TRANSACTIONS

AND

PROCEEDINGS

OF THE

NEW ZEALAND INSTITUTE

1883

VOL. XVI.

EDITED AND PUBLISHED UNDER THE AUTHORITY OF THE BOARD OF
GOVERNORS OF THE INSTITUTE

BY

JAMES HECTOR, C.M.G., M.D., F.R.S.

ISSUED MAY, 1884.

WELLINGTON
LYON & BLAIR, PRINTERS, LAM[illegible]
TRUBNER & CO., [illegible], PATERNOSTER ROW[illegible]

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NEW ZEALAND INSTITUTE.

ESTABLISHED UNDER AN ACT OF THE GENERAL ASSEMBLY OF NEW ZEALAND INTITULED "THE NEW ZEALAND INSTITUTE ACT, 1867."

BOARD OF GOVERNORS.

(EX OFFICIO.)

His Excellency the Governor | The Hon. the Colonial Secretary.

(NOMINATED.)

The Hon. W. B. D. Mantell, F.G.S., W. T. L. Travers, F.L.S., James Hector, C.M.G., M.D., F.R.S., the Ven. Archdeacon Stock, B.A., Thomas Mason, M.H.R., the Hon. G. M. Waterhouse, M.L.C.

(ELECTED.)

1883.—The Hon. William Rolleston, M.H.R., James McKerrow, Martin Chapman.

1884.—The Hon. Wm. Rolleston, M.H.R., James McKerrow, Dr. Buller, C.M.G., F.R.S.

MANAGER:

James Hector.

HONORARY TREASURER:

The Ven. Archdeacon Stock.

SECRETARY:

R. B. Gore.

ABSTRACTS OF RULES AND STATUTES.

GAZETTED IN THE "NEW ZEALAND GAZETTE," 9TH MARCH, 1868.

SECTION I.

Incorporation of Societies.

1. No Society shall be incorporated with the Institute under the provisions of "The New Zealand Institute Act, 1867," unless such Society shall consist of not less than twenty-five members, subscribing in the aggregate a sum of not less than fifty pounds sterling annually, for the promotion of art, science, or such other branch of knowledge for which it is associated, to be from time to time certified to the satisfaction of the Board of Governors of the Institute by the Chairman for the time being of the Society.

2. Any Society incorporated as aforesaid shall cease to be incorporated with the Institute in case the number of the members of the said Society shall at any time become less than twenty-five, or the amount of money annually subscribed by such members shall at any time be less than £50.

3. The bye-laws of every Society to be incorporated as aforesaid shall provide for the expenditure of not less than one-third of its annual revenue in or towards the formation or support of some local public Museum or Library; or otherwise shall provide for the contribution of not less than one-sixth of its said revenue towards the extension and maintenance of the Museum and Library of the New Zealand Institute.

4. Any Society incorporated as aforesaid, which shall in any one year fail to expend the proportion of revenue affixed in manner provided by Rule 3 aforesaid, shall from thenceforth cease to be incorporated with the Institute.

5. All papers read before any Society for the time being incorporated with the Institute, shall be deemed to be communications to the Institute, and may then be published as Proceedings or Transactions of the Institute, subject to the following regulations of the Board of the Institute regarding publications:—

Regulations regarding Publications.

(*a.*) The publications of the Institute shall consist of a current abstract of the proceedings of the Societies for the time being incorporated with the Institute, to be intituled, "Proceedings of the New Zealand Institute," and of transactions comprising papers read before the Incorporated Societies (subject, however, to selection as hereinafter mentioned), to be intituled, "Transactions of the New Zealand Institute."

(*b.*) The Institute shall have power to reject any papers read before any of the Incorporated Societies.

(*c.*) Papers so rejected will be returned to the Society before which they were read.

(*d.*) A proportional contribution may be required from each Society towards the cost of publishing the Proceedings and Transactions of the Institute.

(*e*) Each Incorporated Society will be entitled to receive a *proportional* number of copies of the Proceedings and Transactions of the Institute, to be from time to time fixed by the Board of Governors.

(*f.*) Extra copies will be issued to any of the members of Incorporated Societies at the cost price of publication.

6. All property accumulated by or with funds derived from Incorporated Societies and placed in the charge of the Institute, shall be vested in the Institute, and be used and applied at the discretion of the Board of Governors for public advantage, in like manner with any other of the property of the Institute.

7. Subject to "The New Zealand Institute Act, 1867," and to the foregoing rules, all Societies incorporated with the Institute shall be entitled to retain or alter their own form of constitution and the bye-laws for their own management, and shall conduct their own affairs.

8. Upon application signed by the Chairman and countersigned by the Secretary of any Society, accompanied by the certificate required under Rule No. 1, a certificate of incorporation will be granted under the Seal of the Institute, and will remain in force as long as the foregoing rules of the Institute are complied with by the Society.

Section II.

For the Management of the Property of the Institute.

9. All donations by Societies, Public Departments, or Private Individuals, to the Museum of the Institute, shall be acknowledged by a printed form of receipt, and shall be duly entered in the books of the Institute provided for that purpose, and shall then be dealt with as the Board of Governors may direct.

10. Deposits of articles for the Museum may be accepted by the Institute, subject to a fortnight's notice of removal to be given either by the owner of the articles or by the Manager of the Institute, and such deposits shall be duly entered in a separate catalogue.

11. Books relating to Natural Science may be deposited in the Library of the Institute, subject to the following conditions:—

(*a.*) Such books are not to be withdrawn by the owner under six months' notice, if such notice shall be required by the Board of Governors.

(*b.*) Any funds specially expended on binding and preserving such deposited books, at the request of the depositor, shall be charged against the books, and must be refunded to the Institute before their withdrawal, always subject to special arrangements made with the Board of Governors at the time of deposit.

(*c.*) No books deposited in the Library of the Institute shall be removed for temporary use except on the written authority or receipt of the owner, and then only for a period not exceeding seven days at any one time.

12. All books in the Library of the Institute shall be duly entered in a catalogue which shall be accessible to the public.

13. The public shall be admitted to the use of the Museum and Library, subject to bye-laws to be framed by the Board.

Section III.

The Laboratory shall, for the time being, be and remain under the exclusive management of the Manager of the Institute.

Section IV.

Of Date 23rd September, 1870.

Honorary Members.

Whereas the rules of the Societies incorporated under the New Zealand Institute Act provide for the election of Honorary Members of such Societies; but inasmuch as such Honorary Members would not thereby become members of the New Zealand Institute, and whereas it is expedient to make provision for the election of Honorary Members of the New Zealand Institute, it is hereby declared—

1st. Each Incorporated Society may, in the month of November next, nominate for election as Honorary Members of the New Zealand Institute three persons, and in the month of November in each succeeding year one person, not residing in the colony.

2nd. The names, descriptions, and addresses of persons so nominated, together with the grounds on which their election as Honorary Members is recommended, shall be forthwith forwarded to the Manager of the New Zealand Institute, and shall by him be submitted to the Governors at the next succeeding meeting.

3rd. From the persons so nominated, the Governors may select in the first year not more than nine, and in each succeeding year not more than three, who shall from thenceforth be Honorary Members of the New Zealand Institute, provided that the total number of Honorary Members shall not exceed thirty.

LIST OF INCORPORATED SOCIETIES.

NAME OF SOCIETY.	DATE OF INCORPORATION.
Wellington Philosophical Society	10th June, 1868.
Auckland Institute	10th June, 1868.
Philosophical Institute of Canterbury	22nd October, 1868.
Otago Institute	18th October, 1869.
Westland Institute	21st December, 1874.
Hawke's Bay Philosophical Institute	31st March, 1875.
Southland Institute	21st July, 1880.
Nelson Philosophical Society	20th December, 1883.

WELLINGTON PHILOSOPHICAL SOCIETY.

Office-bearers for 1883:—*President*—The Hon. G. Randall Johnson, M.L.C.; *Vice-presidents*—Dr. Buller, C.M.G., F.R.S., A. K. Newman, M.B., M.R.C.P.; *Council*—R. Govett, M. Chapman, James Hector, M.D., C.M.G., F.R.S., S. H. Cox, F.G.S., F.C.S., T. King, W. T. L. Travers, F.L.S., F. B. Hutchinson, M.R.C.S.; *Auditor*—H. F. Logan; *Secretary and Treasurer*—R. B. Gore.

Office-bearers for 1884:—*President*—Dr. Buller, C.M.G., F.R.S.; *Vice-presidents*—A. K. Newman, M.B., M.R.C.P., R. Govett; *Council*—James Hector, M.D., C.M.G., F.R.S., S. H. Cox, F.G.S., F.C.S., T. King, W. T. L. Travers, F.L.S., F. B. Hutchinson, M.R.C.S., G. W. Grabham, M.D.Lond., Martin Chapman; *Auditor*—H. F. Logan; *Secretary and Treasurer*—R. B. Gore.

Extracts from the Rules of the Wellington Philosophical Society.

5. Every member shall contribute annually to the funds of the Society the sum of one guinea.

6. The annual contribution shall be due on the first day of January in each year.

7. The sum of ten pounds may be paid at any time as a composition for life of the ordinary annual payment.

14. The time and place of the General Meetings of members of the Society shall be fixed by the Council and duly announced by the Secretary.

AUCKLAND INSTITUTE.

Office-bearers for 1883:—*President*—Rt. Rev. W. G. Cowie, D.D.; *Vice-presidents*—E. Mackechnie, T. Peacock, M.H.R.; *Council*—G. Aickin, J. L. Campbell, M.D., W. D. Campbell, F.G.S., Mr. Justice Gillies, Hon. Colonel Haultain, Neil Heath, J. Martin, F.G.S., J. A. Pond, Rev. A. G. Purchas, M.R.C.S.E., H. G. Seth Smith, S. Percy Smith, F.R.G.S.; *Secretary and Treasurer*—T. F. Cheeseman, F.L.S.; *Auditor*—T. Macffarlane.

Office-bearers for 1884 :—*President*—H. G. Seth Smith, R.M. ; *Vice-presidents*—Rt. Rev. W. G. Cowie, D.D. ; E. A. Mackechnie ; *Council*—G. Aickin, Professor F. D. Brown, B.Sc., J. L. Campbell, M.D., Hon. Colonel Haultain, Neil Heath, J. Martin, F.G.S., J. Murray Moore, M.D., T. Peacock, M.H.R., J. A. Pond, Rev. A. G. Purchas, M.R.C.S.E., S. Percy Smith, F.R.G.S. ; *Secretary and Treasurer*—T. F. Cheeseman, F.L.S., F.Z.S. ; *Auditor*—T. Macffarlane.

Extracts from the Rules of the Auckland Institute.

1. Any person desiring to become a member of the Institute, shall be proposed in writing by two members, and shall be ballotted for at the next meeting of the Council.

4. New members on election to pay one guinea entrance fee, in addition to the annual subscription of one guinea, the annual subscriptions being payable in advance on the first day of April for the then current year.

5. Members may at any time become life-members by one payment of ten pounds ten shillings, in lieu of future annual subscriptions.

10. Annual General Meeting of the Society on the third Monday of February in each year. Ordinary Business Meetings are called by the Council from time to time.

PHILOSOPHICAL INSTITUTE OF CANTERBURY.

Office-bearers for 1883 :—*President*—Professor F. W. Hutton ; *Vice-presidents*—R. W. Fereday, E. Dobson ; *Treasurer*—W. M. Maskell ; *Secretary*—Geo. Gray ; *Council*—Professor J. von Haast, Dr. Symes, C. Chilton, T. Crook, J. Inglis, T. S. Lambert.

Office-bearers for 1884 :—*President*—R. W. Fereday ; *Vice-presidents* Professor F. W. Hutton, J. Inglis ; *Treasurer*—W. M. Maskell ; *Secretary*—C. Chilton ; *Auditor*—C. R. Blakiston ; *Council*—H. R. Webb, G. Gray, G. Hogben, E. Dobson, T. Crook, Dr. Lendenfeld.

Extracts from the Rules of the Philosophical Institute of Canterbury.

21. The Ordinary Meetings of the Institute shall be held on the first Thursday of each month during the months from March to November inclusive.

35. Members of the Institute shall pay one guinea annually as a subscription to the funds of the Institute. The subscription shall be due on the first of November in every year. Any member whose subscription shall be twelve months in arrears, shall cease to be a member of the Institute, but he may be restored by the Council if it sees fit.

37. Members may compound for all annual subscriptions of the current and future years by paying ten guineas.

OTAGO INSTITUTE.

Office-bearers for 1883 :—*President*—A. Montgomery ; *Vice-presidents*—W. Arthur, C.E., Rev. Dr. Roseby ; *Hon. Secretary*—Professor Parker ; *Hon. Treasurer*—D. Petrie, M.A. ; *Auditor*—D. Brent ; *Council*—Dr. Hocken, Professor Scott, G. M. Thomson, F. Chapman, R. Gillies, G. Joachim, Professor Mainwaring Brown.

Office-bearers for 1884 :—*President*—Donald Petrie, M.A.; *Vice-presidents*—Alex. Montgomery, Professor Scott; *Hon. Secretary*—Professor Parker; *Hon. Treasurer*—J. C. Thomson; *Council*—F. R. Chapman, W. Arthur, C.E., Professor Mainwaring Brown, Professor Ulrich, R. Gillies, F.L.S., G. M. Thomson, F.L.S., T. M. Hocken, M.R.C.S.; *Auditor*—D. Brent, M.A.

Extracts from the Constitution and Rules of the Otago Institute.

2. Any person desiring to join the Society may be elected by ballot, on being proposed in writing at any meeting of the Council or Society by two members, on payment of the annual subscription of one guinea for the year then current.

5. Members may at any time become life-members by one payment of ten pounds and ten shillings in lieu of future annual subscriptions.

8. An Annual General Meeting of the members of the Society shall be held in January in each year, at which meeting not less than ten members must be present, otherwise the meeting shall be adjourned by the members present from time to time, until the requisite number of members is present.

(5.) The session of the Otago Institute shall be during the winter months, from May to October, both inclusive.

WESTLAND INSTITUTE.

Office-bearers for 1883 :—*President*—W. A. Spence; *Vice-president*—T. O. W. Croft; *Hon. Treasurer*—J. P. Will; *Secretary*—Richard Hilldrup.

Office-bearers for 1884.—*President*—W. A. Spence; *Vice-president*—T. O. W. Croft; *Treasurer*—J. P. Will; *Secretary*—Richard Hilldrup.

Extracts from the Rules of the Westland Institute.

3. The Institute shall consist :—(1) Of life-members, *i.e.*, persons who have at any one time made a donation to the Institute of ten pounds ten shillings or upwards; or persons who, in reward of special services rendered to the Institute, have been unanimously elected as such by the Committee or at the general half-yearly meeting. (2) Of members who pay two pounds two shillings each year. (3) Of members paying smaller sums, not less than ten shillings.

5. The Institute shall hold a half-yearly meeting on the third Monday in the months of December and June.

HAWKE'S BAY PHILOSOPHICAL INSTITUTE.

Office-bearers for 1883 :—*President*—The Right Rev. the Bishop of Waiapu; *Vice-president*—W. I. Spencer; *Hon. Secretary and Treasurer*—W. Colenso; *Council*—T. W. Balfour, J. N. Bowerman, H. R. Holder, T. K. Newton, F. W. C. Sturm, C. H. Weber; *Auditor*—T. K. Newton.

Extracts from the Rules of the Hawke's Bay Philosophical Institute.

3. The annual subscription for each member shall be one guinea, payable in advance, on the first day of January in every year.

4. Members may at any time become life-members by one payment of ten pounds ten shillings in lieu of future annual subscriptions.

(4.) The session of the Hawke's Bay Philosophical Institute shall be during the winter months from May to October, both inclusive; and general meetings shall be held on the second Monday in each of those six months, at 8 p.m.

SOUTHLAND INSTITUTE.

Office-bearers for 1883:—*President*—J. T. Thomson, C.E., F.R.G.S.; *Vice-president*—Rev. P. W. Fairclough; *Secretary and Treasurer*—J. C. Thomson; *Council*—Dr. Galbraith, Messrs. Carswell, Denniston, Hamilton, Robertson, Scandrett.

Office-bearers for 1884:—*President*—J. T. Thomson; *Vice-president*—Mr. Denniston; *Secretary*—W. S. Hamilton; *Treasurer*—W. R. Robertson; *Council*—Dr. Galbraith, — Scandrett, — Webber, J. T. Martin, — Carswell, J. B. Greig.

NELSON PHILOSOPHICAL SOCIETY.

Office-bearers for 1884:—*President*—The Bishop of Nelson; *Vice-presidents*—Dr. L. Boor, A. S. Atkinson; *Secretary*—Dr. J. Hudson; *Treasurer*—J. Holloway; *Council*—The Hon. J. C. Richmond, J. Meeson, M. Fearnley, J. Park, Col. Walcott.

Extract from the Rules of the Nelson Philosophical Society.

4. That members shall be elected by ballot.
6. That the annual subscription shall be one guinea.
7. That the sum of ten guineas may be paid in composition of the annual subscription.
16. That the meetings be held monthly.
23. That papers read before the Society shall be immediately delivered to the Secretary.

NEW ZEALAND INSTITUTE.

ANNIVERSARY ADDRESS

OF

THE PRESIDENT,

HIS EXCELLENCY SIR W. F. D. JERVOIS,

G.C.M.G., C.B., ETC.,

DELIVERED TO THE MEMBERS OF THE NEW ZEALAND INSTITUTE, AT THE ANNIVERSARY MEETING, HELD ON THE 8TH AUGUST, 1883.

GENTLEMEN,—

There is, I think, a special value in meetings such as the present, affording as they do an opportunity for looking back, not only at the proceedings of the Institute, but also at some of the principal events in the literary and scientific world, during the past year, and then of glancing forward at the aim and objects of the Society in the future.

The New Zealand Institute already possesses a history of its own, and one which reflects great credit on the members of its various incorporated Societies, and I may add on the colony as a whole. Thirty-two years ago, when the total European population was but 32,000, the New Zealand Society was founded, mainly through the instrumentality of Sir George Grey; and, although it never met with the success that it deserved, we cannot regard the efforts of its promoters as thrown away. They were the real pioneers of the movement; they broke up the virgin soil, and planted the germ out of which has sprung the present Institute, with branches established in almost every provincial district, and an influence extending from Auckland to Invercargill.

The existing Association, however, dates only from 1867, when the Act for its establishment was passed, or rather from the following year, when the separate bodies then existing at Wellington, Auckland, and Christchurch became incorporated with the central Institute.

Since that date have been added the local Institutes of Otago, Westland, Hawke's Bay, and Southland, all of which, I am glad to learn, are in a flourishing condition, both as regards numbers and vitality. An Association at Nelson was also incorporated, but I regret to say that circumstances led to its ceasing to exist as a branch of the New Zealand Institute. I trust, however, that efforts which are now being made to resuscitate it will meet with deserved success.

The principal objects of the Institute as thus founded may be gathered from the list of subjects on which special information was desired, mentioned in the preface to the first volume of Transactions. They include, in short, all subjects of peculiar interest to the country, whether ethnological, zoological, geological (including chemical and mineralogical), or botanical; suggestions for improvements in agriculture and farming, sanitary matters, and the development of the country. Towards these and similar subjects, members of all the local Societies were invited to contribute, by personal observation, study, and the reading of papers at meetings, the Government co-operating by paying for the printing of the Annual Volume of Transactions, and the central Institute disseminating the information thus collected by the local bodies. I am happy to say that there is not one of these subjects that has been not merely touched upon, but very carefully gone into; in fact, I greatly doubt whether any young country in the world has been so systematically investigated as New Zealand has been under the auspices of this Institute. I need not say how much of this has been due to the untiring energy of Dr. Hector, who has not only been the life and soul of the Society, but has had the laborious duty of editing the Volumes of Transactions.

Three years ago, at the time when it was resolved to limit the Government expenditure in every way possible, it was contemplated to discontinue the annual grant of £500 for the publication of the Transactions; but the Board of Governors were able to give so good an account of the proceedings of the Institute that, on further consideration, the vote was allowed, and has since been continued.

The Institute has moreover been useful not only as a centre for the operations of local societies, but also as a focus for the work of various kindred departments, such as the Colonial Museum, the Geological Survey, the Laboratory, the Botanic Garden, the Observatory, the Meteorological Department, the Department of the Inspector of Weights and Measures, and the Patent Office. These would, no doubt, have in any case existed; but had they been entirely separate, much time and money would have been lost, which have now been wisely saved by their working together under the auspices of the New Zealand Institute.

The various Museums which are under the charge of the Institute, and the incorporated Societies, have all been more or less enriched during the last year; notably that at Auckland, by the beautiful and valuable Pompeian statue presented, amongst other works of art, by Mr. Mackelvie. This Museum is also one of the many institutions at Auckland which have been so largely benefited by the munificence of the late Mr. Costley; and, although it will not actually belong to the Institute, the Auckland members will have the additional advantage of the splendid library presented to that city by Sir George Grey.

TRANSACTIONS FOR 1882.

The large volume of Transactions and Proceedings for 1882 gives evidence of the genuine and valuable work that is still being done by the Institute. Amongst the essays which are printed at length in the volume, I wish especially to refer to Mr. Meyrick's learned and careful account of his examinations concerning the Micro-lepidoptera of New Zealand, a comparatively new field for zoological research. The object of such inquiries may not at once be obvious, but they are nevertheless of great value as being immediately connected with important agricultural interests; the minute moths, which form the subject of investigation, being amongst the most frequent causes of blight in plants. I am glad to observe that Mr. Meyrick intends continuing these investigations, and publishing the results through the medium of the Institute. Mr. Colenso's rambles through the forest have added materially to our knowledge of the ferns and plants indigenous to this country; and I trust that, although it seems a matter of great difficulty, the attention which Mr. Arthur has drawn to the question of the disease which is now playing havoc amongst the trout in Lake Wakatipu may ultimately lead to the discovery of some means whereby it may be overcome. The acclimatization of foreign varieties of fish is of such importance as a means of increasing the food-supply of this country, that it is a matter for serious concern that a disease should have appeared amongst the one variety—English trout—which it was hoped had been successfully introduced.

I am particularly glad to find that the attention of members in both Islands has again been drawn—as it had on several previous occasions—to the important, but too often forgotten, subject of forest conservation. As was pointed out by Captain Walker, in the interesting and exhaustive addresses delivered by him in 1876 and 1877, which are printed in the 9th volume of the Transactions, silviculture is doubly useful: first, on account of the value of the product; and, secondly, on account of the change of climate it brings about.

It appears, from the paper read by Mr. Justice Gillies before the Auckland Institute, that the cork tree may be most successfully cultivated in that district, and that each tree above the age of twenty-five years may be calculated to produce on an average about 9s. worth of cork every year; whilst Mr. McArthur, speaking at Invercargill, pointed out that in a few years the demand for railway sleepers alone—not to mention the other purposes in the way of building, carving, and fencing, for which timber is required—will exhaust the supply of native wood, and that the difficulty should be met by planting quickly-growing trees, such as larch and fir, on a large scale, without delay: in short, "planting here should follow the sawmillers, and this cannot be done too soon."

