoned" . . . and D. H. Scott,⁹ in 1922, "that it may be mentioned that a possible *Psilophyton* has recently been

*Read before the Field Naturalists' Club of Victoria, March 13, 1933.



Psilophyales and graptolites on the same slab

recorded by Prof. Halle from the Silurian (Lower Ludlow) of Gorthland, an interesting discovery if confirmed".

We have long known that Psilophytales occur at several localities in Victoria. As far back as 1912, Chapman records Psilophytales from Walhalla, Perkin's Creek, Wood's Point, Halford's Hill, and the Thomson River, north-west of Walhalla. Many more localities have been added to these during the last decade, and it has been common knowledge to Victorian graptoliteologists that Psilophytales and graptolites often occur associated. Although we have repeatedly assured palaeobotanists of the Silurian age of Victorian Psilophytales beds, the author preferred to wait until a specimen was forthcoming with a graptolite and a plant on the one slab which could be photographed. Through the kindness of Mr. William Rae, of Wood's Point, such a specimen has come to my hands. Mr. Rae obtained his specimen from a quarry on the Yarra Track, between the roadman's hut and The Oaks. The graptolites and Psilophytales occur in a pale yellow shale, of even texture, and normal in every respect. Fortunately the graptolites are quite well preserved, and one can identify with certainty *Monograptus riccartonensis* Lapworth, which places the beds in the Yeringian of the Victorian Silurian, or its equivalent, the Wenlock of the British Silurian succession. The Victorian plant beds are, then, somewhat older than Halle's.

The purpose of this paper is to record the graptolite, and incidentally fix the age of the plant-bed. The work of describing Victorian palaeozoic plants is at present being undertaken by Professor Lang and Dr. Cookson, and no attempt is made here to identify them other than generically. Photographs of both the graptolites and plants are shown on illustration.

Incidentally, it may be mentioned that in the Melbourne University Geological Museum, there is a specimen (Rock No. 2385) showing both graptolites and plants on a slab collected on the Warburton Road, about seventeen miles from Wood's Point, by Mr. L. Retchford. The locality is undoubtedly the same as that from which our specimens came, but the plant is of another type of uncertain affinities, although undoubtedly from the same flora, and among the graptolites is a form referable to *M. riccartonensis*.

EXPLANATION OF ILLUSTRATION

Magnified about twice

1. One of the *Psilophyton* group and *Monograptus* on the same slab. Spec. No. 13751.
2. One of the *Psilophyton* group. Spec. No. 13750.
3. Fragmentary plants and graptolites on the same slab. Spec. No. 13752.
4. *M. riccartonensis* Lap., Proximal portion. Spec. No. 13752.
5. One of the *Psilophyton* group with fragmentary graptolites. Spec. No. 13753.

All the specimens are in the Collection of the National Museum, Melbourne.

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NEW RECORDS OF PLANTS ATTACKED BY NATIVE INSECTS

By C. FRENCH, IENR., Government Biologist.

"The Light Brown Apple Moth" (*Tortrix pastinana* Walker).

No. 3.—The greenish-coloured, active grub of this moth, measuring about $\frac{3}{4}$ " in length, has become unpleasantly familiar to many fruitgrowers, flower-lovers, and vegetable growers in Victoria and elsewhere. In glass houses it is certainly one of the worst pests of orchids, begonias, ferns, coleus, and other plants. In the orchards it usually attacks the late varieties of apples, especially the variety "Yates."

These moths formerly bred on various species of Acacia, viz., *A. dealbata*, *A. decurrens*, and others. From the wattles, it has spread to other trees and plants; viz.:—Apples, pears, plums, apricots, peaches, gooseberries, potatoes, cabbages, chrysanthemums, roses, mignonette, boronias, asters, begonias, lasiandras, oranges, lemons, grapes, cherries, and cinerarias. In fact, there are very few garden plants which are not attacked by this insect.

When attacking leaves, the caterpillars of this moth roll them together, hiding within them, and coming out at intervals to eat holes in other leaves, and finally pupating in the leaves. The grubs often attack stored fruit—one grub will often spoil half-a-dozen apples in a case, whilst occasionally greater damage is done. These insects certainly cause much annoyance to plant lovers.

GENUS *CYMBIDIUM* IN AUSTRALIA

The Rev. H. M. R. Rupp, M.A., has undertaken a review of *Cymbidium* in Australia. He would be glad to hear from readers of this journal who have any acquaintance with Australian species of this genus. Particularly needed is information concerning *C. Hillii* F.v.M., *C. gonyphocarpum* Fitz., *C. quaconianum* Kluge. Mr. Rupp's address is 71 George Street, East Maitland, N.S.W.