With regard to forest conservation as concerning the question of climate, I may quote the words of Mr. Firth, who, in a paper read before the Auckland Institute in 1874, remarks that: "Denudation of timber produces barrenness of soil, increases insect life, creates drought, diminishes rain, accelerates evaporation, causes floods and untimely frosts, lessens the production of food, diminishes population, and finally degrades a nation. The glory of many an ancient empire departed with its forests. To-day Persia and Spain present sad but warning spectacles of desolation and degradation, which, though partially due to various causes, have been intensified by the destruction of their forests."

The forms which the evils resulting from want of timber take differ, of course, in different countries. In addition to the remarks made by Mr. McArthur, Mr. Travers, in speaking before the Wellington Philosophical Society, has pointed out that the destruction of the forests in this country has already caused disastrous floods, and Dr. Meldrum and Dr. Hutchinson have explained how similar causes are bringing about similar results in Mauritius and the Sandwich Islands. From all parts of the world the story is the same. I lately received from the Secretary of State for the Colonies an interesting despatch on the subject, with reference to a large part of Southern Europe. Austria, Switzerland, and France have turned their attention to the reforesting of the bare mountain slopes; but in many districts of Italy the evil has gone on unchecked, and, in consequence of this, the floods are higher, and the average flow of the rivers is lower, than it used to be at the time when the mountains were clothed with timber and vegetation. Last September the inundations in the Province of Venetia, which were, no doubt, to a great extent brought about by this cause, resulted in serious loss of life and wholesale destruction of property.

I am glad to learn that this important subject has for some time been under the consideration of the Government of New Zealand.

Time will not allow me to make more than a passing mention of the papers of Mr. Samuel Locke and Mr. Barstow concerning the Native race and the history of the earliest European settlers in this colony; of Dr. Newman's paper respecting the healthiness of New Zealand; or of many other contributions. I will only add that I cannot look through the compressed report of the local Societies without a feeling of regret that I have no opportunity of reading at greater length several of the interesting papers, of which only an abstract can be given.

The honorary members who have been added to the roll of the Institute during the last year are: Professor W. B. Carpenter, the eminent physiologist, who has done great service to New Zealand by assisting in the organization of the University; Sir Wm. Thompson, from whose researches in physics and especially in electricity, this colony, in common with other countries, is deriving daily benefit; and Professor Ellery, the well-known astronomer at the Melbourne Observatory, whose work in the preparation of star catalogues is of great benefit in all survey operations in these latitudes.

SCIENCE.

The past year has been one of exceptional activity in the world of science. Astronomers in all quarters of the globe have been watching with keen interest the movements of the magnificent comet which was visible last spring; two months ago we had the opportunity of seeing one of the most beautiful of astronomical phenomena—a total eclipse of the sun; and in December last scientific parties were despatched by almost every European nation to take careful observations of the transit of Venus.

COMET.

In the recent volume of Transactions there is a valuable paper on the constitution of comets, which was read before the Southland Institute last October by Mr. Fairclough. There and elsewhere you will find it stated that, according to Kepler, comets are as numerous as fishes in the sea. But, however that may be, there is no doubt that they may be numbered by hundreds of thousands, and that they are indeed the most numerous family of bodies in the universe. The movements of some hundreds only, however, have been studied, and of these only a few by the aid of modern appliances. They all describe a course round the sun; but, whilst some revolve in orbits occupying only a comparatively short period, which can be calculated with precision—as, for instance, Encke's Comet and Halley's Comet, which accomplish their revolutions in about three and a half years and seventy-six years respectively—the elements of the motion of others are not sufficiently known to admit of their return being predicted.

Those who recollect the great comet of 1843 confess that it hardly, if at all, surpassed the one of last year in brilliancy, although some maintain that it exceeded it in the apparent length of its tail as seen from the earth. The large majority of those now living, however, have never seen anything that can be compared to the magnificent comet of 1882. It was visible from all quarters of the globe, and so brilliant as to be seen with the naked eye at noon in a clear sky. On the 17th of September a unique observation was made at the Cape, where the comet was seen to pass right up to the sun's limb, after which it became invisible, not intercepting the faintest portion of the sun's light. The following morning it passed its perihelion passage so close as to be within the region beyond which the great solar jets of incandescent hydrogen (to which I will presently refer in another connection) are often seen to extend. It must, whilst in that position, have been exposed to a heat so intense, that rock-crystal, agate, or the most infusible substance we know of, would have been vapourized. The gigantic tail covered a space at least as long as the distance between the earth and the sun, and, although apparently of very small substantiality, several observers report that they saw distinctly in the sky the black shadow cast by the tail of the comet.

The question as to the relations between the comets of 1843, 1880, and 1882 is one of great interest. According to Mr. Chandler, the orbit of the comet of last year is such as to be quite inconsistent with a short period of revolution, and, if so, it must be distinct from either of the earlier comets,—or from the earlier comet, supposing those of 1843 and 1880 to be identical.

Another view has lately been put forward in the "Observatory," from which I quote the following words :—"The physical appearance of the comet, which like that of 1843, and unlike that of 1880, showed at first a decided nucleus, together with the intimation of a period very considerably greater than that of the interval from the 27th January, 1880, the date of perihelion of the 1880 comet," to September, 1882, "suggest that perhaps the 1843 comet suffered disintegration when at its nearest approach, and that the 1880 comet was a portion of its less condensed material, whilst the body of the comet with the principal nucleus, suffering less retardation than the separated part, has taken two and a half years longer to perform a revolution."

The latest, and I understand the most accurate, calculations, however, attribute to the orbit of the comet of 1882 a period of 840 years, so that the last time it passed round the sun was about the year 1140, in the days of King Stephen.

ECLIPSE.

The total eclipse of the sun, visible throughout this part of the world, which took place on the 6th of May last, had been looked forward to by men of science with special attention, on account of the interesting questions which it was expected to solve.

The roseate protuberances of the chromosphere which are seen surrounding the limb of the sun during an eclipse were, by the investigations which were made during and consequent upon the eclipse of 1868, proved to be jets, composed almost exclusively of incandescent hydrogen gas, to which I before referred in speaking of the passage of the comet, bursting forth from the layers of vapour which form the atmosphere to the sun. Amongst these vapours spectrum analysis has detected sodium, magnesium, and calcium.

Beyond this atmosphere, however, there is visible during a total eclipse a magnificent silvery aureole, or luminous corona, which may reach to a distance equal to an entire radius of the moon's orbit. It is not yet certain of what this corona is composed, and it is quite possible that it may be a magnetic phenomenon analogous to the aurora borealis. The remarkable association of the breaking-out of sun-spots with the occurrence of violent magnetic storms on the sun's surface gives support to this view. A marked instance of this occurred on the 19th November last, when telegraphic communication was interfered with throughout the world, and an aurora was visible over both hemispheres, associated with a very large sun-spot.

To the corona again immense appendices have been observed. Whether they are dependent on the coronal atmosphere, or are really streams of meteorites circulating round the sun, was still uncertain; and this was one of the questions which it was hoped would be decided by the observations taken during the eclipse of 1883, especially as bearing on the remarkable theory lately put forth by Dr. Siemens to explain the maintenance of the sun's energy, which suggests that energy thrown off from the equatorial regions of the sun is reabsorbed at the sun's poles, to be again re-formed into a source of power.

From the observations of the eclipse it was moreover expected that information would be furnished respecting the small round spots which have frequently been observed to appear and disappear in front of the sun's orb. Can these be planets, revolving round the sun, but which the illumination of our atmosphere, so bright in the neighbourhood of the sun, conceals from us at other times? There are but two ways in which the matter can be investigated—viz., the attentive study of the solar surface (a work of great difficulty), and the examination of the circumsolar region whilst an eclipse renders such examination possible. As ordinary eclipses have only a duration of two minutes at the point where the phase is maximum, the eclipse of the 6th May last, which was to have a duration three times as great, was looked forward to the more eagerly, and scientific parties were sent out from England, France, and America to examine the phenomenon from Flint and Caroline Islands, situated to westward of the Marquesas, and the nearest points of land to the central line. We have learnt, by telegram, that the observations made by them were successful, especially as regards the photographs taken; but it is impossible to discuss the details of the results until further accounts reach us.

TRANSIT OF VENUS.

Next, as regards the transit of Venus. I need scarcely mention that the object of observing the transit of Venus across the sun's disc is to determine the distance of the sun from the earth;—in the words of Sir George Airey, "the noblest problem in astronomy." Although, through the sublime discoveries of Copernicus and Kepler, we have a just conception of the order of the solar system and its relative dimensions as expressed in Kepler's Law: that the squares of the periodic times of the planets in their orbits are to each other as the cubes of their distances from the sun; yet we know not with anything like absolute certainty any of these distances. But, in virtue of the law just quoted, given the true distance of any of the planets from the sun or from each other, and we have all the rest. The distance we seek, therefore, is not alone that of the earth from the sun, but in reality the base-line of the universe.

The sun's distance was to the ancient astronomers an insoluble problem, owing to the want of adequate instrumental means. Aristarchus gave the distance as nineteen times that of the moon, which, according to our value of the moon's distance, would give that of the sun under 5,000,000 miles. Even so late as the time of Kepler, not 300 years ago, the estimate of the sun's distance was 13,000,000 miles, or less than one-seventh of what is now accepted.

Indeed, in Kepler's time, the idea of utilizing the transit of Venus, as astronomers now do, was not thought of. It was reserved for the celebrated Scottish philosoper, James Gregory, in 1663, to point out the probability of determining the sun's parallax by means of the transit of Venus.

As is well known, these transits occur in pairs, the first and second of a pair being divided by an interval of only eight years, whilst between one pair and another there are successively intervals of 105½ and 121½ years. Thus, there were transits of Venus in 1631 and 1639; next in 1761 and 1769; the present generation has been specially favoured by having seen the transits of 1874 and 1882; and the next will not take place till 2004 and 2012.

Dr. Halley, of comet renown, who died in 1742, left to his countrymen, not only the famous prediction of the return of his comet, which has since been twice verified at the appointed times, but also the most earnest recommendation to observe the transits of Venus of 1761 and 1769. Halley's injunction was well obeyed, especially in 1769, when the observations of Captain Cook's expedition at Otaheite, combined with observations at other stations in various parts of the world, resulted in the conclusion, until recently relied on as correct, that 95,000,000 miles is the true distance of the sun.

The mention of the honoured name of Cook recalls to mind how close the association is between the observation of the transit of Venus in 1769 and the rediscovery and settlement of these southern lands.

The principle of the observation is that followed by the surveyor in ascertaining the distance of an inaccessible object. A line is measured on the ground, also the two angles which it forms with the inaccessible point; the third angle of the triangle is then inferred, and the computation of the distance required is one of the simplest in plane trigonometry. But the distance to the inaccessible sun is so immeasurably great that any base line which the surveyor could mark off on the earth's surface would be as useless for the purpose as a mathematical point. Even if we could stay the sun in his course, and grant other impossible conditions, the most delicate instrument would fail to show any convergence of the sides of the wished-for triangle. In other words, there would be no parallax.

The solution of the problem must be tried in some other way, and the most obvious thing to do, in the first instance, is to increase the length of the base. The longest possible base on the earth is, of course, the diameter of the earth itself. By placing observers suitably, in widely separated parts of the globe, the longest practicable base will be obtained, but still the problem is insoluble, unless we can have some intermediate body of known rate of circular motion coming in line between the observers and the sun. In the problem before us, Venus is that body, and, as she is, at transit, nearer the earth than the sun in the ratio of about 2 to 5, it will be seen that, to observers widely apart, Venus must necessarily come in line with the edge of the sun at different times to the two observers; just as would be the case were two observers, standing apart on the bank of a river, each to signal as a passing boat came in line with a tree on the opposite bank. It would be seen that an interval of time elapsed between the two signals. This interval, in the case of Venus, gives the measure of the angle subtended at the sun by the base line joining the stations of the observers. For the rate of the motion of Venus relative to that of the earth being known, the interval observed is convertible into angular measure; hence the problem can be solved. This, of course, is a very general statement of the principle of the observation, and takes no account of the many difficulties in giving effect to it, or of the laborious and abstruse computations in the after reduction of the observations.

The methods of observation are known as Halley's and Delisle's. In Halley's the duration of the transit is observed from two stations, so selected that internal ingress and internal egress may be observed at both; also that, by the rotation of the earth, the interval between ingress and egress may be increased at the one station and diminished at the other. The duration of the transit gives the length of the chords which Venus traces on the face of the sun, from which the angle or parallax is deduced. Halley's method does not require any great accuracy in the longitudes of stations, and in that respect was very convenient at the time it was promulgated, the longitudes of distant points not being then well known. But, as both ingress and egress must be observed at both stations, there is always great risk of failure from unfavourable weather. Previous to the transit of 1874 the utilization of this method was very carefully considered by Sir George Airey and others. As it was found that full advantage of it could only be obtained by establishing a station on the Antarctic Continent, the proposal was abandoned, and it was decided to rely on Delisle's method. This has the advantage that two observations suffice —one of internal ingress or egress at each of two stations. The exact time-differences between the two observations is the essential point in this method, consequently the absolute accuracy of the longitudes of the observing stations, which is now obtained through the electric telegraph, is of paramount importance.

The transit of 1874, which I suppose all present here can recollect, excited great interest. The observations on that occasion received hearty and substantial assistance from Governments, and no less than a quarter of a million sterling was expended in the aggregate by different nations on this object. It was observed from numerous stations throughout the globe, but, unfortunately, the observations in New Zealand were obscured through bad weather.

On this occasion, with the view of avoiding the errors incidental to observations of contact, photography was employed in addition to other means, and a series of pictures was obtained showing Venus in transit across the Line. The distances of the planet from the edge of the sun were afterwards measured micrometrically and at leisure from the picture. The English astronomers, however, found the photographs unsatisfactory; though, on the other hand, the Americans met with considerable success in this mode of observation.

The result of the observations of the transit of 1874 cannot be regarded as satisfactory; for, whilst Sir George Airey, in his official report, stated the solar parallax as 8·76″—corresponding to 93,375,000 miles—Colonel Tupman and Mr. Stone, from the very same observations, deduced the parallax respectively as 8·81″ and 8·88″. The agreement to within the tenth of a second of arc in angular measure seems, at first sight, very close; but, so vast is the distance represented in the solar parallax by that fraction, that these three calculations differ to an extent considerably exceeding a million of miles.

The observations of the transit of Venus of last year were undertaken by all civilized nations with the same zeal and interest that characterized the efforts of 1874. On this occasion the British astronomers discarded photography, whilst the Americans relied greatly on that means of observation.

In New Zealand the egress alone could be seen, and was observed from thirteen stations by seventeen scientific gentlemen, amongst whom were Dr. Hector, Mr. McKerrow, and Archdeacon Stock. There were also an English party of observers, near Christchurch, under Colonel Tupman, and an American party at Auckland, under Mr. Edward Smith, of the United States Coast Survey. The Government assisted liberally both by grants of money and by placing the Telegraph Department at the disposal of the observers. Unfortunately, Dr. Hector's observation at Clyde was partially intercepted by a cloud, but, with the exception of this *contretemps*, the observations in New Zealand were entirely successful. I cannot but remark that it reflects great credit on the colony that so many gentlemen should have voluntarily engaged in this work; and I have no doubt that, when the report of the results of the British expeditions are published, their services will receive cordial acknowledgment.

The observations of last year's transit throughout the world were attended with thorough success, and it is expected that, when the calculations have been completed, a great step will be made towards reconciling the conflicting results that have hitherto been obtained. But, before the question can be finally set at rest, the results of the observations on the transit of Venus must be reconciled with those obtained by other methods, which it would be out of place for me now to discuss.

Judging, however, from the conclusions already derived from various independent calculations, it seems probable that the true distance of the earth from the sun will be found to be between ninety-two and ninety-three millions of miles.

Meanwhile the scientific world awaits with the greatest interest the calculations of astronomers on this vital problem. The importance of it is not merely to be regarded as one which concerns the scientific astronomer alone; for, to state it shortly, until we have the means of affixing accurate numerical values to those forms of vibration which are at present loosely known to us as light, electricity, magnetism, and other imponderable forms of energy, we can only imperfectly avail ourselves in practical life of these wonderful agents in ministering to the wants of mankind.

After dealing with the immensities of celestial space, it is not without an effort that we drag ourselves down to consider matters more immediately connected with our own little planet, less than 8,000 miles in diameter, and one is insensibly led to exclaim, in the language of the old Hebrew Psalmist, "When I consider Thy heavens, the work of Thy fingers, the moon and the stars which Thou hast ordained, what is man that Thou art mindful of him, or the son of man that Thou visitest him!" Yet, in our present state of existence, it is unavoidable that our minds should be mainly occupied in attending to the ways and works of our fellow-men upon this sublunary sphere.

ENGINEERING.

The year is marked by the completion of great feats and the commencement of fresh efforts in engineering. The geological difficulties which for some time seemed insuperable to the completion of the San Gothard Tunnel have been overcome, and another route, which may be of some importance both as regards passengers and the mail service, has thus been opened between Australasia and England. The great canal that is to cut the Isthmus of Panama is in process of construction, and a second Suez Canal is contemplated. Tunnels have been commenced under both the Severn and the Mersey, and, were it not for political considerations, the great scheme of connecting England with the Continent would no doubt be speedily progressing. The Frith of Forth is being bridged over by what will be, when completed, the boldest structure of the kind throughout the world, with gigantic spans of no less than 1,700 feet.

ELECTRICITY.

But the subject which at present commands most attention in the scientific world is the use of the electric current; and it may be well to note here how far we have now advanced in the various ways of utilizing this marvellous instrument. One of the chief obstacles for many years to the use of electric force was the great cost of producing an electric current so long as chemical means had to be resorted to. This has been overcome by the invention of the dynamo-machine, which has been brought to such a state of perfection that by it we are enabled to convert mechanical into electrical force, and back again into mechanical force, with a marginal loss of not more than 20 per cent.; frictional resistance and the deterioration of the materials composing the instrument, caused by continuous working, being reduced to a minimum. The principles involved in the construction of these machines have been known to scientific men for some years; but their practical introduction is due to M. Gramme, whose efforts have been the immediate cause of the marvellous advance that has been made in the last few years in the utilizing of electricity. We have already in this city examples of one form of electric action — I refer, of course, to the transformation of electric into heat energy, so as to produce incandescent electric light. The principal arguments in favour of electric light are that it is colourless, and thus enables us not only to see pictures and flowers by it as perfectly as we can by sunlight, but also to carry on photography and many other industries as well at night as during the day. It is free from those products of combustion which not only heat the lighted apartments, but substitute carbonic acid and deleterious sulphur compounds for the oxygen upon which respiration depends; and supports growing plants instead of poisoning them. Interesting experiments have for some time been made as to the influence of the electric light on wheat, oats, and barley, and it has now been conclusively proved that, so far from its having any harmful effect, cereals placed under the influence of an electric lamp grow much more rapidly than those which are exposed only to the light of the sun; whereas any one who has tried to keep plants in a room constantly lighted with gas knows only too well how prone they are to wither and die.

As we have lately heard, this light has already been introduced into English mines, and there can be no doubt but that it will ere long supersede gas in all public places and large halls; but it does not seem probable that it will for some time compete with it successfully as a means of lighting smaller buildings. The great convenience of gas for heating as well as lighting is a strong argument in its favour, whilst for the degrees of temperature ordinarily required electricity is hardly available. For intense heat, however — I mean above 1,800° C.—it possesses advantages that far surpass any offered by combustion. It is hardly too much to hope that ere long there will be in this colony iron furnaces worked by the current generated by neighbouring rivers or tidal waves. Owing to the comparative smallness of our towns, the great advantage of this as a means of avoiding smoke-fogs may not seem at present a question of practical importance, but when we consider the probable increase of factories, and the rapid growth of our cities, and that from the imperfect combustion of coal there is a constant exhalation of carbonic oxide, a poisonous compound which when in large quantities causes sickness and death, we can realize how vastly important the absence of smoke may be to the health of future generations.

At the same time it must be admitted that gas has as yet not been fairly treated; it has been regarded almost entirely as a means of lighting, not sufficiently as a means of heating, and hardly at all as a motive-power. Dr. Siemens (who has protested strongly against this mistake) confidently predicts that, before many years have elapsed, we shall find in our factories and on board our ships, engines, with a fuel consumption not exceeding 1 lb. of coal per effective horse-power per hour, in which the gas-producer takes the place of the present steam-boiler.

With regard to electricity as a motive-power, electric railways are already in existence in Ireland and in Germany; but scientific men seem of opinion that, except in cases in which natural sources of energy, such as hills and waterfalls, are found, it will be long before electric power can take the place of steam on ordinary railways. I need not point out, however, that this is a country in which such sources of energy abound everywhere. I trust that at no distant day the force which is now applied in the form of friction necessary to hold back the trains in their descent of the Rimutaka Hill, and which is now dissipated and lost in wear and tear, may be utilized for propelling the engines for miles of their journey along the level country.

Whilst speaking of scientific discoveries as applied to practical matters, I cannot leave unmentioned a process which, though extremely simple in itself, is likely to mark an era in the history of the colony, and greatly to increase its wealth. I refer to the freezing of meat, and other products which might perhaps be similarly treated. I may mention, in passing, that the object of the process is not, as might have been supposed, to change the temperature of the atmosphere, but to suspend the vivifying powers of the germs which are continually floating about in it. As Professor Tyndall has pointed out, in his lecture before the Royal Institution in 1877 and elsewhere, animal matter may remain uncorrupted for months exposed to the air, provided that air is rendered perfectly free from these germs; whereas the slightest contact with air in its ordinary impure state—a mere pin-hole in the vessel containing the clarified atmosphere, for instance—admits the germs, and corruption ensues. The attempt to exclude the atmosphere from meat during the passage to Europe has been made, and has been found impracticable; but the desired result has been obtained by chilling the air to such an extent that the vivifying power of these germs is suspended.

The coldness of the nights in New Zealand makes the climate specially favourable for the process of freezing the meat; but, admirable as are the arrangements at Belfast, near Christchurch (where I had the pleasure of witnessing the operations), and elsewhere, I feel that much may yet have to be considered in the working-out of the details.

The principle of the machinery now in use is, that air is first compressed to such an extent that it attains a temperature of 300°, is then passed through cold tubes so as to be restored to its former temperature, though in its compressed state, and is then allowed to re-expand to its original dimensions, which causes its temperature to fall to zero. It seems probable, however, that, under some circumstances, it will be found that other means—as, for instance, the application of ammonia, ether, or sulphurous acid—are more suitable for freezing purposes than the compression of air.

LITERATURE.

I consider it a most healthy sign of the times that, during a period in which scientific knowledge has so rapidly advanced, literary study and research have made such steady and remarkable progress. Time would not permit me even to emunerate the principal literary works of the past year; but, to take merely one branch as an example—archæology—how much is there to tell!

DISCOVERIES IN EGYPT.

Foremost amongst the archæological discoveries must be placed the interesting investigations which have recently been made in Egypt.

In 1878 some ruins at Tel-El-Maskutah, which had previously been considered "not worth visiting" (although some scholars had believed them to mark the site of Raamses, mentioned in the book of Exodus), were practically examined, and, amongst other things, was found a sculptured group, which was conveyed to Ismailia. When Sir Erasmus Wilson's exploring expedition commenced operations last year, the first step taken by M. Naville, who was in command of the party, was to examine these carvings. He observed that they were dedicated to the god Tum, the setting sun, and describe Rameses II. (the great monarch of the 18th Egyptian dynasty, who reigned in the 14th century B.C.) as the friend of Tum. Hence he conjectured that they might come from one of the many cities which bore the sacred or temple name (as opposed to the popular name) of Pe-Tum (*i.e.*, the abode of Tum); and that this Petum might be the same as the City of Pithom, which is mentioned in Exodus i., 11, as one of the treasure cities built by the children of Israel for Pharaoh. On the strength of this conjecture, M. Naville, in February last, commenced excavations at Tel-El-Maskutah; and before he had been many weeks at work he had laid bare a vast enclosure, about 200 metres square, divided into square chambers built of large bricks, principally made without straw; all the chambers were without doors, and were evidently intended not for dwelling-rooms, but for storehouses or granaries. This was in fact the Temple of Tum, and the monuments found in the enclosures point clearly to its having been founded by Rameses II., although added to in the 22nd dynasty.

The Egyptian city "Thuku" had already been identified with the Succoth of the Bible; but now the missing link in the chain of identification was to be supplied. Certain inscriptions on statues referred to "Pe Tum in the city of Thuku," that is, "Pithom in the city of Succoth;" in other words, Pithom was the name of the temple from which the city, which was also called Succoth, took its name. Thus, in the words of Mr. Stanley Lane Poole, "Not only do we see the actual storehouses which the children of Israel are related to have built, but we now know "the first station on their journey from Egypt to Palestine," when, as we read in the twelfth chapter of Exodus, they "journeyed from Rameses to Succoth." In this way, by the explorations of a party which had only been at work for a few weeks, the identification of Pharaoh the oppressor with Rameses II. has been almost established, and the authenticity of the biblical narrative strongly confirmed; and every student of archæology will watch with the deepest interest the further investigations of those who have begun with so remarkable a success.

AT TROY.

With regard to the excavations in the Troad, however, the result of the latest investigations has been rather to lead us to modify conclusions formerly arrived at than to add to the list of archæological discoveries. Until a few years ago, the site of Homer's Troy was disputed—some placing it on the spot now known by the name of Hissarlik, others at the modern Village of Bunárbashi, about six miles to the south, others again maintaining that Troy never had any existence except in the poet's imagination. Dr. Schliemann, nearly ten years ago, astonished the literary world by announcing that, having carefully examined both places, he had proved that there were no relics of antiquity worth mentioning at Bunárbashi, but that at Hissarlik he had unearthed the ruins not only of the Homeric City, including the Palace of King Priam, the Scæan Gate, the great surrounding wall, and the great Tower of Ilium, but even the still earlier town which had been destroyed by Hercules!

To state it shortly, he claimed to have discovered the remains of five cities, one above another, the second from the bottom being the city described by Homer, and the fifth being the Greek city known as Ilium, built shortly after the founding of Rome. He admitted that the ruins of the fire-destroyed city which he identified with Troy, hardly corresponded with the palaces "with polished corridors adorned," described in the Iliad, but replied that the destruction took place long before Homer was born, and the description was added to by tradition and poetic license. The same spots were investigated last September by Mr. Jebb, Professor of Greek at the Glasgow University, and formerly Public Orator at Cambridge, and he has come to the conclusion that Dr. Schliemann's view—that he has discovered the very City of Priam, and proved that the Iliad was based upon real facts; that Ilium did really exist, and that Homer, even although he exaggerates, nevertheless sings of events that actually happened—must be definitely abandoned.

He admits, however, that the ruins of the five cities described by Schliemann exist; that one, or perhaps two of them, represents the Greek Colony of Ilium, and that the earliest, or possibly the earliest two—if we may distinguish between the city destroyed by fire and an earlier settlement—dates from pre-Hellenic times; that this *may* have been the town the siege of which gave rise to the poetic legend of Homer. But he contends that neither the ruins themselves, nor the surroundings, correspond with the poet's description; and arrives at the somewhat unsatisfactory conclusion, "that the Homeric data are essentially irreconcilable with each other, being, in fact, derived partly from Bunárbashi, and partly from Hissarlik." He adds that, in his belief, "Bunárbashi was the place where the oldest legends or lays, local to the Troad, placed Troy," and that "Hissarlik may have been the centre around which poets of the Ionian epic school grouped incidents or traits which they added to the original nucleus."

I may remark, however, that this is just the opposite to the order in which legends would seem likely to grow. I should rather have expected that the story would have been originally told about the city which was burnt, and afterwards, when the site was forgotten, have been transferred to some neighbouring locality where the surroundings are more imposing or romantic.

It must, at any rate, be admitted, that the discoveries of Dr. Schliemann, both in the way of ruined walls and buildings which he has found, and of pottery, jewellery, wrought metals, and armour which he has collected, are amongst the most valuable of the many additions that have been made in recent years to our knowledge of archæology, although he has probably gone too far in identifying the several remains of antiquity which he has brought to light with the subjects mentioned in legends which have been handed down to us through the uncertain traditions of the poets.

The unhappy complications in Eastern Europe of a few years ago have at least brought forth some good results to antiquarian research. Thessaly having been ceded to Greece, learned men at Athens are already taking steps for the preservation of any objects of interest which may be brought to light on that classic soil. In Cyprus, English, Greek, and Turk are united in the careful search for Cypriotic, Phœnician, and Greek remains, which no doubt still abound in that island, no longer, I am glad to say, to sell to the highest bidder in Western Europe or America, but to form a local museum at Nicosia.

The Commission which is now labouring at Rome has already been rewarded, besides minor triumphs, by the discovery of the walls of Antemnæ, a city which is mentioned by Virgil, when he tells how—

> Five mighty towns, their anvils set,
> With emulous zeal their weapons whet:
> Crustumium, Tibur the renowned,
> And strong Atina there are found,
> And Ardea and Antemnæ crowned
> With turrets round her wall;

and which is stated by Livy to have been the birth-place of Hersilia, the wife of Romulus, and to have been one of the cities that joined in the attack on Rome in revenge for the rape of the Sabines. How far we can regard the incidents related by Livy as literally true, or whether we must treat them as a vast pile of legend built on a slender foundation of history, it would be out of place for me here to consider; but at least we may take it as a fact that Antemnæ was a town which flourished ere Rome was built, and was destroyed long before the time of Pliny, and that even a very few years since it was believed that no traces of it could be found.

Turning to geographical research, much valuable information has been obtained concerning the hitherto little known countries of Central Asia, by the explorations of O'Donovan in the Merv Oasis, by Floyer in Beloochistan, Baber in Western China, and other travellers both English and Russian.

The results of the interesting geographical and ethnological investigations made by my friend M. Miklouho Maclay during his scientific travels in South-Eastern Asia and Oceanica, have been given to the world by means of lectures before the Russian Geographical Society, and are soon to appear in a complete form, the work being published at the expense of the Emperor. Recent events, which have turned our attention to New Guinea, make the information he has collected during several prolonged visits to that island of special importance. So determined was M. Maclay to lose no opportunity of acquiring a knowledge of the Papuan raçe, that he submitted to all the discomforts of living amongst them for several months at a time, away from all European society, dwelling in a small hut, and for some time supporting himself by hunting. He has come to the conclusion (in opposition to the view formerly held) that the inhabitants of New Guinea are all of one race, although some who dwell near the coast have intermarried with the Malays and the inhabitants of other islands; and so low is the stage of culture to which they have attained that they have not learned even how to kindle a flame, but can only carry a torch from another fire; yet even amongst savages such as these the labours of the missionaries have not been in vain, as they have succeeded in teaching them something of the truths of the Christian religion, and have introduced the art of reading and writing. M. Maclay is of opinion, although he will not speak positively until he has made further investigations, that the Australian blacks are not connected either with the Papuans or the Polynesians, but form an independent race. I have lately heard that he has returned to this part of the world to carry on his ethnological investigations; and I trust that, should he come to New Zealand, he will be cordially welcomed by the members of the Institute.

Whilst speaking on this subject I should like to draw the attention of all here to the Geographical Society of Australasia, which, I learn, has been founded, and before which an interesting paper on New Guinea was lately read by Mr. La Meslee. I believe that the establishment of a society by which the residents in the various colonies would be united for the advancement of geographical knowledge, more especially in connection with the imperfectly known parts of Australasia, would be of great value, whether regarded from a scientific, commercial, or educational point of view, and I sincerely hope that New Zealand will unite with the other colonies in so admirable an undertaking.

The hand of death seems to have been unusually busy during the past year amongst men of science and letters. Scarcely had the grave closed over the remains of Charles Darwin before the news reached us of the fatal accident which had carried away Professor Balfour, at the early age of 32, one of the ablest and most promising men of his generation at Cambridge. In Professor Palmer we have lost one of the brightest scholars of Oriental literature. Amongst others whose loss we have to deplore are—Mr. Green, whose careful researches, made in spite of all the obstacles of a life of anxiety and feeble health, have placed English history in a new light; Robertson, the Ecclesiastical historian; Anthony Trollope, one of the most popular of modern novelists; Stanley Jevons, the logician; and, last not least, Spottiswoode, the late President of the Royal Society, a man celebrated no less for his ability and scientific attainments than for his high character and benevolence, lately laid to rest in Westminster Abbey, amidst statesmen, warriors, poets, and heroes of literature and science, whose names will ever be honoured throughout the British Empire.

And now, having referred to the history of the Institute in the past, and glanced at a few of the principal events which have recently taken place in the world of science and literature, I turn to the future, and ask, what do we set before us as the object of the Institute, and with what attainment may we rest content? I have already spoken of the various subjects which were specially recommended for study fourteen years ago. Of these, some few (such as the history of the Maori race, about which Mr. Colenso, Mr. Travers, and others have contributed valuable and exhaustive papers) may be considered as almost completed; others, perhaps, have for various reasons ceased to be of importance; but the large majority call for further investigation, and will for many years demand careful research. I think, too, that the time has come when it may fairly be considered whether the subjects on which papers are specially desired should not take a wider range. The Institute and the incorporated societies supply machinery which is already being utilized, but which I believe to be capable of being utilized to a greater extent than it is at present, in the grand work of diffusing general education. In this sense I regard the Institute as supplementary to the schools, which are so rapidly increasing in number, and the University Colleges which are being established in all the centres of population in New Zealand, as a means by which that spirit of inquiry which has been aroused in early youth may find scope in later life. The great discoveries that are being every day made in the scientific world show us that, in the present state of society, some amount of scientific education is, in most cases, essential to make a successful practical man, a fact which none are more ready to admit than those who themselves feel the want of such a training. At the same time I would impress on every member of the Society that science, in the popular sense of the term, is only a part of education; and I trust the day may be far distant when literature is neglected, as some fear it may be, for the study alone of purely external objects. I believe that vast good is done by those who bring before the notice of others the thoughts and actions of great men, whether in ancient or modern times, in other parts of the world. By this means, a healthy desire for improvement may be instilled into the minds of many who otherwise would have but little inclination or opportunity for independent study, and the general taste will be elevated. At the same time let each man who has the ability add something original, in his own department of information, whether pertaining to science or literature, to the common stock of knowledge.

It is thus that we, who have derived so rich an inheritance from the toils, the attempts, and even the failures of our ancestors, may, in our turn, labour to lay up a store for our descendants which shall make them nobler, wiser, and more enlightened than ourselves; thus, that each generation may rise superior to those which have gone before; thus, that the dreams of the Past may become the realities of the Present and the starting-point for the Future. In the words of the poet,—

> Thy far-off children shall possess
> That flying gleam of rainbow happiness:
> Each wish unfilled, impracticable plan,
> Goes to the forging of the force of man;
> Thro' thy blind craving novel powers they gain,
> And the slow race develops in its pain.
> See their new joy, begotten of thy woe,
> When what thy soul desired their soul shall know;
> Thy heights unclimbed shall be their wonted way,
> Thy hope their memory and thy dream their day.

TRANSACTIONS

TRANSACTIONS

OF THE

NEW ZEALAND INSTITUTE

1883.

I.—ZOOLOGY.

Art. I.—*Descriptions of New Zealand* Micro-Lepidoptera.*

By E. Meyrick, B.A.

[*Read before the Philosophical Institute of Canterbury, 3rd May,* 1883.]

III.—ŒCOPHORIDÆ.

The *Œcophoridæ* are the principal family of the *Tineina* in New Zealand, as in Australia, and attain considerable development; 55 species are here described, but the actual number is probably much more considerable. In addition to those characterized, I have included in an appendix references to descriptions of some other species, which I have not yet satisfactorily identified. The family here constitutes about a sixth of the entire *Micro-Lepidoptera;* in Australia it forms more than a fourth, whilst in Europe it is about a thirtieth.

I have elsewhere discussed the internal development of the family, and its relation to other families of the group, and need not again enter into these questions. Two points, however, present themselves, on which something needs to be said; firstly, the relation of this portion of the fauna to Australian forms, and secondly, the inferences to be drawn from the character of the fauna itself.

Since the family occupies such a prominent position in both Australia and New Zealand, compared with such other regions as are yet known, it seems at first sight reasonable to infer a more or less close interconnection between the species of these two countries. Such an impression is not confirmed on investigation. No species is yet known common to both. Fourteen genera are found in New Zealand; of these, ten are endemic, three occur also in Australia, and one is cosmopolitan. Of the three genera shared with Australia, two (*Eulechria* and *Phlæopola)* are large and typically Australian genera, represented in New Zealand by three species, obviously mere stragglers; the third, *Trachypepla*, is a typical New Zealand genus of

* For Parts I. and II., see Trans. N.Z. Inst., vol. xv., art. i.

probably considerable extent, and is represented in Australia by two species only, evidently also stray wanderers. Of the ten endemic genera, none are very closely related to Australian forms; the nearest approach is made by *Nymphostola* and *Proteodes*, monotypic genera which are certainly akin to *Hoplitica*, but whose common ancestor must have possessed characters not now exhibited by any allied Australian genus. Nearly the same may be said of the affinity of *Atomotricha* and *Brachysara* with *Eulechria*. The other six, of which three are probably rather extensive, are more closely allied to each other and to *Œcophora* than to any Australian form. Finally, although *Œcophora* is a cosmopolitan genus, the New Zealand species appear to form a single numerous group, having no direct affinity with the Australian species of the genus, any more than with the European. From these facts it may be concluded that it is not improbable that a slight interchange of species has taken place at some date not exceedingly remote, but that it is certain that almost the whole of the group is of much more ancient origin, and was derived from another and quite distinct region. I consider it probable that a much closer affinity will be found to exist with South America, of which little is known in this group; but there is one well-defined case of relationship, viz., between *Gonionota* and *Semiocosma*, which are apparently more nearly related together than to any other genus. Attention should also be given to the undoubted affinity of *Trachypepla* with the European *Anchinia* and *Cacochroa;* these latter are very small genera, remote from any other European forms, and of Alpine habit; they are probably surviving remnants of a once more extensive stock.

It is remarkable that of the New Zealand genera not one has vein 7 of the forewings terminating in the hindmargin. This character is found in more than half of the Australian genera, many of them being of great extent and doubtless also of considerable age. Nearly all the New Zealand species belong to the group in which vein 7 terminates in the costa, and this is undoubtedly much older, being the original type of the family; a few are of the intermediate form, in which this vein terminates in the apex. It is clear, then, that this portion of the New Zealand fauna is older than the corresponding group in Australia. It is important that the food-plants of the larvæ should be ascertained; they would probably point to the oldest portion of the New Zealand flora. It is probable that *Trachypepla* and *Semiocosma*, like other principal genera of these islands, are attached to lichens or mosses. Several species of *Œcophora* seem to be specially adapted to *Fagus solandri*, as also is *Proteodes*, all being protectively coloured.

It will be necessary to examine the South Pacific Islands, before the origin of the New Zealand fauna can be decided. I made a hurried inspection of the Rev. T. Blackburn's collections from the Hawaiian Islands; the *Œcophoridæ* appeared to be altogether absent, their place being taken by a peculiar group of the *Gelechidæ*.

The following is an abstract of the family characters of the *Œcophoridæ*, which will be found given more fully in my paper on Australian species of the family :—

Head with appressed hairs and side-tufts. Antennæ shorter than forewings, in male regularly ciliated, basal joint often with a pecten of long hair-scales. Maxillary palpi usually distinct, small, simple. Labial palpi well developed, curved, ascending, acutely pointed. Hindwings not broader than forewings, elongate-ovate or lanceolate (not in New Zealand). Forewings with 12 veins, 7 and 8 stalked, 7 to costa or apex (elsewhere also to hindmargin), 1 furcate at base. Hindwings with 8 veins, 3 and 4 from a point, 6 and 7 parallel.

Larva sixteen-legged, habits various.

The following is a tabulation of the fourteen New Zealand genera :—

1a. Vein 7 of forewings to apex.
  2a. Forewings with tufts of raised scales.
    3a. Ciliations of antennæ moderate, even .. .. 7. *Trachypepla.*
    3b. „ „ „ long, fasciculated .. .. .. 4. *Atomotricha.*
  2b. Forewings smooth.
    3a. Thorax crested .. .. 6. *Phlæopola.*
    3b. „ smooth.
      4a. Ciliations of antennæ long (5) .. .. 5. *Brachysara.*
      4b. „ „ „ moderate (1 to 2) .. .. .. 3. *Eulechria.*
      4c. „ „ „ very short (⅛).
        5a. Second joint of palpi shortly tufted beneath .. 1. *Nymphostola.*
        5b. „ „ „ „ „ evenly scaled .. .. .. 2. *Proteodes.*
1b. Vein 7 of forewings to costa.
  2a. Terminal joint of palpi with median tooth of scales .. .. 9. *Semiocosma.*
  2b. „ „ „ „ „ smooth.
    3a. Second joint of palpi more or less tufted beneath.
      4a. Vein 2 of forewings widely remote from angle of cell .. 8. *Aochleta.*
      4b. „ „ „ „ near angle .. .. 11. *Thamnosara.*
    3b. Second joint of palpi evenly scaled.
      4a. Basal joint of antennæ without pecten.
        5a. Thorax crested .. .. 10. *Lathicrossa.*
        5b. „ smooth .. .. 12. *Gymnobathra.*
      4b. Basal joint of antennæ with pecten.
        5a. Ciliations of antennæ in an even series .. .. 13. *Œcophora.*
        5b. „ „ „ whorled or clothing whole surface 14. *Cremnogenes.*

1. NYMPHOSTOLA, Meyr.

Head loosely haired, sidetufts large, dilated posteriorly; in male an expansible pencil of long hairs on side of face beneath eye. Antennæ in male stout, somewhat serrate, very shortly ciliated (⅛), basal joint rather stout, without pecten. Palpi moderately long, second joint reaching base of antennæ, clothed with dense rather loose scales, with a short projecting triangular tuft of scales beneath towards apex, terminal joint as long as second, stout, strongly reflexed. Thorax smooth. Forewings somewhat oblong, broad, apex obtusely rounded, hindmargin perpendicular, rounded beneath. Hindwings as broad as forewings, broadly ovate, apex and hindmargin evenly rounded, cilia $\frac{1}{6}$. Abdomen moderate. Middle tibiæ roughly haired beneath; posterior tibiæ clothed with rather short rough hairs. Forewings with vein 7 to apex, 2 from distinctly before angle of cell. Hindwings with vein 5 bent and approximated to 4 at base.

This and the next genus are very closely allied, differing mainly in the structure of the palpi. Both are confined to New Zealand, but remote in character from the other New Zealand genera of the family, closely approaching the Australian *Hoplitica*, from which they are distinguished by the very short ciliations of the antennæ. Both must be regarded as descendants of a common ancestor, very nearly resembling *Hoplitica*, and doubtless an immigrant from Australia.

1. *Nymph. galactina*, Feld.

(*Cryptolechia galactina*, Feld., Reis. Nov., Pl. CXL., 34; (*Nymphostola*) Meyr., Proc. Linn. Soc. N.S.W., 1882, 492).

Media, alis ant. niveis, puncto disci postico nigro, venis omnibus punctis minimis griseis notatis; post. niveis.

Male, female.—23–26 mm. Head, palpi, antennæ, thorax, abdomen, and legs snow-white. Forewings broad, costa strongly arched, apex obtuse, hindmargin straight, not oblique; white, with a faint greenish tinge between the veins; all the veins are marked at regular intervals with faint minute dark grey dots; a more conspicuous dark grey dot in disc beyond middle; a very slender indistinct dark grey hindmarginal line: cilia white. Hindwings and cilia white.

A very delicate and conspicuously distinct species.

Stated by Professor Hutton to have been bred from a green pupa found on *Myrtus bullata*.

Hamilton, Dunedin, and Otira Gorge, in January; probably widely distributed in forest regions.

2. Proteodes, Meyr.

Head with appressed scales, sidetufts large, spreading. Antennæ in male moderate, somewhat serrate towards apex, very shortly ciliated ($\frac{1}{3}$), basal joint moderate, without pecten. Palpi moderately long, second joint reaching base of antennæ, thickened with appressed scales, rather rough beneath, terminal joint much shorter than second, rather stout, slightly rough anteriorly. Thorax smooth. Forewings somewhat oblong, moderately broad, apex obtusely rounded, hindmargin not oblique. Hindwings as broad as forewings, ovate, rounded, cilia $\frac{1}{5}$. Abdomen moderate.

Posterior tibiæ clothed with rather short rough hairs. Forewings with vein 7 to apex, 2 from before angle of cell. Hindwings with vein 5 bent and approximated to 4 at base.

2. *Prot. carnifex*, Butl.

(*Cryptolechia carnifex*, Butl., Proc. Zool. Soc. Lond., 1877, 406; (*Proteodes*) Meyr., Proc. Linn. Soc. N.S.W., 1882, 493; *Cryptolechia rufosparsa*, Butl., l.c. 406).

Media, alis ant. griseo-ochreis vel flavis, interdum ferrugineis, costa ferruginea, linea perobliqua punctoque disci obscuris griseis, venis omnibus punctis crebris griseis notatis; post. albis, apice leviter griseo.

Male, female.—20–23 mm. Head, palpi, and thorax whitish-ochreous or yellow, palpi generally somewhat suffused with ferruginous. Antennæ grey. Abdomen whitish. Legs ochreous-whitish, tarsi more ochreous, anterior tibiæ and tarsi dull ochreous-carmine. Forewings rather broad, posteriorly dilated, costa rather strongly arched, in female faintly sinuate in middle, apex obtuse, hindmargin nearly straight, not oblique; light greyish-ochreous or yellow, often irregularly suffused with reddish or ferruginous, sometimes wholly; costal edge obscurely ferruginous or deeper yellow, except about $\frac{1}{3}$ and $\frac{2}{3}$; sometimes an irregular greyish suffusion; the darker shades of colour, when distinct, usually tend to form a very oblique transverse fascia before middle, extending along costa to base, and a large patch along posterior half of costa; a curved linear dark ferruginous or blackish-grey mark in disc, extending from $\frac{1}{3}$ to $\frac{2}{3}$, extremities directed upwards, generally obsolete in middle, or sometimes wholly; all veins regularly dotted with blackish-grey, but these dots sometimes obsolete; often a dark grey hindmarginal line: cilia light greyish-ochreous or yellow. Hindwings whitish, apex often narrowly suffused with grey, sometimes with a grey marginal line; cilia whitish.

Extremely variable; the yellow and ferruginous forms (which are principally characteristic of the female) are strikingly similar in size, shape, and colouring to the decaying or fallen leaves of the beech, which is its principal food-plant. Mr. J. D. Enys called my attention to this mimetic resemblance, in which most of the beech-feeding insects participate.

Larva 16-legged, rather stout, cylindrical, tapering behind; pale whitish-green or yellowish-green, on sides generally more greyish-green; dorsal broad, irregular, dark fuscous-purple, sap-green, or yellowish-green mixed with reddish-ochreous, bisected by a slender interrupted whitish-line, and dilated on posterior margin of segments; lateral sap-green or obsolete; subspiracular slender, interrupted, dark fuscous-purple or faintly pinkish; spots small, shining, dark-fuscous; head ochreous-brown or yellowish-green; second segment greener than body, or blackish marbled with pale ochreous; remarkably variable. Feeds on *Fagus solandri* (the common mountain beech, miscalled "birch"), making a slight web amongst the leaves, from which it is very readily dislodged. Pupa short, stout, pale-greenish, irregularly shaded with brownish, in a slight cocoon. Although specially attached to the *Fagus*, on which it occurs in great abundance, the larva probably affects various shrubs; and I think I have met with it on *Fuchsia excorticata.*

Christchurch, Mount Hutt, Castle Hill, Arthur's Pass, from January to April; larvæ in all stages in January.

3. Eulechria, Meyr.

Head loosely scaled, sidetufts large. Antennæ in male moderate, evenly and moderately or rather strongly ciliated (1 to 2), basal joint moderate, with strong pecten. Palpi moderate or rather long, second joint hardly reaching or rarely somewhat exceeding base of antennæ, thickened with appressed scales, somewhat loose or slightly rough beneath, terminal joint somewhat shorter than second, moderate, recurved. Thorax smooth. Forewings elongate, moderate, apex rounded more or less strongly, hindmargin obliquely rounded. Hindwings slightly narrower than forewings, elongate-ovate, hindmargin rounded, cilia $\frac{1}{2}$ to 1. Abdomen moderate, generally strongly margined. Posterior tibiæ clothed with long hairs above. Forewings with vein 7 to apex, 2 from or close before angle of cell. Hindwings normal.

A very large Australian genus, represented in New Zealand by two species very different from each other, but quite of Australian types; they appear to be stray immigrants. This and the four succeeding genera are nearly allied together, and are quite distinct from those that precede and follow.

3. *Eul. zophoëssa*, Meyr.

(*Eulechria zophoëssa*, Meyr., Proc. Linn. Soc. N.S.W., 1882, 515.)

Minor, alis ant. fuscis, punctis disci tribus, macula costæ post medium parva, strigaque postica flexuosa saturatioribus; post. saturate griseis.

Male.—15$\frac{1}{2}$ mm. Head fuscous, mixed with whitish-ochreous. Palpi dark fuscous, second joint whitish-ochreous internally and at extreme apex, apex of terminal joint whitish-ochreous. Antennæ dark fuscous. Thorax dark fuscous, becoming ochreous posteriorly. Abdomen dark fuscous. Anterior and middle legs dark fuscous, tarsi whitish-ochreous beneath; posterior legs dark grey, apex of joints whitish-ochreous. Forewings somewhat dilated, costa gently arched, apex rounded, hindmargin obliquely rounded; fuscous, slightly reddish-tinged, basal $\frac{3}{5}$ irregularly mixed and suffused with whitish-ochreous, and thinly irrorated with dark fuscous, hindmargin rather broadly suffused with dark fuscous; a small dark fuscous spot at base of costa, and another at base of inner margin; a small dark fuscous spot in disc before middle, a second in disc beyond middle, and a third almost directly beneath first on fold; first and second connected by a clear whitish-ochreous line, beneath which is a fourth similar spot between them; a small dark fuscous spot on costa at $\frac{3}{5}$, its apex suffusedly confluent with second discal spot; a very indistinct suffused strongly curved dark fuscous line from $\frac{3}{4}$ of costa to anal angle, beneath closely approximating to hindmargin: cilia dark fuscous-grey, mixed with whitish-ochreous. Hindwings dark grey; cilia grey, with a dark grey line near base.

An inconspicuous but distinct species.

Wellington, in January; one specimen.

4. *Eul. photinella*, Meyr.

(*Eulechria photinella*, Meyr., Proc. Linn. Soc. N.S.W., 1882, 541.)

Minor, alis ant. albido-griseis, basi, maculis costæ duabus obscuris, tertia dorsi, quarta apicis, punctis disci tribus strigaque postica saturate griseis; post. griseis.

Male.—17 mm. Head fuscous-grey mixed with ochreous-whitish, especially on face. Palpi fuscous-grey, base of terminal joint, and extreme apex of second ochreous-whitish. Antennæ grey. Thorax fuscous-grey, irrorated with whitish. Abdomen light ochreous-grey, anal tuft whitish-ochreous. Anterior and middle legs dark fuscous-grey, with ochreous-whitish rings at middle and apex of tibiæ, and apex of tarsal joints; posterior legs ochreous-whitish, tarsal joints grey towards base. Forewings moderately elongate, somewhat dilated, costa moderately strongly arched, apex round-pointed, hindmargin very obliquely rounded; light fuscous-grey, irregularly irrorated and suffused with whitish, especially in disc and posteriorly; base of wing very narrowly suffused with dark fuscous; a very ill-defined small dark fuscous-grey spot on costa at $\frac{2}{5}$, and a similar rather larger one on costa slightly beyond middle; a third on inner margin slightly before middle; a tolerably well-defined small roundish dark fuscous spot in disc before middle, a second obliquely before it on fold, and a third in disc beyond middle; a short inwardly oblique cloudy dark fuscous-grey streak from costa at $\frac{4}{5}$, emitting an irregular outwards-curved line to inner margin before anal angle; apex dark fuscous-grey: cilia whitish, at and above apex suffused with grey, on basal half mixed irregularly with dark fuscous-grey. Hindwings grey; cilia white, with a dark grey line near base.

Wellington, in January; one specimen.

4. ATOMOTRICHA, Meyr.

Head with appressed scales, sidetufts small. Antennæ in male moderate, with fine long ciliations (5), in whorls of six at apex of joints, basal joint moderate, with strong pecten. Palpi moderately long, second joint exceeding base of antennæ, clothed with appressed scales, rough and somewhat furrowed beneath, terminal joint shorter than second, slender, recurved. Thorax smooth. Forewings elongate, apex rounded, hindmargin very obliquely rounded, surface with tufts of scales; in female abbreviated, broadly lanceolate. Hindwings as broad as forewings, elongate-ovate, hindmargin rounded, cilia $\frac{3}{5}$; in female much abbreviated, lanceolate or almost obsolete. Abdomen moderate. Posterior tibiæ clothed with loose hairs above. Forewings with vein 7 to apex, 2 from hardly before angle of cell. Hindwings normal.

Allied to *Eulechria*, differing in the long whorled ciliations of the antennæ, the tufts of scales on the surface of forewings, and the abbreviated wings of the female. This and the following genus are closely allied, and are apparently descendants of a single progenitor, both being confined to New Zealand; these two genera stand in exactly the same mutual relation as *Hoplitica* and *Proteodes*.

5. *Atom. ommatias*, n. sp.

Media, alis ant. fuscis, saturatiori-nebulosis, signis disci tribus arcuatis lineaque postica transversa obscuris saturatioribus: post. albido-griseis.

Male.—21–24 mm.; *female.*—13–18 mm. Head, palpi, and thorax pale fuscous, more or less suffused with dark fuscous. Antennæ pale fuscous, slenderly annulated with dark fuscous. Abdomen ochreous-whitish. Legs ochreous-whitish, tarsal joints suffused with dark fuscous towards base. Forewings elongate, somewhat dilated posteriorly, costa moderately arched, apex round-pointed, hindmargin very obliquely rounded; light fuscous, irregularly or wholly suffused with dark fuscous; a large tuft of raised scales almost at base, and two or three much smaller in disc; an obscurely indicated pale dot in disc before $\frac{1}{3}$, partially surrounded by a dark ring, and a similar one on fold obliquely beyond it; a dark fuscous crescentic spot in disc slightly beyond middle, extremities directed downwards, anteriorly and posteriorly distinctly margined with paler; a slender dark fuscous transverse line from $\frac{4}{5}$ of costa obliquely outwards, twice angulated above middle, thence running to $\frac{4}{5}$ of inner margin, often obsolete: cilia pale fuscous, mixed with dark fuscous, with a row of cloudy dark fuscous spots. Hindwings whitish-grey or grey, with a darker grey discal spot; cilia grey-whitish, with one or two cloudy dark grey lines.

Considerably broader-winged, and generally darker, than *Brach. sordida*.

An early spring species, occurring tolerably commonly at rest on tree-trunks and fences round Christchurch, in August and September; the female is quite incapable of flight.

5. BRACHYSARA, Meyr.

Head smooth, sidetufts small, appressed. Antennæ in male moderate, with fine long ciliations (5), in whorls of eight at apex of joints, basal joint moderate, with strong pecten. Palpi short, second joint not nearly reaching base of antennæ, with short loose rough hairs beneath somewhat projecting anteriorly, terminal joint short, slender, curved. Thorax smooth. Forewings elongate, apex rounded, hindmargin very obliquely rounded. Hindwings as broad as forewings, elongate-ovate, hindmargin very faintly sinuate, cilia 1. Abdomen moderate. Posterior tibiæ clothed with loose hairs above. Forewings with vein 7 to apex, 2 from hardly before angle of cell. Hindwings normal.

Closely allied to the preceding genus, but differing in the structure of the palpi, and the smooth surface of forewings. The female is unknown to me, but I should not be surprised to find that it had abbreviated wings, as in *Atomotricha*.

6. *Brach. sordida*, Butl.

(*Œcophora sordida*, Butl., Proc. Zool. Soc. Lond., 1877, 405.)

Media, alis ant. angustis, dilute fuscis, vitta media nigricante interdum obsoleta, signis disci duobus arcuatis lineaque postica transversa obscuris saturatioribus; post. albidis.

Male.—20–21 mm. Head, palpi, and thorax light fuscous, somewhat mixed with darker. Antennæ light fuscous. Abdomen ochreous-whitish. Legs ochreous-whitish, anterior pair obscurely suffused with fuscous. Forewings elongate, narrow, costa slightly arched, distinctly sinuate in middle, apex round-pointed, hindmargin extremely oblique, slightly rounded; light fuscous, sometimes slightly mixed with darker; a straight narrow tolerably well-defined blackish longitudinal streak somewhat above middle from base nearly to apex, tending to be very slightly interrupted at $\frac{1}{3}$ and $\frac{2}{3}$, rather suffused beneath towards apex and near base, sometimes entirely obsolete; when obsolete, there are sometimes visible an arched fuscous mark before $\frac{1}{3}$ and another just beyond middle, which are usually obscured by the streak; a slender very obscure fuscous transverse line from $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin, twice angulated above middle, usually terminating the longitudinal streak, often obsolete: cilia light fuscous, with a cloudy blackish interrupted basal line. Hindwings whitish, slightly suffused with ochreous-grey towards costa; cilia whitish, with faint cloudy grey basal and apical lines.

Variable in respect of the central streak, but easily known at once from the preceding species by the narrower wings, apart from generic differences. Butler's description would do tolerably for either, but I have seen a specimen of this species identified by Butler himself.

Mr. R. W. Fereday formerly met with this species abundantly in the Rakaia district.

6. Phlœopola, Meyr.

Head with loosely appressed scales, sidetufts large, loosely spreading. Antennæ in male moderately stout, somewhat serrate, moderately and evenly ciliated (1), basal joint rather elongate, moderate, without pecten. Palpi long, second joint reaching or exceeding base of antennæ, dilated with dense appressed scales, slightly rough beneath, terminal joint as long as second or somewhat shorter, moderate or stout, strongly recurved. Thorax with dense posterior crest. Forewings elongate, moderate, apex bluntly rounded, hindmargin obliquely rounded. Hindwings as broad as forewings or somewhat narrower, elongate-ovate, hindmargin rounded, cilia $\frac{1}{2}$ to $\frac{2}{3}$. Abdomen moderate, strongly margined. Middle tibiæ with a median whorl of projecting hairs, and roughly short-haired beneath; posterior tibiæ clothed with long dense hairs above. Forewings with vein 7 to apex, 2 from angle of cell. Hindwings normal.

An Australian genus of moderate extent; the single New Zealand species appears truly referable here, but my specimen is hardly good enough to allow of accurate determination.

7. *Phlœ. dinocosma*, n. sp.

Media, alis ant. fuscis, ochreo-nebulosis, costa partim, dorsi basi, maculis disci tribus strigulaque media nigricantibus; post. albido-griseis, lunula media saturatiore.

Male.—19 mm. Head pale ochreous, with a few dark fuscous scales between antennæ, and a dark fuscous spot on each side of crown. Palpi with second joint whitish-ochreous, base and a subapical ring dark fuscous, terminal joint dark fuscous, apex, base, and anterior edge whitish-ochreous. Antennæ pale ochreous, indistinctly ringed with dark fuscous. Thorax pale ochreous, anteriorly suffused with dark fuscous. Abdomen whitish-ochreous. Anterior and middle legs dark fuscous, tibiæ with central and apical whitish-ochreous rings, tarsi with whitish-ochreous rings at apex of joints; posterior legs ochreous-whitish, tarsal joints somewhat infuscated at base. Forewings moderate, posteriorly dilated, costa gently arched, apex rounded, hindmargin obliquely rounded; pale ochreous, coarsely and suffusedly irrorated with fuscous; costal edge suffusedly dark fuscous, interrupted by a very small pale ochreous spot in middle, and a rather larger one at $\frac{3}{4}$; a dark fuscous spot at base of costa, and a linear mark along base of inner margin; a short linear dark fuscous mark along fold near base; a very small round dark fuscous spot in disc at $\frac{1}{3}$, and a rather larger subquadrate spot below and slightly beyond it, both margined anteriorly and posteriorly with pale ochreous; an irregular subquadrate suffused dark fuscous spot in disc beyond middle, similarly margined; between this and first discal spot is a short longitudinal dark fuscous streak; a small suffused dark fuscous spot beyond third discal spot; from costal spot at $\frac{3}{4}$ proceeds a slender irregular outwards-curved pale ochreous line to before anal angle, touching this spot posteriorly; a suffused dark fuscous line along hindmargin and apical fourth of costa, interrupted by pale ochreous dots: cilia whitish-ochreous, mixed with fuscous, with clear whitish-ochreous spots opposite hindmarginal dots. Hindwings light-grey, more whitish-grey towards base, with a distinct crescentic-oval darker grey spot in middle of disc; cilia grey-whitish, with an indistinct grey line near base.

Immediately separable from all other species of the genus by the distinct central lunule of the hindwings.

Wellington, in January; one specimen.

7. TRACHYPEPLA, Meyr.

Head loosely haired, sidetufts moderate or rather large, loosely spreading. Antennæ in male moderate, somewhat serrate, moderately and evenly ciliated (1 to $1\frac{1}{2}$), rarely fasciculated, basal joint moderate, with strong pecten. Palpi moderate or rather short, second joint not exceeding base of antennæ, densely scaled, somewhat rough beneath, terminal joint markedly shorter than second, moderate, curved. Thorax smooth or crested posteriorly. Forewings elongate, moderate or narrow, apex obtuse, hindmargin very oblique; surface with tufts of raised scales. Hindwings distinctly narrower than forewings, elongate-ovate, hindmargin slightly rounded, cilia $\frac{3}{4}$ to 1. Abdomen moderate, strongly margined. Posterior tibiæ clothed with fine moderately long hairs above. Forewings with vein 7 to apex, 2 from angle of cell. Hindwings normal.

An interesting and characteristically New Zealand genus, of which at present only two other species are known, from Eastern Australia. Amongst the genera with vein 7 to apex, it is immediately known by the tufts of scales on the forewings, and the moderate ciliations of the antennæ. It is certainly allied to the European *Anchinia* and *Cacochroa*, but is of an older type. The larvæ are unknown, but I think it probable that they may be found to feed on moss or lichens. The species are forest-frequenting, and often found at rest on fences or tree-trunks. The first three species appear to mimic the droppings of birds, and the rest moss or lichens.

With respect to the variation of structure, *T. leucoplanetis*, *T. spartodeta*, *T. anastrella*, and *T. lichenodes* have the thorax distinctly crested, whilst in the rest it is smooth. *T. leucoplanetis* and *T. anastrella* have longer ciliations of the antennæ ($1\frac{1}{2}$), and in the latter species they are distinctly fasciculated; in all the other species of which the male is known the ciliations are moderate and even. The genus does not, however, admit of subdivision.

The following is a tabulation of the species :—

1a. Head dark fuscous.
  2a. Forewings with clear white markings.
    3a. Basal half white .. .. 8. *leucoplanetis.*
    3b. „ third „ .. .. 9. *euryleucota.*
    3c. „ fifth „ .. .. 10. *conspicuella.*
  2b. Forewings without white markings .. .. 16. *anastrella.*
1b. Head light greyish or ochreous.
  2a. Hindwings dark fuscous .. .. 17. *lichenodes.*
  2b. „ grey.
    3a. Anterior transverse line very obtusely angulated .. .. 12. *nyctopis.*
    3b. „ „ „ rectangularly „ .. .. 11. *spartodeta.*
    3c. „ „ „ acutely „ .. .. 14. *protochlora.*
  2c. Hindwings grey-whitish .. .. 15. *aspidephora.*
1c. Head white .. .. 13. *galaxias.*

8. *Trach. leucoplanetis*, n. sp.

Parva, alis ant. dimidio anteriori niveo, posteriori fusco, costæ basi nigricante, macula costæ anteapicali cum linea transversa conjuncta nivea ; post. griseis.

Male.—11–12½ mm. Head dark fuscous, face white. Palpi dark fuscous mixed with white, internally whitish. Antennæ dark fuscous. Thorax dark fuscous, posteriorly mixed with white. Abdomen whitish-grey. Legs dark fuscous, middle tibiæ with central and apical whitish rings, posterior tibiæ whitish, all tarsi with whitish rings at apex of joints. Forewings moderate or rather short, costa moderately arched, apex round-pointed, hindmargin obliquely rounded ; white, very faintly ochreous-tinged in disc ; base of costa dark fuscous, dilating basally to touch inner margin ; a large fuscous-grey transverse patch, its inner edge nearly straight, extending from middle of costa to middle of inner margin, outer edge convex below middle, extending from ¾ of costa to middle of hindmargin, margins irregularly mixed with blackish, and containing some white scales in disc and towards anal angle, and some spots of raised ferruginous scales partially margined with blackish ; a grey spot on costa before apex, and a small irregular grey patch extending along upper part of hindmargin : cilia grey, white at base along hindmargin and below anal angle. Hindwings grey, apex darker ; cilia grey.

The smallest and proportionally shortest-winged species of the genus, very distinct.

Hamilton and at the foot of the Otira Gorge, in January ; two specimens.

9. *Trach. euryleucota*, n. sp.

Minor, alis ant. saturate fuscis, macula magna basali alteraque parva costæ postica lineam transversam emittente canis, costæ basi nigra ; post. saturate griseis.

Male, female.—14–17 mm. Head, palpi, and antennæ dark fuscous. Thorax white, anterior margin dark fuscous. Abdomen fuscous. Legs dark fuscous, apex of tarsal joints obscurely pale. Forewings elongate, costa arched towards base and apex, rest nearly straight, apex round-pointed, hindmargin very obliquely rounded; dark fuscous; a large white basal patch, slightly ochreous-tinged, outer edge slightly irregular, extending from $\frac{1}{4}$ of costa to before middle of inner margin; a small elongate blackish spot on base of costa; two large spots of raised ochreous-brown scales, partially black-margined, in disc before middle, and two smaller ones beyond middle; a small somewhat triangular inwardly oblique white spot on costa at $\frac{4}{5}$, emitting from its apex a slender white outwards-angulated line to hindmargin above anal angle, anteriorly blackish-margined: cilia fuscous-grey, with an obscure darker line. Hindwings fuscous-grey, darker towards apex; cilia fuscous-grey, with an obscure darker line.

Nearly allied to the following, but immediately known by the considerably larger white basal patch, and differing also in the unevenly arched costa and deeper colouring, with the clear white thorax.

Auckland, Wellington, Dunedin, in January; eight specimens.

10. *Trach. conspicuella*, Walk.

(*Gelechia conspicuella*, Walk., Brit. Mus. Cat., 651; *Gelechia taongella*, Feld., Reis. Nov., Pl. CXL., 45.)

Minor, alis ant. fuscis, macula ad basim transversa angustiori alteraque parva costæ postica nebulosa lineam transversam emittente canis; post. griseis.

Male, female.—13–16½ mm. Head, palpi, and antennæ fuscous. Thorax fuscous, posteriorly mixed with white. Abdomen pale fuscous. Legs dark fuscous, apex of tarsal joints pale. Forewings elongate, costa moderately arched, apex round-pointed, hindmargin very obliquely rounded; fuscous, suffused with dark fuscous towards costa, more ochreous-tinged towards inner margin; an irregularly triangular white patch towards base, its base resting on basal third of inner margin, its apex touching costa at $\frac{1}{4}$; a very large tuft of raised blackish and fuscous scales on fold at $\frac{1}{3}$, a smaller one above it, and two others in disc beyond middle; a small suffused white spot on costa at $\frac{3}{4}$, emitting a cloudy outwards-angulated white line to anal angle, anteriorly blackish-margined: cilia grey, with two obscure dark fuscous lines. Hindwings grey; cilia pale grey.

Differs from *T. euryleucota* by the much smaller and differently shaped white basal patch, the lighter and more confused colouring, the suffusion of the white costal spot, and the lighter hindwings.

Wellington and Christchurch, in December and January; common at rest on fences.

11. *Trach. spartodeta*, n. sp.

Minor, alis ant. dilute griseo-ochreis, linea antica transversa rectangulata, altera postica sinuata, maculaque costæ media elongata saturate fuscis, macula disci parva ferruginea ; post. dilute griseis.

Female.—15 mm. Head and palpi pale greyish-ochreous, terminal joint of palpi with two obscure dark fuscous rings, second joint obscurely banded with dark fuscous. Antennæ fuscous. Thorax pale greyish-ochreous, mixed with dark fuscous. Abdomen grey. Anterior and middle legs dark fuscous, with pale greyish-ochreous rings at apex of joints ; posterior legs whitish-ochreous, slightly infuscated. Forewings elongate, rather narrow, costa moderately arched, apex nearly pointed, hindmargin hardly rounded, very oblique ; greyish-ochreous, somewhat mixed with dark fuscous ; markings cloudy dark fuscous ; a small spot at base of costa, and another on inner margin near base ; a transverse line from $\frac{1}{4}$ of costa to $\frac{1}{3}$ of inner margin, forming a right angle outwards in disc, where it is mixed with ferruginous, and preceded near inner margin by a tuft of raised scales ; a narrow elongate spot along central third of costa, connected with a raised ferruginous spot in middle of disc, beneath which is a raised tuft and some irregular dark fuscous spots ; a transverse line proceeding from costa at $\frac{4}{5}$ obliquely inwards, a little beneath costa sharply bent outwards, and thence curved to anal angle; three or four small cloudy marginal spots round apex : cilia pale greyish-ochreous, mixed with dark fuscous. Hindwings pale grey, apex and hindmargin darker ; cilia grey-whitish, with two faint grey lines.

This and the three following species are closely allied, and are most easily distinguished from one another by the angulation of the anterior transverse line ; in this species and *T. galaxias* it forms nearly a right angle, but in this species the head and forewings are greyish-ochreous, whilst in *T. galaxias* they are white ; the apex of the forewings is more pointed than usual.

Wellington, in January ; one specimen.

12. *Trach. nyctopis*, n. sp.

Minor, alis ant. griseis, striga antica transversa leviter flexa nigra, interdum fascia lata pallidiori, macula costæ media elongata lineaque postica transversa sinuata saturate fuscis ; post. griseis.

Male, female.—$13\frac{1}{2}$–17 mm. Head and palpi whitish-grey, second joint of palpi externally suffused with dark fuscous. Antennæ grey. Thorax whitish-grey, sometimes mixed with dark fuscous. Abdomen grey. Legs dark fuscous-grey, middle tibiæ with central and apical whitish rings, all tarsi with whitish rings at apex of joints. Forewings elongate, rather narrow, costa moderately arched, apex rounded, hindmargin very obliquely rounded ; grey, coarsely irrorated with dark fuscous ; base of costa, and a small spot on inner margin near base dark fuscous; a thick black transverse streak from $\frac{1}{4}$ of costa to $\frac{1}{3}$ of inner margin, becoming obsolete towards margins but very conspicuous in disc, very obtusely and roundly angulated outwards in middle, including two tufts of raised scales, between which is a ferruginous mark; between this streak and base the ground-colour is often dark grey; beyond this streak is sometimes a broad transverse whitish band, becoming white on costa, but generally suffused and obsolete; an elongate cloudy dark grey spot along costa about middle, beneath which are some irregular ferruginous marks in disc; two small tufts of scales in disc beyond middle; a cloudy blackish-grey transverse line proceeding from costa at $\frac{4}{5}$ obliquely inwards, a little beneath costa sharply bent outwards, and thence curved to anal angle; two or three obscure blackish-grey spots round apex: cilia whitish-grey, with two cloudy dark fuscous lines. Hindwings grey, towards apex dark grey; cilia whitish-grey, with two cloudy grey lines.

Characterized by the very obtuse angulation of the anterior line, which is so rounded as hardly to form any apparent angle, and is also much thicker, blacker, and more conspicuous in disc than in the allied species.

Christchurch and Dunedin, in January and February; common in forest.

13. *Trach. galaxias*, n. sp.

Minor, alis ant. canis, griseo-sparsis, postice interdum griseo-suffusis, fascia ad basim lata postice fere rectangulata nigroque marginata, costæ triangulo medio, lineaque postica transversa sinuata saturate griseis; post. griseis.

Male, female.—14–15 mm. Head white. Palpi white, second joint externally dark fuscous, except towards apex, apex of terminal joint blackish. Antennæ grey. Thorax dark grey, irregularly mixed with white. Abdomen grey. Legs dark fuscous, middle tibiæ with whitish central and apical wings, posterior tibiæ grey-whitish, all tarsi with whitish rings at apex of joints. Forewings elongate, costa moderately arched, apex rounded, hindmargin very obliquely rounded; white, with a few scattered grey scales; a small dark fuscous spot at base of costa; a dark grey transverse band near base, its inner edge more or less near to base and suffused into ground-colour, outer edge extending from $\frac{1}{4}$ of costa to $\frac{1}{3}$ of inner margin, edged with blackish and almost rectangularly angulated outwards in middle, preceded by a black tuft of raised scales above and below middle, between which are some ferruginous scales; a triangular dark grey patch on costa about middle, its apex touching a ferruginous irregularly blackish-margined spot in disc, and connected with inner margin beyond middle by a twice strongly dentate blackish line; a suffused grey spot on costa at $\frac{3}{4}$, another on middle of hindmargin, and sometimes a larger one on inner margin before anal angle, sometimes all partially confluent ; a slender cloudy blackish transverse line from costal spot to anal angle, irregularly sinuate, and strongly dentate inwards beneath costa : cilia whitish, with two cloudy dark grey lines. Hindwings grey, apex and hindmargin darker ; cilia grey-whitish, with a faint darker line.

At once distinguished by the white head and white ground-colour of the forewings ; in the form of the anterior line it approaches *T. spartodeta.*

Hamilton, Wellington, and the Bealey River, in January ; four specimens.

14. *Trach. protochlora*, n. sp.

Minor, alis ant. albidis, virescenti-suffusis, fascia ad basim, triangulo costæ medio maculaque apicis griseis, linea antica transversa acute angulata nigra ; post. griseis.

Male.—13½–14½ mm. Head, pale whitish-ochreous. Palpi ochreous-whitish, second joint dark fuscous on basal half, terminal joint with a dark fuscous subapical ring. Antennæ dark fuscous. Thorax ochreous-whitish, anterior margin suffused with dark grey. Abdomen light ochreous-grey, anal tuft ochreous. Legs dark fuscous, middle tibiæ with whitish central and apical rings, posterior tibiæ grey-whitish above, all tarsi with whitish rings at apex of joints. Forewings elongate, costa moderately arched, apex round-pointed, hindmargin very obliquely rounded ; whitish, with numerous scattered ochreous-green scales, forming an irregular suffusion, and also partially suffused with light greyish ; a small blackish spot at base of costa ; basal third of costa dark grey : a slender sharply defined black line from ¼ of costa to ⅓ of inner margin, very acutely angulated outwards in middle, becoming obsolete on margins, preceded by a tuft of raised scales above and below middle ; a small triangular dark grey patch on middle of costa, beneath which are two raised tufts of scales almost completely margined with black, upper one greenish, lower white ; lower tuft almost connected with inner margin beyond middle by some black scales ; a small cloudy grey spot on costa at ¾, whence a partially obsolete blackish line proceeds to anal angle, sharply angulated inwards beneath costa ; a cloudy grey spot on upper half of hindmargin ; two or three ill-defined blackish dots round apex, sometimes confluent : cilia grey-whitish, greenish-tinged, with a cloudy grey line obscurely spotted with blackish. Hindwings grey ; cilia grey-whitish, with a cloudy grey line.

Well separated by the acute angulation of the anterior line, and the ochreous-green suffusion of the ground-colour.

Palmerston, and at the foot of the Otira Gorge, in January and February ; three specimens.

15. *Trach. aspidephora*, n. sp.

Minor, alis ant. albidis, partim ochreo-suffusis, macula costæ postica magna subtriangulari alteraque apicis parva saturate griseis, nigro-mixtis; post. griseo-albidis.

Male, female.—13½–14½ mm. Head and antennæ whitish-ochreous. Palpi whitish-ochreous, mixed with dark fuscous, terminal joint with a blackish subapical ring. Thorax whitish-ochreous, anterior margin mixed with dark fuscous. Abdomen pale whitish-ochreous. Legs dark fuscous, a central ring of median tibiæ, hairs of posterior tibiæ, and apex of all joints ochreous-white. Forewings elongate, costa moderately arched, slightly sinuate in middle, apex rounded, hindmargin very obliquely rounded; whitish, irregularly suffused with whitish-ochreous; basal $\frac{2}{5}$ of costa dark grey, with a small blackish basal spot; an obscurely indicated slender blackish transverse line in disc before middle, nearly rectangularly angulated, wholly obsolete towards margins, preceded by two tufts of raised pale ochreous scales above and below middle; a small elongate cloudy dark grey spot along costa somewhat beyond middle, beneath which is a raised ochreous partially blackish-circled spot in disc, and between this and anal angle another raised tuft; a cloudy blackish-grey elongate outwards-curved spot extending from $\frac{3}{4}$ of costa to the blackish-circled discal, more or less suffused beneath; from this near costa proceeds a transverse blackish line to anal angle, obtusely angulated outwards in middle; a cloudy blackish-grey apical spot, rather produced along hindmargin: cilia ochreous-whitish, with two cloudy blackish lines. Hindwings grey-whitish, apex darker; cilia whitish, with a cloudy grey line.

Very distinctly characterized by the dark markings combining to form a large posterior patch on the costa, contrasting with the pale ochreous suffusion of the ground-colour.

Christchurch and Dunedin, in December and January; not uncommon in forest.

16. *Trach. anastrella*, n. sp.

Minor, alis ant. fuscis, saturatiori-suffusis, linea antica transversa fere rectangulata nigra, altera postica sinuata costæque triangulo saturate fuscis; post. saturate fuscis.

Male.—11½–14 mm. Head, palpi, and thorax dark fuscous, somewhat mixed with whitish-ochreous. Antennæ dark fuscous. Abdomen fuscous. Legs dark fuscous, middle and posterior tibiæ with ochreous-whitish central and apical rings, all tarsi with ochreous-whitish rings at apex of joints. Forewings moderate, costa moderately arched, slightly sinuate in middle, apex rounded, hindmargin very obliquely rounded; fuscous or ochreous-fuscous, coarsely irrorated with dark fuscous or blackish; sometimes a suffused oblique ochreous transverse spot almost at base; a tuft of raised scales at base; a cloudy blackish transverse line from $\frac{1}{4}$ of costa to $\frac{1}{3}$ of inner margin, tolerably rectangularly angulated in middle, preceded by two large tufts of raised scales above and below middle; beyond this the ground-colour is suffusedly paler or mixed with ochreous-whitish towards costa; costa suffusedly dark fuscous towards middle; two tufts of raised scales in disc beyond middle; a very ill-defined dark fuscous transverse line from $\frac{4}{5}$ of costa to anal angle, angulated inwards beneath costa, sometimes followed on costa by an ochreous-whitish spot: cilia fuscous, with two cloudy blackish lines. Hindwings dark fuscous-grey; cilia fuscous, with a cloudy darker line.

Differs from all by the general dark fuscous colouring, without definite pale markings; it is shorter-winged than any preceding species except *T. leucoplanetis.*

Christchurch, the foot of the Otira Gorge, Dunedin, and Invercargill, in December, January, and March; not uncommon.

17. *Trach. lichenodes,* n. sp.

Minor, alis ant. saturate purpureo-fuscis, partim flavido-sparsis, maculis disci tribus parvis nigris, macula dorsi ad basim albida, macula dorsi postica fasciaque marginis postici flavidis; post. saturate fuscis.

Female.—14½ mm. Head dull whitish-yellow; palpi broken. Antennæ dark fuscous. Thorax dark fuscous, slightly mixed with whitish-ochreous. Abdomen dark fuscous. Legs dark fuscous, middle and posterior tibiæ with yellow-whitish central and apical rings, all tarsi with yellow-whitish rings at apex of joints. Forewings moderate, costa moderately arched, apex rounded, hindmargin obliquely rounded; dark purplish-fuscous; base mixed with black, with a tuft of raised scales; a trapezoidal ochreous-white patch on inner margin, extending from near base to $\frac{1}{3}$, and reaching half across wing; between this and costa the ground-colour is mixed with whitish-yellow; a cloudy very irregular whitish-yellow fascia from costa at $\frac{1}{3}$ to fold, containing two tufts of raised black scales in disc; a roundish black spot in disc beyond middle, partially margined with whitish, on its lower margin containing a tuft of raised white scales, and connected with a semi-oval whitish-yellow spot on inner margin; a small cloudy whitish-yellow spot beneath costa at $\frac{3}{4}$, barely touching costa and hindmarginal suffusion; a suffused whitish-yellow hindmarginal patch extending from costa to anal angle, attenuated to a point beneath, mixed with dark fuscous towards hindmargin beneath apex: cilia whitish-yellow, with an ill-defined dark purplish-fuscous apical spot, a larger one at anal angle, and a cloudy basal line. Hindwings dark fuscous; cilia fuscous, with a cloudy darker line.

In form of wing approaching the preceding, but differing from all in the purplish-fuscous forewings variegated with yellowish, and the yellowish head.

Bealey River, in January; one specimen taken in my presence by Mr. J. D. Enys, who kindly transferred it to my possession.

8. AOCHLETA, Meyr.

Head with appressed scales. Antennæ in male moderate, evenly and moderately ciliated (1), basal joint rather elongate, without pecten. Palpi rather long, second joint exceeding base of antennæ, densely scaled, scales forming a short loose rough projecting tuft towards apex beneath, terminal joint as long as second, slender, curved, slightly roughened in middle. Thorax smooth (?). Forewings elongate, apex obtuse, hindmargin oblique. Hindwings as broad as forewings, somewhat trapezoidal, hindmargin rounded, cilia $\frac{2}{3}$. Abdomen moderate. Posterior tibiæ clothed with long fine hairs above. Forewings with vein 7 to costa, 2 from considerably before angle of cell. Hindwings with veins 3 and 4 short-stalked.

Nearly allied to *Semiocosma*, differing essentially in the structure of the palpi, of which the second joint is distinctly tufted, and the terminal joint lacks the median tooth of scales; the forewings also appear to be without raised tufts. The genus is doubtless a development of *Semiocosma*, and contains only one species, confined to New Zealand.

18. *Aochl. psychra*, n. sp.

Media, alis ant. albidis, griseo-sparsis, postice partim griseo-suffusis, punctis disci duobus minimis ocelloque nigris; post. albidis.

Male.—21 mm. Head and thorax grey-whitish, sprinkled with fuscous-grey. Palpi grey-whitish, mixed with fuscous, basal half of second joint dark fuscous externally, terminal joint with a slender dark fuscous ring above middle. Antennæ grey. Abdomen grey-whitish. Legs dark-fuscous, posterior tibiæ with grey-whitish hairs, all tarsi with obscure whitish rings at apex of joints. Forewings elongate, slightly dilated, costa gently arched, apex obtuse, hindmargin oblique, nearly straight; whitish, irregularly irrorated with grey and fuscous scales; these tend to form suffused markings, a spot on middle of inner margin, another above anal angle, a narrow suffusion along posterior half of costa, and an apical patch; a small cloudy darker spot towards hindmargin in middle; a minute black dot in disc at $\frac{1}{3}$, another slightly above it in middle, and a very small blackish ocellus in disc at $\frac{2}{3}$: cilia whitish, with two cloudy grey lines. Hindwings whitish; cilia whitish, with two faint grey lines.

Not closely resembling any other species.

Castle Hill; one specimen received from Mr. J. D. Enys, without date.

9. Semiocosma, Meyr.

Head with appressed scales, sidetufts large, loosely appressed. Antennæ in male stout, very shortly ciliated ($\frac{1}{4}$), basal joint moderate, without pecten. Palpi moderately long, second joint not exceeding base of antennæ, thickened with dense scales, somewhat loose beneath, terminal joint rather shorter than second, slender, recurved, with a tooth of erect scales in middle on posterior surface. Thorax smooth. Forewings elongate, moderate, apex rounded, hindmargin almost straight, oblique; surface with tufts of raised scales. Hindwings as broad as forewings, elongate-trapezoidal, hindmargin faintly sinuate, cilia $\frac{2}{3}$. Abdomen moderate, slightly flattened, distinctly margined. Middle tibiæ with a median whorl of projecting hairs, roughly short-haired beneath; posterior tibiæ with moderate dense somewhat appressed hairs above. Forewings with vein 7 to costa, 2 from considerably before angle of cell. Hindwings with vein 5 bent and approximated to 4 at base.

Not nearly allied to any New Zealand genus except *Aochleta*, and distinguished from all genera of the family, except the South American *Gonionota*, by the median tooth of scales on the terminal joint of the palpi; from *Gonionota*, which possesses similar palpi and also tufts of scales on the surface of the forewings, and is doubtless nearly related, it may be separated by the smooth thorax (in *Gonionota* the thorax is crested), and probably by other points, but Zeller's description of the genus is given in so little detail, that they cannot be stated. There can also be little doubt that the genus has some true affinity with the European *Psecadia*.

The genus is confined to New Zealand; I have five species, of which the folowing is a tabulation:—

1a. Head dark fuscous .. .. 23. *austera.*
1b. „ white or green.
  2a. Ground-colour of forewings suffused.
    3a. With a sharply angulated blackish transverse line about $\frac{1}{4}$ 21. *epiphanes.*
    3b. Without angulated anterior line .. .. 22. *prasophyta.*
  2b. Ground-colour of forewings clear.
    3a. With three transverse strigæ .. .. 20. *picarella.*
    3b. With disconnected marks .. .. 19. *peroneanella.*

19. *Sem. peroneanella*, Walk.

(*Gelechia peroneanella*, Walk., Brit. Mus. Cat., 658; *Cryptolechia lichenella*, ib. 769; *Œcophora huttonii*, Butl., Cist. Ent., ii., 511.)

Media, alis ant. dilute viridibus, signis plerisque contortis serieque punctorum marginis postici nigris; post. albidis, apicem versus griseis.

Male, female.—15–27 mm. Head pale green, or sometimes whitish. Palpi pale green, second joint with basal third and a subapical ring, terminal joint with apex, a median band, and a dot near base black. Antennæ dark fuscous, basal joint pale green. Thorax pale green, a small spot on each side of neck, an oblique mark on each side of back, and a small posterior spot black. Abdomen whitish-grey. Legs dark fuscous, tibiæ with central and apical rings, tarsi with apex of joints whitish, posterior tibiæ with whitish hairs above. Forewings moderate, costa gently or moderately arched, faintly sinuate in middle, apex obtuse, hindmargin oblique, slightly sinuate or nearly straight; pale green, with sharply defined black linear markings; a dot at base, and a small mark near base on costa, connected along costal edge; a dot on inner margin near base; a mark very near base and an inwardly oblique bar in disc at $\frac{1}{5}$, connected centrally by a longitudinal line; an oblique bar from costa at $\frac{1}{3}$, forked at apex, not reaching middle; a short longitudinal mark beneath fold at $\frac{1}{3}$, anteriorly furcate; a short oblique bar in disc below middle, very shortly furcate beneath; a short sinuate oblique bar in disc beyond middle, furcate above, (in Southern specimens connected centrally with preceding by a longitudinal line); all these markings preceded in disc by tufts of raised scales; a spot on costa beyond middle, furcate at apex; a sinuate dentate transverse bar in disc about $\frac{4}{5}$; a row of small spots along hindmargin and apical third of costa: cilia pale green. Hindwings grey-whitish, posteriorly suffused with fuscous grey, with an obscure darker central spot, and a dark fuscous interrupted hindmarginal line; cilia whitish-grey, becoming whitish-green round apex, with a faint darker line.

A beautiful insect, mimicking the colour of the long drooping lichens on which it always sits, and on which the larva probably feeds; the markings are not united to form complete transverse strigæ, as in *S. picarella.* Butler's *huttonii* is merely a bleached specimen.

Hamilton, Christchurch, Dunedin, in December and January; tolerably common, and probably widely distributed. The slight difference in marking between forms from the North and South Islands is worthy of notice.

20. *Sem. picarella,* Walk.

(*Œcophora picarella,* Walk., Brit. Mus. Cat., 699; *Psecadia teras,* Feld., Reis. Nov., Pl. CXL., 28.)

Major, alis ant. niveis, strigis tribus transversis contortis, signis duobus posticis serieque punctorum marginis postici nigris; post. griseis, disco albido-suffuso.

Male, female.—22–28 mm. Head white. Palpi white, second joint with basal third and a subapical ring, terminal joint with apex and a median band black. Antennæ dark fuscous, basal joint white at base. Thorax white, anterior margin, a central arrowhead, and small posterior spot black. Abdomen whitish-grey. Legs dark fuscous, median ring of tibiæ and apex of all joints whitish, posterior tibiæ with whitish hairs above. Forewings moderate, costa gently arched, faintly sinuate in middle, apex rounded, hindmargin rather oblique, slightly rounded; white, with sharply defined black linear markings; costa black at base, emitting a transverse streak, twice deeply angulated, to inner margin at $\frac{1}{5}$, its inner angle connected by a bar with base of inner margin; an irregular oblique transverse streak from $\frac{1}{4}$ of costa to fold, sending a tooth inwards beneath costa and another outwards above fold, apex reflexed towards base and sinuate; a small spot on inner margin beyond middle; a short inwardly oblique streak from costa beyond middle, emitting from middle of posterior edge an oblique sometimes interrupted line almost to anal angle, whence proceeds from middle of anterior edge a short branch obliquely downwards, and from $\frac{3}{4}$ of posterior edge a short streak obliquely upwards, almost confluent with a small spot towards costa; a somewhat crescentic transverse bar near hindmargin above middle; discal markings partially preceded by tufts of raised scales; a row of coarse black dots along hindmargin and apical third of costa: cilia white, with a small black apical spot, and another in costal cilia on second dot before apex. Hindwings grey, irregularly suffused with grey-whitish in disc, with a dark fuscous interrupted hindmarginal line; cilia grey-whitish, with a cloudy grey line.

A distinct and striking species.

Dunedin, in January; rather common on fences and at light.

21. *Sem. epiphanes*, n. sp.

Media, alis ant. canis, griseo-conspersis, macula basali postice angulata alteraque costæ magna signis nigris notata saturate fuscis; post. griseo-albidis.

Male.—20 mm. Head white, lower half of face sharply fuscous. Palpi white, second joint with basal $\frac{2}{3}$ and a subapical ring dark fuscous, terminal joint with a median blackish band. Antennæ dark fuscous. Thorax grey, mixed with white. Abdomen grey-whitish. Legs dark fuscous, central ring of tibiæ and apex of all joints white, posterior tibiæ with whitish hairs above. Forewings moderate, costa gently arched, apex obtuse, hindmargin nearly straight, rather oblique; whitish, densely irrorated and partially suffused with grey; a dark fuscous basal patch, bounded by a blackish-fuscous line from $\frac{1}{5}$ of costa to $\frac{1}{4}$ of inner margin, acutely angulated outwards on fold, containing a large tuft of scales near base, and two others before posterior margin; immediately beyond this line the ground-colour is clearer white; a tuft of scales beneath fold at $\frac{1}{3}$; a large fuscous patch, mixed with dark fuscous, extending on costa from $\frac{1}{4}$ to $\frac{3}{4}$, anterior edge oblique, reaching fold, posterior edge inwardly oblique, reaching middle, lower edge angularly excavated; this patch contains a large tuft of scales near middle of anterior edge, a smaller tuft in lower anterior angle, and a third in lower posterior angle, first tuft bordered above anteriorly by a short blackish mark, second on three sides posteriorly by an angulated blackish streak, third anteriorly and posteriorly by two short straight blackish streaks; a very indistinct cloudy grey angulated transverse line near hindmargin; a row of cloudy dark grey spots along hindmargin and apical third of costa: cilia whitish, with an indistinct grey line. Hindwings grey-whitish, slightly darker towards apex; cilia grey-whitish.

Very distinct by the grey colouring, and dark costal and basal patches.

Wellington, in January; one fine specimen.

22. *Sem. prasophyta*, n. sp.

Media, alis ant. canis, virescenti-suffusis, strigula ad basim, squamis disci sparsis, punctis costæ lineaque marginis postici nigris; post. griseis, basim versus albidis.

Male, female.—17–18 mm. Head white (?). Palpi white, second joint with a subbasal and subapical ring, terminal joint with a median ring black. Antennæ grey-whitish, obscurely annulated with fuscous, basal joint whitish, with a fuscous subapical spot. Thorax whitish, anteriorly mixed with dull green and black. Abdomen grey-whitish. Anterior tibiæ dark fuscous with central and apical whitish rings, middle tibiæ dark fuscous broadly suffused with whitish towards centre and apex, posterior tibiæ whitish, all tarsi dark fuscous with whitish rings at apex of joints. Forewings moderate, costa gently arched, sinuate in middle, apex obtuse, hindmargin slightly sinuate, oblique; whitish, irrorated and partially suffused with dull ochreous-green, especially on central third and towards hindmargin; extreme base and an irregular streak from costa near base to base of inner margin black; a small cloudy blackish spot on costa before middle, and another beyond middle; two tufts of green scales in disc before middle, followed by scattered black scales, and two tufts beyond middle, preceded and followed by black scales; a clear whitish sinuate transverse line from $\frac{3}{4}$ of costa to before anal angle; three black dots on posterior third of costa, and an interrupted black hindmarginal line: cilia fuscous, with a cloudy blackish line. Hindwings grey, becoming whitish towards base; cilia grey-whitish, with a cloudy grey line.

Not to be confused with any other species.

Wellington and Taranaki, in January and February; two specimens.

23. *Sem. austera*, n. sp.

Media, alis ant. fuscis, fascia antica lineaque postica curva vix pallidioribus, signo disci arcuato saturatiori; post. saturate fuscis.

Male.—17–18 mm. Head, antennæ, thorax, and abdomen dark fuscous. Palpi dark fuscous, second joint mixed with pale ochreous, terminal joint with a suffused pale ochreous band above and below middle. Legs dark fuscous, median ring of tibiæ and apex of all joints whitish-ochreous. Forewings moderate, costa gently arched, apex rounded, hindmargin oblique, hardly rounded; dull fuscous, mixed with darker and lighter; the lighter tint appears to form an obscure transverse fascia before middle parallel to hindmargin, and a curved transverse line from $\frac{3}{4}$ of costa to before anal angle; a tuft of dark fuscous scales beneath fold at $\frac{1}{3}$; an arched dark fuscous mark in disc beyond middle; hindmargin and apical fourth of costa obscurely spotted with darker: cilia fuscous, with a darker line. Hindwings dark fuscous, somewhat lighter towards base; cilia fuscous, with a cloudy darker line.

Conspicuously distinct by its deep fuscous colouring.

Wellington, in January; two specimens.

10. Lathicrossa, n. g.

Head with appressed scales, sidetufts moderate, loosely spreading. Antennæ in male moderate, strongly serrate towards apex, very shortly ciliated ($\frac{1}{4}$), basal joint moderate, without pecten. Palpi moderately long, second joint not exceeding base of antennæ, thickened with dense appressed scales, terminal joint as long as second, rather stout, curved. Thorax crested posteriorly. Forewings moderate, apex obtuse, hindmargin oblique. Hindwings as broad as forewings, trapezoidal, hindmargin slightly sinuate, cilia $\frac{3}{5}$. Abdomen moderate. Posterior tibiæ with short rough hairs above. Forewings with vein 7 to costa, 2 from rather before angle of cell. Hindwings normal.

Allied to *Gymnobathra*, from which it is distinguished by the very short ciliations of the antennæ, and the thoracic crest. The single species is confined to New Zealand.

24. *Lath. leucocentra*, n. sp.

Minor, alis ant. saturate fuscis, maculis costæ duabus parvis serieque punctorum marginis postici albido-ochreis, punctis disci tribus niveis; post. saturate fuscis.

Male.—15 mm. Head whitish-ochreous, suffused on crown and forehead with dark fuscous. Palpi whitish-ochreous, externally sprinkled with dark fuscous, anterior edge marked throughout by a slender dark fuscous line. Antennæ dark fuscous. Thorax and abdomen dark fuscous, with a few whitish-ochreous scales. Legs dark fuscous, central ring of tibiæ, hairs of posterior tibiæ, and apex of all joints whitish-ochreous. Forewings moderate, somewhat dilated, costa gently arched, apex obtuse, hindmargin oblique, almost straight, very faintly sinuate beneath apex; dark fuscous, with irregularly scattered whitish-ochreous scales; a very small whitish-ochreous spot on middle of costa, and a rather larger transverse spot on costa at $\frac{3}{4}$, giving rise to a very faint curved line of whitish-ochreous scales to anal angle; a white dot in disc at $\frac{1}{3}$, a second hardly beyond middle, and a third somewhat larger on fold between these; a row of whitish-ochreous dots along hindmargin and apical fourth of costa: cilia dark fuscous. Hindwings dark fuscous; cilia fuscous, with a darker basal line.

The conspicuous white discal dots afford an easy point of recognition.

Dunedin, in January; one specimen received from Mr. A. Purdie.

11. THAMNOSARA, n. g.

Head with appressed scales, sidetufts moderate, loosely spreading. Antennæ in male moderate, biserrate, moderately and evenly ciliated (1), basal joint rather long, without pecten. Palpi moderate, second joint not exceeding base of antennæ, densely scaled, beneath with long projecting hairscales, forming a large square tuft, terminal joint slightly shorter than second, slender, curved. Thorax smooth. Forewings moderate, apex rounded, hindmargin oblique. Hindwings as broad as forewings, elongate-ovate, hindmargin rounded, cilia $\frac{4}{5}$. Abdomen moderate. Posterior tibiæ shortly rough-haired above. Forewings with vein 7 to costa, 2 from rather before angle of cell. Hindwings normal.

Allied to *Gymnobathra*, of which it is probably a development; differs from all New Zealand genera except *Aochleta* in the tuft of the second joint of palpi; but in *Aochleta* the tuft is much less developed. Vein 2 of the forewings is widely remote from the angle of the cell; and veins 3 and 4 of the hindwings are stalked. Only one species is known, peculiar to New Zealand.

25. *Thamn. chirista*, n. sp.

Minor, alis ant. albido-fuscis, saturate fusco creberrime irroratis; post. griseis.

Male, female.—13–14 mm. Head, palpi, antennæ, and thorax fuscous-grey; terminal joint of palpi grey-whitish, anterior edge dark fuscous. Abdomen grey, anal tuft pale greyish-ochreous. Legs dark fuscous; posterior tibiæ and apex of all tarsal joints whitish. Forewings moderate, costa moderately arched, apex rounded, hindmargin very obliquely rounded; whitish fuscous, very densely and finely irrorated with dark fuscous; a few scattered black scales: cilia whitish fuscous, on lower half densely irrorated with dark fuscous. Hindwings grey, somewhat darker towards apex; cilia whitish-grey, with a darker line near base.

A very dull-coloured and inconspicuous insect.

Christchurch, in December; three specimens amongst bush, in indifferent condition.

12. GYMNOBATHRA, Meyr.

Head loosely scaled, sidetufts large, appressed, projecting over forehead. Antennæ in male moderate, moderately and evenly ciliated (1), basal joint rather elongate, moderate, without pecten. Palpi moderate, second joint reaching base of antennæ, with smooth appressed scales, somewhat loose beneath towards apex, terminal joint shorter than second, slender, recurved. Thorax smooth. Forewings elongate, moderate, apex obtuse, hindmargin somewhat concave or rounded, oblique. Hindwings slightly narrower than forewings, elongate-ovate, hindmargin rounded, cilia $\frac{1}{2}$ to $\frac{2}{3}$. Abdomen moderate. Posterior tibiæ clothed with rather short hairs above. Forewings with vein 7 to costa, 2 from rather considerably before angle of cell. Hindwings normal.

Nearly allied to *Œcophora*, from which it is separated by the absence of the basal pecten of antennæ, differing also in the greater remoteness of vein 2 of the forewings from the angle of cell. The forewings are more triangular, and the hindmargin sometimes markedly concave. The genus is endemic in New Zealand, so far as is known, and has attained some degree of development; it is doubtless an offshoot of *Œcophora*.

I have nine species, which may be tabulated as follows :—

1a. Hindwings ochreous-yellow	.. 33. *hyetodes* ♀.
1b. „ fuscous or grey.	
2a. Hindmargin of forewings distinctly concave.	
3a. Posterior fascia straight	.. 33. *hyetodes* ♂.
3b. „ „ angulated	.. 32. *hamatella* ♂.
2b. Hindmargin of forewings not distinctly concave.	
3a. Forewings densely irrorated with dark fuscous ..	.. 29. *tholodella.*
3b. „ not „ „ „ „	
4a. Costa and hindmargin spotted with dark fuscous	.. 30. *calliploca.*
4b. „ „ „ not spotted	.. 28. *parca.*
1c. Hindwings more or less whitish.	
2a. Hindwings becoming grey at apex.	
3a. Forewings grey	.. 34. *philadelpha.*
3b. „ yellow	.. 31. *flavidella.*
2b. Hindwings becoming grey at base	.. 26. *coarctatella.*
2c. „ wholly ochreous-whitish.	
3a. Forewings with two transverse fasciæ	.. 32. *hamatella* ♀.
3b. „ not fasciated	.. 27. *sarcoxantha.*

26. *Gymn. coarctatella*, Walk.

(*Cryptolechia coarctatella*, Walk., Brit. Mus. Cat., 768.)

Media, alis ant. rufo-ochreis, punctis disci tribus saturate griseis interdum obsoletis; post. ochreo-albidis, basim versus griseo-suffusis.

Male, female.—17–20 mm. Head, palpi, and thorax reddish-ochreous. Antennæ grey-whitish, slenderly annulated with dark fuscous, basal joint reddish-ochreous. Abdomen ochreous-whitish. Legs ochreous-whitish, anterior pair infuscated. Forewings moderate, posteriorly dilated, costa moderately arched, apex obtuse, hindmargin somewhat sinuate, rather oblique; reddish-ochreous; a round cloudy dark fuscous-grey dot in disc at $\frac{1}{3}$, a second at $\frac{2}{3}$, a third more obscure on fold beyond first, in the female specimen all obsolete; cilia reddish-ochreous, becoming whitish-ochreous towards tips. Hindwings whitish, faintly ochreous-tinged, towards inner angle suffused with grey; cilia whitish, tinged with grey at inner angle.

Immediately known by the grey basal suffusion of the hindwings, and the pronounced reddish-ochreous forewings. This and the two following species are rather closely allied.

Wellington and Castle Hill, in January; two specimens. Walker's type is certainly of this species; it is stated to be from Auckland, but no reliance can be placed on this.

27. *Gymn. sarcoxantha*, n. sp.

Media, alis ant. dilute ochreis, punctis disci tribus saturate ochreofuscis; post. ochreo-albidis.

Male.—19–20 mm. Head, palpi, antennæ, and thorax whitish-ochreous, sometimes slightly reddish-tinged. Abdomen and legs ochreous-whitish. Forewings elongate, somewhat dilated, costa gently arched, apex obtuse, hindmargin oblique, nearly straight; whitish-ochreous, with a few scattered reddish-ochreous scales, margins sometimes partially suffused with deeper ochreous; a reddish-ochreous or dark fuscous dot in disc at $\frac{1}{3}$, a second, larger and oblique, at $\frac{2}{3}$, and a third, very small, on fold very obliquely beyond first: cilia whitish-ochreous. Hindwings whitish, faintly ochreous-tinged: cilia ochreous-whitish.

Very near the preceding, but with the forewings more elongate, and the ground-colour lighter, without pronounced reddish tinge, and the hindwings without any grey suffusion.

Dunedin and Christchurch, in January and March; six specimens.

28. *Gymn. parca*, Butl.

(*Œcophora parca*, Butl., Proc. Zool. Soc. Lond., 1877, 405.)

Minor, alis ant. ochreis vel flavis, interdum griseo-mixtis, costa pallidiori, punctis disci tribus saturate griseis sæpius obsoletis; post. griseis.

Male, female.—13–16 mm. Head palpi, and thorax ochreous or yellowish. Antennæ dark-grey. Abdomen grey-whitish, anal tuft ochreous-whitish. Legs whitish, more or less wholly suffused with fuscous-grey. Forewings moderate, somewhat dilated, costa gently arched, apex obtuse, hindmargin obliquely rounded; dull ochreous or yellow, sometimes partially suffused with reddish-ochreous, especially towards inner margin, and sometimes mixed with grey, except along a costal band; sometimes a cloudy round dark grey dot in disc before middle, a second beyond middle, and a third on fold obliquely beyond first, but often these are absent, or sometimes indicated by a reddish-ochreous suffusion: cilia ochreous or yellowish, paler and sometimes greyish towards tips. Hindwings grey, somewhat darker towards apex; cilia ochreous-whitish or grey-whitish, sometimes with a cloudy grey line.

Very variable, but hardly to be confused with any other; immediately known from the two preceding species by the grey hindwings and smaller size.

Wellington, Christchurch, Lake Wakatipu, in December and January; generally common on bare grassy hills; at Lake Wakatipu it occurred sparingly up to an elevation of 4,000 feet.

29. *Gymn. tholodella*, n. sp.

Minor, alis ant. fuscis, ochreo-conspersis, punctis disci tribus saturatioribus; post. griseis.

Male, female.—12–13 mm. Head, palpi, and thorax light brownish-ochreous, more or less mixed and suffused with dark fuscous. Antennæ brownish-ochreous, annulated or suffused with dark fuscous. Abdomen grey-whitish, anal tuft whitish-ochreous. Legs dark fuscous, central ring of anterior and middle tibiæ and apex of all joints whitish, posterior tibiæ with whitish hairs. Forewings moderate, somewhat dilated, costa moderately arched, apex obtuse, hindmargin oblique, hardly rounded; light brownish-ochreous, densely mixed and irregularly suffused with dark fuscous; generally a clear pale spot on costa before middle; a cloudy round dark fuscous dot in disc before middle, a second, oblique and sometimes obscurely double, in disc beyond middle, and a third on fold obliquely beyond first: cilia pale ochreous, with a cloudy dark fuscous line near base. Hindwings grey; cilia pale ochreous, with a faint fuscous line.

Not nearly resembling any other; the pale ochreous cilia contrast noticeably with the ground-colour on both wings.

Hamilton, Palmerston, Christchurch, Dunedin, from January to March; common, and sometimes very abundant, in forest; probably of general occurrence.

30. *Gymn. calliploca*, n. sp.

Minor, alis ant. albido-ochreis, fusco-sparsis, punctis disci tribus, costæ quinque posticis serieque marginis postici saturate fuscis; post. dilute griseis.

Male.—17 mm. Head, palpi, antennæ, thorax, abdomen, and legs pale whitish-ochreous; second joint of palpi externally, and anterior margin of thorax suffused with dark fuscous; anterior and middle tibiæ dark fuscous with pale central and apical rings, tarsi banded with dark fuscous. Forewings moderate, costa moderately arched, apex obtuse, hindmargin straight, oblique; pale whitish-ochreous, finely and scantily irrorated with fuscous and dark fuscous scales; a small dark fuscous spot at base of costa; five conspicuous dark fuscous dots on posterior half of costa; a dark fuscous dot in disc before middle, a second beyond middle, and a third on fold rather beyond first; a cloudy dark fuscous streak along hindmargin from apex nearly to anal angle, thickest above, attenuated beneath; a row of cloudy dark fuscous dots along hindmargin, partially obscured in the streak: cilia pale whitish-ochreous, basal half with fine dark fuscous bars on the veins. Hindwings pale grey, cilia grey-whitish.

At once recognizable by the conspicuous dark costal dots.

Dunedin, in January; one specimen received from Mr. A. Purdie.

31. *Gymn. flavidella*, Walk.

(*Gelechia flavidella*, Walk., Brit. Mus. Cat., 655; *Œcophora utuella*, Feld., Reis. Nov., Pl. CXL., 46.)

Minor, alis ant. dilute flavis, punctis disci tribus nigricantibus, triangulo marginis postici inferiori dilute fusco, antice nigro-marginato, umbramque costam versus emittente, ciliis fuscis; post. albis, postice roseo-griseis.

Male, female.—12–16 mm. Head, palpi, antennæ, and thorax pale yellow. Abdomen rosy-whitish. Legs rosy-grey, central ring of tibiæ and apex of all joints whitish, posterior tibiæ with whitish hairs. Forewings moderate, rather dilated posteriorly, costa gently arched, apex almost acute, hindmargin straight, rather strongly oblique; pale yellow, rarely irrorated and suffused with reddish-ochreous; extreme costal edge pale fuscous, becoming deeper at base; a dark fuscous dot in disc before middle, a second beyond middle, and a third rather obliquely beyond first on fold; a triangular light rosy-fuscous patch on lower half of hindmargin, anterior side margined by a slightly curved black line, emitting from its apex a narrow inward-curved rosy-fuscous suffusion towards costa at $\frac{3}{4}$, very faint above, posteriorly sometimes margined by a few black scales: cilia rosy-fuscous. Hindwings white, posteriorly suffused with pale rosy-fuscous; cilia very pale rosy-fuscous, more whitish towards inner angle.

A beautiful and very distinct species.

Auckland, Taranaki, Wellington, and Christchurch, in January and February; common amongst bush, but principally in the North Island.

32. *Gymn. hamatella*, Walk.

(*Œcophora hamatella*, Walk., Brit. Mus. Cat., 700.)

Minor, alis ant. albido-ochreis, interdum ochreo-suffusis, fusco-sparsis, linea transversa antica recta, altera postica angulata, punctis disci duobus strigulaque transversa, ciliis etiam saturate fuscis; post. M. griseis, F. albidis.

Male, female.—15–18 mm. Head, palpi, antennæ, and thorax whitish-ochreous, suffused with deeper ochreous. Abdomen ochreous whitish. Legs dark grey, apex of tarsal joints whitish, posterior tibiæ with whitish hairs.

Forewings moderate, considerably dilated posteriorly, costa gently arched, in male more strongly, apex acute, hindmargin sinuate, oblique; whitish-ochreous, irregularly irrorated with fuscous, sometimes wholly suffused with ochreous-fuscous; costal edge suffusedly dark fuscous; a straight narrow somewhat irregular dark fuscous fascia from $\frac{1}{3}$ of costa to $\frac{1}{3}$ of inner margin, dilated on margins; a round dark fuscous dot towards costa in middle, and another (sometimes two longitudinally placed) above fold in middle; a short linear dark fuscous transverse mark in disc beyond middle; a narrow dark fuscous fascia from $\frac{2}{3}$ of costa to $\frac{4}{5}$ of inner margin, rather acutely angulated outwards above middle, dilated on costa: cilia dark fuscous. Hindwings in male rather light grey, with a darker central lunule, cilia whitish-grey; in female whitish, posteriorly slightly ochreous-tinged, cilia ochreous-whitish.

This species and the preceding form the transition in the shape of the forewings from the rounded to the subfalcate apex. It varies considerably in depth of colour, but the characteristic fasciæ can generally be made out.

Christchurch and Akaroa, from January to March; not uncommon amongst bush.

33. *Gymn. hyetodes*, n. sp.

Media, alis ant. M. fuscis, F. ochreo-flavis, punctis disci tribus obscuris fasciaque postica recta nebulosa saturatioribus; post. M. saturate griseis, F. ochreo-flavis.

Male.—20 mm. Head and thorax greyish-fuscous. Palpi whitish, anterior edge marked by a sharp black line throughout, second joint also with a black stripe on each side. Antennæ dark fuscous. Abdomen fuscous-grey. Legs dark fuscous, apex of tarsal joints whitish, posterior tibiæ grey. Forewings moderate, considerably dilated posteriorly, costa moderately arched, apex acute, hindmargin sinuate, rather strongly oblique; light fuscous, paler posteriorly, irrorated with darker; an indistinct darker dot in disc before middle, and a second rather obliquely beyond it on fold; a cloudy dark fuscous transverse fascia from $\frac{2}{3}$ of costa to $\frac{3}{4}$ of inner margin, obsolete on margins, posterior edge tolerably well-defined, slightly concave, anterior edge suffused, containing an obscure darker dot in disc: cilia with basal half dark fuscous, apical half whitish-ochreous. Hindwings dark fuscous; cilia dark fuscous, tips paler.

Female.—26 mm. Similar to male, but head, thorax, abdomen, posterior tibiæ, forewings, and hindwings with fuscous colour wholly changed to golden-ochreous.

I have little hesitation in uniting these sexes; although at first sight very dissimilar, the difference is of ground-colour only, and I suspect that the yellow tints of the female are protective, approaching those of a decaying leaf. This and the next species are characterized by the elegant form of the subfalcate forewings, of which however the apex is less produced than it appears to be.

Wellington, in February; two specimens of each sex taken by Mr. R. W. Fereday.

34. *Gymn. philadelpha*, n. sp.

Media, alis ant. griseis, leviter albido-sparsis, ciliorum apice albo; post. griseo-albidis, apice leviter griseo.

Female.—25 mm. Head and thorax whitish-ochreous, somewhat suffused with pale grey. Palpi whitish-ochreous. Antennæ grey, basal joint whitish-ochreous. Abdomen grey-whitish. Legs grey, central ring of middle tibiæ and apex of all joints ochreous-whitish, posterior tibiæ ochreous-whitish. Forewings moderate, posteriorly dilated, costa moderately arched, apex acute, hindmargin sinuate, rather strongly oblique; grey, somewhat mixed with ochreous-whitish: cilia with basal half grey, terminal half ochreous-whitish. Hindwings grey-whitish, apex somewhat suffused with light grey; cilia whitish, round apex greyish-tinged.

Very similar in form to *G. hyetodes*, but differing from both sexes in the grey forewings, the absence of markings, and the whitish hindwings. It is probable that the male may have some points of difference from the female.

Mount Hutt, in January; two specimens taken by Mr. R. W. Fereday, without note of elevation.

13. Œcophora, Z.

Head smooth, sidetufts moderate, loosely appressed, projecting somewhat above antennæ. Antennæ in male moderate, somewhat serrate, moderately and evenly ciliated (1), basal joint rather elongate, moderate, with strong pecten. Palpi moderate, second joint not exceeding base of antennæ, with appressed scales, somewhat loose beneath, terminal joint shorter than second, moderate, curved, Thorax smooth. Forewings elongate, moderate or rather narrow, apex obtusely pointed, hindmargin very oblique, slightly rounded. Hindwings somewhat narrower than forewings, elongate-ovate, hindmargin rounded, cilia $\frac{3}{4}$ to 1. Abdomen moderate, often somewhat flattened, more or less distinctly margined. Posterior tibiæ clothed with long fine hairs. Forewings with vein 7 to costa, 2 from or somewhat before angle of cell, rarely stalked with 3. Hindwings normal.

This is the typical genus of the family; it is also the most widely distributed, and probably one of the oldest and most extensive. It is well represented in Europe, North America, and Australia, and there is every likelihood that it will be found to be nearly cosmopolitan; but its limits have been so ill understood by many writers, that no reliable authority can be quoted at present for its occurrence elsewhere. The larvæ are little known, but appear to feed mostly on dead wood, bark, and seeds; the habits of none of the New Zealand species are known, and it is of considerable importance to discover them. The imagos generally frequent bush.

Nineteen species are here described, which may be thus tabulated :—

1a. Forewings strongly dilated posteriorly.
2a. Forewings grey or whitish-ochreous .. .. 42. *griseata.*
2b. „ reddish-ochreous-brown .. .. 43. *phegophylla.*
1b. Forewings not noticeably dilated.
2a. Forewings narrow.
3a. With sharply defined fasciæ.
4a. Head dark fuscous .. .. 53. *chrysogramma*
4b. „ yellow .. .. 52. *hoplodesma.*
3b. With fasciæ obscure or obsolete .. .. 51. *siderodeta.*
2b. Forewings moderate.
3a. Forewings yellow or whitish-ochreous.
4a. Head suffused with dark fuscous .. .. 48. *anæma.*
4b. „ yellow or whitish-ochreous.
5a. Thorax wholly yellow .. .. 44. *oporæa.*
5b. „ partially dark fuscous.
6a. Forewings with a dark anterior fascia .. .. 38. *chloritis.*
6b. „ without anterior fascia.
7a. Anterior half of thorax wholly dark fuscous.
8a. Forewings ochreous .. .. 45. *horæa.*
8b. „ pale yellow .. .. .. 49. *macarella.*
7b. Anterior half of thorax not wholly dark fuscous.
8a. Forewings yellow .. .. 46. *armigerella.*
8b. „ pale whitish-ochreous .. .. 47. *apanthes.*
3b. Forewings brownish-ochreous .. .. 35. *pseudospretella.*
3c. Forewings whitish or grey.
4a. Without definite markings .. .. 50. *homodoxa.*
4b. With distinct darker markings.
5a. Forewings coarsely irrorated with reddish fuscous .. 36. *scholæa.*
5b. „ without reddish fuscous scales.
6a. Costa with cloudy darker spots.
7a. Head ochreous-white .. .. 40. *contextella.*
7b. „ more or less grey.
8a. Discal dots well defined .. .. .. 37. *letharga.*
8b. „ obscure or obsolete .. .. 39. *epimylia.*
6b. Costa not spotted .. .. 41. *hemimochla.*

35. *Œc. pseudospretella*, Stt.

Media, alis ant. ochreis, saturate fusco conspersis, maculis disci tribus parvis serieque postica subcostali ac marginis postici saturate fuscis; post. dilute griseis.

Male, female.—17–21 mm. Head, palpi, and thorax light brownish-ochreous, strongly suffused with dark fuscous. Forewings elongate, costa gently arched, apex rounded, hindmargin very obliquely rounded; light brownish-ochreous, densely mixed with dark fuscous; a small round dark fuscous spot in disc before middle, a second beyond middle, and a third directly beneath first on fold; a row of cloudy dark fuscous spots from beyond middle of costa to hindmargin beneath apex, thence along hindmargin to anal angle: cilia light brownish-ochreous, mixed with dark fuscous. Hindwings whitish-grey, posteriorly darker; cilia whitish-grey.

Specifically remote from any native species.

The larva feeds on seeds, skins, dried insects, etc., and is capable of doing great damage in a museum.

This well known species has been introduced from England, and is very common in houses, probably throughout New Zealand. I have observed it at Hamilton, Napier, Wanganui, Wellington, Christchurch, Castle Hill, and Dunedin, from December to March.

36. *Œc. scholæa*, n. sp.

Media, alis ant. dilute griseis, rufescenti-conspersis, maculis costæ tribus anticis, punctis disci duobus, tertio plicæ post primum disci posito, lineaque postica transversa angulata saturate fuscis; post. griseis.

Male, female.—19–21 mm. Head, palpi, antennæ, and thorax greyish-ochreous mixed with fuscous. Abdomen whitish-ochreous. Legs dark fuscous, anterior and middle tibiæ with central ring, hairs of posterior tibiæ and apex of all joints whitish-ochreous. Forewings moderate, costa moderately arched, apex rounded, hindmargin extremely obliquely rounded; pale greyish, coarsely irrorated with reddish-fuscous and dark fuscous, especially towards costa and hindmargin; a cloudy dark fuscous spot on base of costa, another on costa at $\frac{1}{4}$, and a third in middle; a dark fuscous dot in disc at $\frac{1}{3}$, a second at $\frac{2}{3}$, and a third obliquely beyond first on fold; a very obscure interrupted dark fuscous transverse line from $\frac{3}{4}$ of costa to anal angle, angulated outwards in middle, somewhat dentate beneath costa: cilia greyish-ochreous, obscurely mixed with dark fuscous at base. Hindwings light grey, towards apex dark grey: cilia grey-whitish, with a grey line.

A dull-coloured species, not nearly allied to any but *Œ. letharga*; from this it differs by the larger size, reddish-fuscous irroration, and position of the third discal dot obliquely beyond the first.

Wellington, Christchurch, Dunedin, Invercargill, from December to February; common.

37. *Œc. letharga*, n. sp.

Minor, alis ant. albido-griseis, fusco-conspersis, maculis costæ tribus anticis nebulosis, punctis disci duobus, tertio plicæ ante primum disci posito, lineaque postica transversa angulata saturate fuscis; post. griseis.

Male.—16–16½ mm. Head, palpi, antennæ, and thorax ochreous-whitish, mixed with fuscous-grey. Abdomen ochreous-whitish. Anterior and middle legs fuscous-grey, central ring of tibiæ and apex of all joints ochreous-whitish; posterior legs ochreous-whitish. Forewings moderate, costa moderately arched, apex rounded, hindmargin extremely obliquely rounded; pale whitish-grey, slightly ochreous-tinged, and irrorated with dark fuscous; a cloudy fuscous spot on costa at base, another at ¼, and a third in middle; a small cloudy dark fuscous spot in disc near base; a dark fuscous dot in disc before middle, a second beyond middle, and a third rather obliquely before first on fold; a cloudy fuscous outwards-bent transverse line from ¾ of costa to anal angle, indented inwards beneath costa: cilia pale whitish-ochreous, sprinkled with dark fuscous. Hindwings light grey, apex darker; cilia grey-whitish, with a distinct grey line near base.

Smaller and paler than the preceding, without reddish tinge, and with the third discal dot placed obliquely before the first.

Dunedin, in January; three specimens.

38. *Œc. chloritis*, n. sp.

Minor, alis ant. albido-flavidis, costæ basi ac puncto sub plica posito nigris, fascia antica angusta plicam non superante, linea anguli analis obliqua, lineaque transversa postica obsoleta griseis; post. griseis.

Male. — 15½ mm. Head whitish-ochreous yellow. Palpi whitish-ochreous, second joint externally mixed with dark fuscous. Antennæ ochreous-whitish, obscurely annulated with dark fuscous. Thorax dark fuscous, posterior margin whitish-yellowish. Abdomen whitish-grey. Legs dark fuscous, posterior tibiæ and apex of all joints whitish-yellowish. Forewings moderate, costa moderately arched, apex pointed, hindmargin very oblique, slightly rounded; pale dull whitish-yellowish; base of costa suffusedly dark fuscous; a very oblique indistinct grey streak from near costa at ¼ to middle of fold; a blackish dot below fold a little before extremity of this streak; a cloudy dark grey transverse mark on anal angle; a faint greyish posterior suffusion, obscurely indicating a transverse line very near handmargin: cilia pale dull whitish-yellowish, with several rows of dark grey points, most distinct towards tips. Hindwings grey; cilia whitish, with a cloudy grey line near base.

Of somewhat doubtful specific affinity; differing from all the other yellow species in the more elongate forewings, and the transverse anterior and submarginal grey lines.

Lake Wakatipu (1,000 feet), in December; one specimen.

39. *Œc. epimylia*, n. sp.

Minor, alis ant. dilute griseis, maculis costæ tribus, quarta plicæ, punctisque disci duobus obscuris saturatioribus; post. griseis; capite griseo.

Male, female.—11½–13 mm. Head and thorax pale grey mixed with darker. Palpi whitish-grey, second joint externally densely irrorated with blackish, terminal joint with two or three slender blackish rings below middle. Antennæ dark grey. Abdomen grey. Legs dark fuscous, central and apical ring of middle tibiæ, hairs of posterior tibiæ, and apex of all tarsal joints whitish. Forewings elongate, costa moderately arched, apex rounded, hindmargin very obliquely rounded; whitish-grey, densely and irregularly irrorated with dark grey, tending to form cloudy very indistinct patches on costa at ¼, middle, and ¾, leaving interspaces somewhat paler; an indistinct cloudy dark fuscous spot on fold at ⅓, a cloudy spot on anal angle, sometimes preceded and followed by a smaller spot, a dot in disc before middle and beyond that on fold, and another in disc beyond middle, all very indistinct and sometimes obsolete: cilia whitish-grey, with several rows of dark grey points. Hindwings light grey; cilia whitish-grey.

Nearly allied to *Œ. contextella*, and having a similar mottled appearance, but readily known by its smaller size, slightly narrower wings, general grey tints, and especially the grey head.

Castle Hill (2,500 feet), in January; beaten in great abundance from *Fagus solandri*.

40. *Œc. contextella*, Walk.

(*Gelechia contextella*, Walk., Brit. Mus. Cat., 656.)

Minor, alis ant. canis, griseo-sparsis, fascia ad basim, altera post medium, maculis costæ duabus, lineaque postica sinuata saturate griseis, striga obliqua sub plica posita signoque disci arcuato nigris; post. dilute griseis; capite ochreo-albo.

Male, female.—13–15 mm. Head ochreous-white. Palpi white, second joint irrorated with dark fuscous except at apex, terminal joint with a cloudy dark fuscous submedian ring. Antennæ grey. Thorax whitish or ochreous-white, anterior margin suffused with dark fuscous. Abdomen whitish-ochreous. Legs dark fuscous, middle tibiæ with central and apical rings, hairs of posterior tibiæ, and apex of all tarsal joints ochreous-whitish. Forewings moderate, costa moderately arched, apex rounded, hindmargin very obliquely rounded; white, irregularly irrorated with fuscous-grey; a cloudy dark grey fascia from base of costa, and a second from costa at ¼, confluent in middle and extending almost to inner margin at ⅓, mixed with ochreous at apex, and margined posteriorly by an oblique blackish streak below middle, sometimes connected with a blackish dot in disc before middle; a cloudy dark grey fascia from rather beyond middle of costa to anal angle, containing an ochreous partially blackish-circled spot in disc, and mixed with ochreous beneath; a small blackish mark on inner margin before this fascia, separated from it by a white line; a cloudy dark grey spot on costa at $\frac{4}{5}$, giving rise to a curved cloudy blackish-grey transverse line to anal angle; all these grey markings are sometimes partially suffused and confluent; a cloudy dark grey apical spot: cilia white, irregularly mixed with dark grey, forming a cloudy spot at apex and anal angle. Hindwings pale grey; cilia grey-whitish.

Separable from *Œ. epimylia* by the larger size, ochreous-white head, and white ground-colour of forewings; from *Œ. hemimochla* by the distinct grey costal spots and transverse fasciæ, and always well-defined oblique streak beneath fold.

Christchurch, Dunedin, Lake Wakatipu, and Invercargill, in December and January; rather common.

41. *Œc. hemimochla*, n. sp.

Minor, alis ant. albidis, griseo-conspersis, striga sub plica posita obliqua, punctis disci duobus, striga anguli analis obliqua, maculaque subapicali nigricantibus; post. albido-griseis; capite ochreo-albo.

Male, female.—14½–16 mm. Head ochreous-whitish. Palpi ochreous-whitish, basal $\frac{2}{3}$ of second joint, and base and apex of terminal joint suffused with dark fuscous. Antennæ grey. Thorax ochreous-whitish, more or less mixed with grey. Abdomen ochreous-whitish. Anterior and middle legs dark fuscous, central ring of middle tibiæ, and apex of all joints ochreous-whitish; posterior legs ochreous-whitish. Forewings moderate, costa moderately arched, apex rounded, hindmargin very obliquely rounded; white, irregularly suffused with whitish-ochreous, and sprinkled with grey and a few blackish scales; costal edge dark fuscous at base; an oblique dark fuscous streak from fold before middle to near inner margin before $\frac{1}{3}$, generally distinct on fold only; a blackish dot in disc before middle, and a larger one beyond middle, sometimes connected with apex of oblique streak by a cloudy dark fuscous line; a cloudy dark fuscous bar extending from anal angle almost or quite to second discal dot; a cloudy dark fuscous apical spot, suffusedly produced along hindmargin; sometimes a curved transverse cloudy dark fuscous line near hindmargin, indented inwards beneath costa, often obsolete: cilia whitish, with rows of dark fuscous points, forming a cloudy spot at apex and anal angle. Hindwings whitish-grey or light grey; cilia grey-whitish.

Closely allied to *Œ. contextella*, and best separated by the absence of the distinct lighter and darker spots of the costa; also somewhat larger and duller, less variegated, without entire fasciæ, the oblique streak beneath the fold not generally distinct, and the hindwings lighter.

Hamilton, Wellington, and Napier, in January and March; rather common. Probably this species may be confined to the North Island, and *Œ. contextella* to the South.

42. *Œc. griseata*, Butl.

(*Œcophora griseata*, Butl., Proc. Zool. Soc. Lond., 1877, 405.)

Media, alis ant. dilatatis, albido-ochreis griseisve, punctis disci duobus, signo sub plica posito obliquo, maculæ costæ media nebulosa alteraque anguli analis saturate fuscis ; post. griseo-albidis griseisve.

Male, female.—15–19 mm. Head, palpi, antennæ, and thorax whitish-ochreous, often suffused with grey ; terminal joint of palpi with sub-basal and subapical dark fuscous rings. Abdomen ochreous-whitish or grey. Legs dark fuscous-grey, central and apical rings of middle tibiæ, hairs of posterior tibiæ, and apex of all tarsal joints ochreous-whitish. Forewings moderate, posteriorly strongly dilated, costa moderately arched, apex rounded, hindmargin obliquely rounded; varying from pale whitish-ochreous to dull grey ; the paler specimens sometimes partially suffused with grey, or mixed with reddish-ochreous in disc, and on fold towards base; a slender oblique dark fuscous streak almost from inner margin at ⅕ to disc before middle, often partially obsolete ; a dark fuscous dot in disc above apex of this streak, and a second in disc beyond middle; a cloudy dark fuscous spot on anal angle, often almost obsolete, anteriorly edged with a darker dot on margin ; a transverse outwards-curved, often partially obsolete, fine dark fuscous line from ¾ of costa to before anal angle, irregularly sinuate towards costa, where it is generally more distinct: cilia pale whitish-ochreous, generally suffused with numerous rows of dark grey points, tips clear pale ochreous. Hindwings whitish-grey or grey; cilia ochreous-whitish, often suffused with grey.

This and the next species are distinguished from all the rest by the posterior dilation of the forewings; *Œ. griseata* varies a good deal in colour, but can hardly be mistaken.

Christchurch, Castle Hill, Dunedin, and Invercargill, from December to March ; common.

43. *Œc. phegophylla*, n. sp.

Media, alis ant. dilatatis, ochreo-rufis, puncto disci strigaque dorsi indentata ochreo-albidis, partim flavo-suffusis ; post. saturate griseis.

Male.—21–22 mm. Head ochreous-yellow. Palpi ochreous-yellow, externally mixed with dark fuscous. Antennæ dark fuscous. Thorax ochreous-yellow, suffused with fuscous except on posterior margin. Abdomen grey. Legs dark fuscous, hairs of posterior tibiæ and apex of all joints ochreous-yellow, beneath wholly ochreous-yellow. Forewings moderate, posteriorly strongly dilated, costa moderately arched, apex obtuse, hindmargin oblique, hardly rounded ; reddish-ochreous-brown, becoming deeper towards inner margin ; a minute ochreous-whitish dot in disc beyond middle ; an ochreous-whitish streak along inner margin from base to ¾, towards extremities suffused with bright ochreous-orange, its upper margin rather deeply indented at $\frac{1}{3}$, thence somewhat dilated, and again attenuated to apex: cilia reddish-ochreous brown, beneath anal angle ochreous-whitish suffused with orange. Hindwings dark grey; cilia grey, extreme base pale.

A very distinct and handsome species, in form of wing very closely approaching the preceding; in colour it is approached by the much smaller and narrower-winged *Cremnogenes oxyina*, but the resemblance is analogous merely, and due in each case to protective imitation of the colouring of a dead beech-leaf.

At the head of Lake Wakatipu, in December; two specimens from *Fagus solandri.*

44. *Œc. oporæa*, n. sp.

Media, alis ant. saturate flavis, linea costæ basali nigrescenti, interdum punctis disci tribus rufis; post. griseis; thorace flavo.

Male, female.—18–20 mm. Head and thorax deep ochreous-yellow. Palpi ochreous-yellow, lower $\frac{2}{3}$ of second joint externally suffused with dark fuscous. Antennæ grey. Abdomen grey. Anterior legs dark fuscous; middle and posterior legs ochreous-whitish. Forewings moderate, costa moderately arched, apex rounded, hindmargin oblique, slightly rounded; deep yellow, sometimes suffused with reddish-ochreous towards middle of inner margin, anal angle, and apex; a short slender blackish streak along base of costa; sometimes a reddish-fuscous dot in disc before middle, a second beyond middle, and a third on fold directly beneath first, but these are usually quite obsolete, especially the first: cilia yellow, sometimes mixed with reddish-ochreous. Hindwings grey, darker posteriorly; cilia grey.

Larger and deeper yellow than any of the other yellow species, from all of which it is at once separated by the wholly yellow thorax.

Castle Hill (2,500 feet), in January; common amongst *Fagus solandri.*

45. *Œc. horæa*, n. sp.

Minor, alis ant. albido-ochreis, flavido-suffusis, striga costæ basali nigrescenti, signo plicæ, altero anguli analis, punctisque costæ duobus obscuris saturate fuscis; post. griseis; thorace antice saturate fusco, postice flavido.

Male, female.—13½–15 mm. Head light yellowish-ochreous. Palpi light yellowish-ochreous, basal half of both joints finely irrorated externally with dark fuscous. Antennæ in male dark fuscous, in female whitish-ochreous annulated with dark fuscous. Thorax light yellowish-ochreous, anterior half suffused with dark fuscous. Abdomen grey, apex whitish-ochreous. Anterior legs dark fuscous; middle legs whitish-ochreous irrorated with dark fuscous, except in middle of tibiæ and at apex of joints;

posterior legs whitish-ochreous. Forewings moderate, costa moderately arched, apex rounded, hindmargin very obliquely rounded; whitish-ochreous, rather suffused with yellowish-ochreous, costal margin yellowish-ochreous; costa suffusedly blackish towards base; a few blackish scales on fold at $\frac{1}{3}$, on costa in middle and at $\frac{3}{4}$, and above anal angle; posterior half of wing more or less irrorated very finely with fuscous: cilia pale yellowish-ochreous, irrorated with fuscous points, especially on tips round apex, and on a spot at anal angle. Hindwings grey; cilia whitish-grey.

Differs from all the other yellow species in its distinct ochreous tint, especially on costa and cilia; not very close to any other.

Hamilton and the Bealey River, in January; four specimens.

46. *Œc. armigerella*, Walk.

(*Œcophora armigerella*, Walk., Brit. Mus. Cat., 698.)

Minor, alis ant. flavis, striga costæ basali nigrescenti, interdum punctis disci duobus lineaque anguli analis obliqua saturate fuscis; post. griseis; thorace flavo, humeris anguste nigrescentibus.

Male.—14½–17 mm. Head yellow. Palpi pale ochreous-yellow, second joint with basal $\frac{2}{3}$ suffused with dark fuscous externally. Antennæ dark fuscous. Thorax yellow, anterior margin of shoulders narrowly dark fuscous. Abdomen grey. Anterior and middle legs dark fuscous, apex of tarsal joints obscurely whitish; posterior legs ochreous-whitish. Forewings moderate, costa moderately arched, apex rounded, hindmargin rounded, rather strongly oblique; rather deep yellow; basal fourth of costa rather broadly blackish; a dark fuscous ill-defined dot on fold before middle, and another in disc beyond middle, often both absent; sometimes a few fine scattered dark fuscous scales, forming a bar from second dot to anal angle, a curved transverse line near hindmargin, and an apical spot, but these are usually obsolete: cilia yellow, with a fuscous-grey spot at apex and another at anal angle. Hindwings grey, darker posteriorly; cilia light grey.

This and the two following species are closely allied, and have considerable superficial likeness; *Œ. armigerella* differs from both the others by its bright yellow colour, and by the narrow dark fuscous spot along the anterior margin of shoulders.

Dunedin, Lake Wakatipu, and Invercargill, from December to February; common.

The British Museum type of this species is lost, but Walker's description can hardly refer to any other.

47. *Œc. apanthes*, n. sp.

Minor, alis ant. dilute albido-ochreis, vix flavido-suffusis, striga costæ basali nigrescenti, macula apicis parva, interdum punctis disci tribus lineaque anguli analis obliqua saturate fuscis; post. albido-griseis; thorace dilute albido-ochreo, macula humeri interiori saturate fusco.

Male.—14½ mm. Head pale whitish-ochreous. Palpi pale whitish-ochreous, basal ⅔ of second joint and lower half of terminal joint externally irrorated with dark fuscous. Antennæ dark fuscous. Thorax pale whitish-ochreous, with an oblong dark fuscous spot on each shoulder not touching lateral margin. Abdomen ochreous-whitish. Anterior legs dark fuscous; middle legs ochreous-whitish irrorated with dark fuscous except at apex of joints; posterior legs ochreous-whitish. Forewings moderate, costa moderately arched, apex obtuse, hindmargin rounded, rather strongly oblique; pale whitish-ochreous, slightly suffused with pale yellowish; basal third of costa broadly dark fuscous; a dark fuscous dot in disc before middle, a second beyond middle, and a third on fold directly beneath first, first and third sometimes obsolete; sometimes a bar of scattered dark fuscous scales between second dot and anal angle; some scattered dark fuscous scales at apex and towards hindmargin: cilia ochreous-whitish, sometimes with scattered grey points, and with a cloudy dark fuscous spot at apex, and a grey spot at anal angle. Hindwings whitish-grey; cilia whitish.

Closely allied to *Œ. anæma*, but slightly brighter, the hindwings lighter, the head and thorax wholly whitish-ochreous except an internal spot on shoulders.

Hamilton and Cambridge, in January; two specimens.

48. *Œc. anæma*, n. sp.

Minor, alis ant. albido-ochreis, levissime griseo-irroratis, striga costæ basali, strigula anguli analis obliqua, interdum etiam signo plicæ saturate fuscis; post. griseis; thorace saturate fusco, macula lateris parva pallida.

Male.—13½–14½ mm. Head whitish-ochreous, finely and closely irrorated with dark fuscous. Palpi pale whitish-ochreous, externally irrorated with dark fuscous except at apex of joints. Antennæ whitish-ochreous, obscurely annulated with dark fuscous. Thorax dark fuscous, with a small whitish-ochreous lateral spot. Abdomen grey. Anterior and middle legs dark fuscous, with ochreous-whitish rings at apex of joints; posterior legs ochreous-whitish. Forewings moderate, costa moderately arched, apex blunt-pointed, hindmargin very obliquely rounded; very pale whitish-ochreous, with fine scattered light fuscous scales; basal third of costa broadly dark fuscous; a short inwardly oblique dark fuscous mark on fold at ⅓, sometimes obsolete; a cloudy oblique dark fuscous bar from disc beyond middle to anal angle: cilia very pale whitish-ochreous, with lines of grey points, forming a broader dark grey shade before tips. Hindwings grey, darker posteriorly; cilia light grey.

Separable from all its immediate allies by the dark fuscous suffusion of the head, as well as of the entire thorax except a small lateral spot; the forewings have a peculiar dull appearance, due to the fine fuscous irroration, which is only perceptible under a lens.

Lake Wakatipu, in December; four specimens.

49. *Œc. macarella*, n. sp.

Minor, alis ant. dilute flavis, costæ basi nigrescenti, interdum signo plicæ lineaque anguli analis obliqua obscuris saturate fuscis; post. albido-griseis; thorace saturate fusco, margine postico anguste flavido.

Male, female.—12½–14 mm. Head pale yellow. Palpi whitish-yellow, basal half of both joints externally irrorated with dark fuscous. Antennæ ochreous-whitish, basal joint dark fuscous except at apex. Thorax dark fuscous, with small lateral and posterior pale yellowish spots. Abdomen grey-whitish. Anterior legs dark fuscous; middle legs ochreous-whitish irrorated with dark fuscous, except at apex of joints; posterior legs ochreous-whitish. Forewings moderate, costa moderately arched, apex blunt-pointed, hindmargin very obliquely rounded; pale yellow, somewhat suffused with deeper yellow; costa dark fuscous towards base; sometimes a few dark fuscous scales on fold at ⅓, and on a bar from disc to anal angle: cilia pale yellow, with several rows of grey points, and a darker grey shade before tips. Hindwings whitish-grey; cilia grey-whitish.

Readily known by the pale yellow colouring, the less defined basal mark on the costa, and the almost wholly dark fuscous thorax.

Christchurch, in January; four specimens.

50. *Œc. homodoxa*, n. sp.

Minor, alis ant. albido-griseis, saturatiori irroratis, signo plicæ ante medium alteroque anguli analis vix saturatioribus; post. griseis.

Male, female.—15½–17½ mm. Head, palpi, thorax, and legs light grey finely irrorated with dark fuscous. Antennæ dark fuscous. Abdomen light grey. Forewings elongate, costa moderately arched, apex pointed, hindmargin very oblique, hardly rounded; pale whitish-grey, very finely and closely irrorated with dark fuscous-grey; indications of an inwardly oblique dark fuscous mark beneath fold about ⅓, and a perpendicular mark on anal angle, both almost obsolete: cilia grey-whitish, with several rows of dark fuscous-grey points. Hindwings grey, in female rather darker; cilia light grey, with a cloudy darker basal line.

An obscure-looking species, differing from the other grey species in the more elongate forewings, the uniform darker irroration, and the absence of distinct darker markings.

Lake Wakatipu, in December; two specimens.

51. *Œc. siderodeta*, n. sp.

Minor, alis ant. angustis, ochreis, saturate fusco-suffusis, interdum fasciis tribus obliquis obscuris, dorso sæpius basim versus pallidiori; post. saturate griseis.

Male, female.—12–14 mm. Head, palpi, and thorax ochreous, densely mixed with dark fuscous. Antennæ dark fuscous. Abdomen grey. Legs dark fuscous, central ring of tibiæ, hairs of posterior tibiæ, and apex of all joints whitish. Forewings elongate, narrow, costa gently arched, more strongly near base, apex pointed, hindmargin extremely obliquely rounded; brownish-ochreous, densely irrorated with dark fuscous, which tends to form three broad oblique cloudy fasciæ, but these are often wholly suffused and confluent; generally there is a more or less distinctly clear brownish-ochreous space towards base of inner margin: cilia ochreous-whitish, with numerous irregular rows of dark fuscous points, tips clear whitish. Hindwings dark fuscous; cilia grey, towards base dark fuscous.

An inconspicuous species, but readily known by the peculiar form of the forewings, ochreous suffused ground-colour, and tendency to form three cloudy fasciæ.

Christchurch, Dunedin, and Lake Wakitipu, from December to February; common, especially at rest on fences.

52. *Œc. hoplodesma*, n. sp.

Minor, alis ant. angustis, dilute flavis, costæ dimidio antico, fasciis tribus obliquis quartaque marginis postici griseis; post. griseis.

Male.—12½ mm. Head and palpi light yellow. Antennæ dark fuscous. Thorax light yellow, mixed with fuscous grey. Abdomen whitish-grey. Legs dark grey, hairs of posterior tibiæ and apex of all tarsal joints whitish. Forewings elongate, narrow, costa moderately arched, apex round-pointed, hindmargin extremely obliquely rounded; light yellow, somewhat deeper in disc; markings very pale whitish-grey, closely irrorated with dark grey scales; a streak along anterior half of costa; a cloudy spot on inner margin near base; a narrow oblique transverse fascia from ¼ of costa to before middle of inner margin, and a second from middle of costa to ¾ of inner margin, both slightly interrupted below middle; a third, less oblique, from ¾ of costa to anal angle, obscurely connected with second near inner margin; an irregular streak along hindmargin: cilia light yellow, with numerous lines of grey points. Hindwings grey; cilia whitish-grey, base slightly darker.

A distinct and pretty species.

South Rakaia, in March; one specimen received from Dr. W. H. Gaze.

53. *Œc. chrysogramma*, n. sp.

Minor, alis ant. angustis, saturate flavis, basi, fasciis duabus obliquis, macula costæ postica transversa, strigaque marginis postici saturate purpureo-fuscis; post. saturate fuscis.

Female.—12½ mm. Head, palpi, antennæ, thorax, abdomen, and legs dark purplish-fuscous, apex of tarsal joints ochreous-whitish. Forewings elongate, costa moderately arched, apex rounded, hindmargin very obliquely rounded; deep golden-yellow; extreme base dark fuscous; anterior half of costal edge dark fuscous; markings dark purple-grey, edged with blackish-fuscous; a rather broad slightly curved oblique transverse fascia from $\frac{1}{4}$ of costa to $\frac{1}{3}$ of inner margin, and a second from middle of costa to $\frac{2}{3}$ of inner margin; a transverse somewhat narrower perpendicular spot from costa at $\frac{3}{4}$, reaching more than half across wing, narrowed beneath, almost touching second fascia; a streak along hindmargin: cilia dark purple-grey. Hindwings and cilia dark fuscous.

Allied to the preceding, but very distinct; it is a striking and handsome species.

Wellington, in December; one specimen at rest on a fence.

14. CREMNOGENES, n. g.

Head smooth, sidetufts small, loosely spreading. Antennæ in male moderate or rather stout, with whorls of cilia at joints or closely set over whole surface (1–2), basal joint rather elongate, with pecten. Palpi moderately long, second joint somewhat exceeding base of antennæ, with dense appressed scales, slightly rough beneath towards apex, terminal joint shorter than second, slender, curved. Thorax smooth. Forewings moderate, apex pointed, hindmargin oblique. Hindwings somewhat narrower than forewings, elongate-ovate, hindmargin rounded, cilia $\frac{4}{5}$. Abdomen rather elongate, stout. Posterior tibiæ clothed with long fine hairs. Forewings with vein 7 to costa, 2 from near angle of cell. Hindwings normal.

Closely allied to *Œcophora*, from which it differs in the ciliations of the antennæ in male; these are not arranged in a single series, but either in whorls at the joints (*C. oxyina*), when they are also proportionately longer, or closely set over the entire surface (*C. aphrontis*). I think these two forms may be justly included in the same genus, at least for the present; besides these I have probably two other species of the genus, which I cannot venture yet to describe.

54. *Cremn. oxyina*, n. sp.

Minor, alis ant. M. saturate fuscis, ferrugineo-mixtis, F. rufo-ochreis, fusco-mixtis, interdum striga dorsi indentata pallida, signo sub plica posito punctoque disci nigricantibus; post. saturate fuscis.

Male, female.—13–15 mm. Head, palpi, antennæ, thorax, and abdomen dark fuscous, slightly ochreous-tinged; thorax with a small sharply-defined ochreous-whitish lateral spot. Legs dark fuscous-grey. Forewings in male elongate, in female rather shorter, costa moderately arched, apex pointed, hindmargin slightly sinuate, extremely oblique; dark fuscous, mixed and suffused with reddish-ochreous or ferruginous, in female almost wholly reddish-ochreous, becoming deeper along fold; an ochreous-whitish, often indistinct or obsolete, streak along inner margin from base to $\frac{3}{4}$, attenuated posteriorly, upper margin deeply dentate before middle, indentation filled with a small black spot; a dark fuscous dot in disc beyond middle, in male obscure; a curved transverse dark fuscous line near hindmargin, often obsolete: cilia in male ferruginous mixed with dark fuscous, in female reddish-ochreous, lighter towards tips. Hindwings dark fuscous-grey; with a dark fuscous line near base.

Easily known by its ferruginous or reddish-ochreous colouring, which in the female closely approaches that of the much larger *Œcophora phegophylla.*

Lake Wakatipu, in December; very common amongst *Fagus solandri,* from 1,000 to 3,000 feet.

55. *Cremn. aphrontis,* n. sp.

Minor, alis ant. ochreo-flavis, partim griseo-suffusis, puncto disci nigro; post. saturate griseis, basim versus dilutioribus.

Male, female.—12–14½ mm. Head and palpi ochreous-yellow, anterior edge of palpi suffusedly dark fuscous. Antennæ blackish. Thorax dark fuscous, with yellowish lateral and posterior spots. Abdomen dark grey, posteriorly becoming whitish-ochreous. Legs dark grey, apex of joints obscurely ochreous-whitish, posterior tibiæ with very dense ochreous-whitish hairs. Forewings moderate, costa moderately arched, apex round-pointed, hindmargin very obliquely rounded; grey, more or less wholly suffused irregularly with ochreous yellow; a blackish dot in disc beyond middle: cilia pale ochreous-yellow, somewhat mixed with grey. Hindwings grey, darker towards apex: cilia ochreous-whitish, suffused with dark grey towards base.

The irregular grey suffusion causes this insect to look like a yellow species in bad condition.

Arthur's Pass, in January; common amongst the grass and rough herbage, at about 5,000 feet.

Appendix.

A certain number of descriptions, probably referable to species of this family, I have not been able to identify with any specimens in my possession. Some of these probably indicate good species; others are so inadequate as to remain always unidentifiable. I give here a list of these, with remarks; the number prefixed to each is for reference in the index only.

56. *Izatha attactella,* Walk., Brit. Mus. Cat., 787.

I noted this in the British Museum collection as apparently a new species of *Semiocosma.* Large; forewings whitish, irrorated with grey, with a black longitudinal interrupted streak, some dark fuscous transverse discal marks, and a row of black spots along hindmargin and apical third of costa; hindwings light grey.

57. *Gelechia copiosella*, Walk., Brit. Mus. Cat., 1028.

I marked this also as probably a new species of *Semiocosma*. Moderate; forewings blackish, clouded and streaked with cinereous; hindwings dark fuscous. The diagnosis however describes it as black, with a silvery-white discal dot. Said to be from Auckland.

58. *Œcophora apertella*, Walk., Brit. Mus. Cat., 698.

These specimens (amongst which is mixed one of *Œc. armigerella*, as I believe), appeared to me, when I saw them, to be a new species of *Œcophora*, but I was not then well acquainted with the yellow group. Less; forewings golden-yellow, without markings; hindwings grey. Said to be from Auckland.

59. *Tingena bifaciella*, Walk., Brit. Mus. Cat., 810.

I did not identify this species, but suspect it might possibly be a yellow specimen of *Gymnobathra parca*, Butl., in which case the name would have to be adopted for the species. Butler's remarks on these species are worthless; I have seen *Œcophora macarella* labelled by Butler himself as his *parca*, but the original type of *parca* in the British Museum belongs truly to the species which I have described under that name.

60. *Œcophora ademptella*, Walk., Brit. Mus. Cat., 698.

The types of this I marked as a good species, probably of *Gymnobathra* or *Œcophora*. Forewings purplish-fuscous, costa yellowish except at base and apex, a yellow streak along inner margin not reaching anal angle; hindwings fuscous.

61. *Œcophora limbata*, Butl., Cist. Ent., vol. ii., 560.

I have not seen this; probably a good species. Forewings dark fuscous, costa bright yellow; hindwings dark fuscous; head yellow. Blenheim.

62. *Gelechia collitella*, Walk., Brit. Mus. Cat., 655.

I could not identify this type at the time. Forewings rather broad, pale cinereous-fawn colour, with four discal spots and a subterminal line rising from a costal spot fuscous; hindwings light grey. I now think this might refer to a variety of *Œcophora griseata*.

63. *Gelechia convulsella*, Walk., Brit. Mus. Cat., 656.

Perhaps a new *Œcophora*. Forewings whitish, with four irregular dark grey bands, four black dots in disc, and a row along hindmargin and apical fourth of costa; hindwings grey. Said to be from Auckland.

64. *Gelechia innotella*, Walk., Brit. Mus. Cat., 652.

Quite unidentifiable, but may very possibly be *Œcophora pseudospretella*.

65. *Gelechia contritella*, Walk., Brit. Mus. Cat., 657.

This appears to be some species of *Trachypepla*, but is so worn and broken as to be absolutely unidentifiable; moreover the description can hardly be reconciled with the type, so that the name must be altogether dropped.

66. *Œcophora munda*, Feld., Reis. Nov., pl. cxl., 38.

Represented in the figure as a small triangular-winged species, with the forewings crossed by oblique rows of dots. I know of no species with this character.

67. *Œcophora melinella*. Feld., Reis. Nov., pl. cxl., 41.

This figure appears to me insufficient for identification.

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conspicuella, Walk.	10.	philadelpha, n. sp.	34.
contextella, Walk.	40.	photinella, Meyr.	4.
contritella, Walk.	65.	picarella, Walk.	20.
convulsella, Walk.	63.	prasophyta, n. sp.	22.
copiosella, Walk.	57.	protochlora, n. sp.	14.
dinocosma, n. sp.	7.	pseudospretella, Stt.	35.
epimylia, n. sp.	39.	psychra, n. sp.	18.
epiphanes, n. sp.	21.	*rufosparsa*, Butl.	2.
euryleucota, n. sp.	9.	sarcoxantha, n. sp.	27.
flavidella, Walk.	31.	scholæa, n. sp.	36.
galactina, Feld.	1.	siderodeta, n. sp.	51.

INDEX OF SPECIES—*continued.*

galaxias, n. sp.	13.	sordida, Butl.	6.
griseata, Butl.	42.	spartodeta, n. sp.	11.
hamatella, Walk.	32.	*taongella*, Feld.	10.
hemimochla, n. sp.	41.	*teras*, Feld.	20.
homodoxa, n. sp.	50.	tholodella, n. sp.	29.
hoplodesma, n. sp.	52.	*utuella*, Feld.	31.
horæa, n. sp.	45.	zophoëssa, Meyr.	3.
huttonii, Butl.	19.		

ART. II.—*A Monograph of the New Zealand* Geometrina.

By E. MEYRICK, B.A.

[*Read before the Philosophical Institute of Canterbury, 2nd August,* 1883.]

I UNDERTOOK the preparation of this paper, the subject of which does not fall within the limits of my special duty, by request; and on the conviction that the work was both highly desirable, and not otherwise likely to be executed. The *Geometrina* are naturally the first group to attract the attention of Lepidopterists in New Zealand; the butterflies and *Bombycina* are but few in number; the *Noctuina* also are neither numerous nor obtrusive. But the *Geometrina* are present everywhere, and are often elegantly or even brilliantly coloured, and their great variability makes them appear more numerous specifically than they are. Notwithstanding, it has been so impracticable for local collectors to get their specimens named, that very few have as yet attempted to do any good with them. The literature on the subject consists entirely of scattered papers and lists, all partial, and generally quite irreconcilable with each other; and the accumulation of synonymy has been so great, that it might well alarm a beginner. Many of the forms described as species are merely varieties, and the genera and families adopted by English writers are in the main both unnatural and unintelligible, being based wholly on wing-form and superficial resemblance, and necessarily incapable of accurate definition. The present paper is intended to provide a tolerably secure foundation for other workers, who will supply the omissions and correct the errors which were inseparable from the circumstances of the case. For their guidance, I will explain fully how far the paper is reliable.

I have never before investigated the genera of the *Geometrina*, and have no access to any works bearing on species outside New Zealand, except Guenée's. The conclusions of Lederer and Heinemann have therefore not been available to me, a very serious loss. It is possible, then, that some of the genera which I have been obliged to regard as new have been previously characterized by them from other species; and that my limitations of some genera already known may not coincide exactly with theirs. The family classification which I have adopted might also require modifications, if I had larger material at my command. On the other hand, the genera which I have here established can be relied on as both natural and accurately definable, and the families are limited and arranged on correct principles, and are also strictly definable as regards New Zealand species at least. Moreover, in view of the specialization of the fauna, it is highly probable that most of the genera are endemic, and are therefore justly considered as new.

As regards the specific nomenclature, it must be observed that I have never even seen Walker's descriptions (though indeed it is improbable that they would have helped me much in the identification of his species), nor have I been able to examine his types in the British Museum. On this question it has been necessary to accept the identifications of Mr. A. G. Butler, who has to some extent cleared up the difficulties; I believe his statements are tolerably correct on this subject, where he has the types before him, though his identifications of other authors' species from descriptions are frequently wrong. There are, however, still several of Walker's species unidentified, as to which I know nothing. Guenée described a number of species in the "Entomologists' Monthly Magazine," from specimens sent by Mr. R. W. Fereday; of each of these Mr. Fereday preserved an exactly similar duplicate, and these I have seen, so that the identification of them is absolutely assured. Felder's and Butler's species I have identified from their works; in some cases I have also seen specimens of Butler's species named by himself.

The limits of each species are almost certainly correct; this was a very important point, and I believe has been satisfactorily attained by the examination of very large material. The localities and seasons recorded must not be understood as exclusive; it was only possible to record observed places and times, dependent largely on the habits of observers; thus comparatively few observations have been made in the North Island. Some new species will doubtless be found in the higher latitudes, and probably a good many more in the interior of the mountain ranges.

In the descriptions of genera and species I have endeavoured to be as brief and concise as possible, consistently with accuracy. To assist in the ready determination of these I have given analytical tables throughout, both of the genera and species. The synonymy is given in full. Little is known of the larvæ; most recorded observations are of little service, owing to the uncertain identification of species; they are for this reason placed in an appendix. The only localities given are those for which I have direct authority from labelled specimens; those quoted by Walker and Butler are very often quite erroneous, and I have neglected them altogether. It is very desirable that collectors should at once begin to work out the larval habits of these insects, and make accurate descriptions of the larvæ, which will probably be found as variable in colour as the imagos. All information as to localities, seasons, and habits will be of value, and also, in the case of mountain species, as to the elevation at which they are found.

Of the New Zealand *Geometrina* Doubleday described six species in the appendix to Dieffenbach's "New Zealand." The descriptions are very brief, but I have identified all with tolerable certainty. Walker in his "British Museum Catalogues" published no less than 92 names, of which 26 represented new species, 47 were synonyms, and 19 are unidentified. Guenée in his "Phalenites," and in a paper published in the "Entomologists' Monthly Magazine," described 25, of which only 5 were new, the rest being all synonyms of species previously known. Felder in the "Reise der Novara" has figured 42 as new; of these 11 are in fact new, 27 are synonyms, and the other 4 I have not yet been able to identify satisfactorily. Butler has published various descriptions—sometimes accompanied with figures, which are mostly very poor—in the "Catalogue of New Zealand Lepidoptera," appended to the "Voyage of the 'Erebus' and 'Terror,'" a paper in the "Proceedings of the Zoological Society of London" for 1877, and two papers in the "Cistula Entomologica," 32 in all; of these 10 are new, 19 are synonyms, and the other three appear unidentifiable. Mr. Fereday has described two species, of which one is new. In the present paper I have added 30 others, including all known to me, and bringing up the total number to 89. Two or three of those which I have described may perhaps be found amongst Walker's unidentified species, but this was unavoidable. In an appendix I have added references to all descriptions which I have not been able to identify, but it must not be supposed that these indicate additional species; probably almost all will prove to be synonyms of others previously described; they are numbered separately for convenience of reference.

The classification of the *Geometrina* is founded almost wholly on characters drawn from the neuration, which is more complex than usual; the antennæ and palpi are liable to no considerable amount of diversity, and are not generally of more than secondary importance. The legs and other organs afford no tangible points, at least among the New Zealand species. The shape of the wings, often employed by superficial observers, is not of the least value, being purely specific. In cases where a specimen cannot be spared for dissection, the neuration can be made out by denuding a small portion of the under-surface with a camel's-hair brush moistened; the part requiring denudation is the neighbourhood of the areole, as in general the other veins can be sufficiently discerned on the lower surface under a lens. Of course the student should first make himself acquainted by full dissection with the ordinary position of the veins, and the nature of the more important points to be observed.

I will repeat here the explanation given in a former paper of the mode of reckoning the veins, with special reference to the *Geometrina*. These are numbered in order, beginning from that nearest to the inner margin, and ending with that nearest to the costa. The forewings have normally 12 veins, of which 1 and 12 rise separately, the rest from the margins of a central cell. Similarly the hindwings have normally 8 veins, of which 1 and 8 are separate, the rest rising from a central cell. Sometimes a vein may be obsolete, especially in the hindwings, which thus appear to have only 7. The veins are assumed to rise from the cell independently of one another, unless otherwise stated. Rarely there is a small additional free vein vetween 1 and the inner margin; this is termed 1*a*. The veins rising from the upper margin of the cell are in the *Geometrina* constantly liable to unite for a short distance in the middle of their course, and then separate again; this I have termed anastomosing. In consequence of it, there is usually formed a small additional cell (termed the areole) upon the margin of the main cell; this areole may be single, double, or even triple (though not in New Zealand), according to the number of veins anastomosing. Vein 12 is also liable to anastomose with 11. This curious structure is highly characteristic of the group. Other organs require little explanation. The length of the ciliations or pectinations of the antennæ is given by numbers in brackets, and is expressed in terms of the breadth of the antennal stalk; where the two series of pectinations are unequal, the inner series is denoted by *a*, the outer by *b* prefixed to these numbers.

GEOMETRINA.

Ocelli always absent. Tongue well-developed. No maxillary palpi. Labial palpi well-developed, usually porrected, roughly scaled. Antennæ moderate, filiform, or dentate, simple, ciliated, or pectinated, pectinations diminishing in length towards base and apex. Abdomen and legs without special characters. Forewings with 12 veins (rarely vein 11 obsolete), 1 simple, 7, 8, and 9 always on a common stalk, 10 generally anastomosing with 9, 11 generally anastomosing with 10, 12 sometimes anastomosing with 11. Hindwings with 8 veins (often 7 by obsolescence of 5), normal vein 8 free or anastomosing with 7 towards base, always leaving 7 before the transverse vein.

Larva with 10 (rarely 12) legs, three pairs of abdominal legs being usually absent.

A very well-defined and interesting group; sometimes but erroneously regarded as a single family, though it certainly comprises several. This error has probably been due to Guenée, who established on superficial grounds families which he could not define, and thereby caused an impression that no accurately definable families existed. I cannot pretend to any certainty in my views of the families hereafter defined; they may be capable of further subdivision, or require partial amalgamation; they are however natural and accurately limited as regards New Zealand species.

The following considerations on the process of development of the group will justify the main outline of my scheme of classification. The ancestral form of the *Geometrina* must have had 12 veins in the forewings, 7, 8, and 9 on a common stalk, the rest all separate; and 8 veins in the hindwings, all separate, and vein 8 free. This is the only form from which all existing types could have originated. Taking first the hindwings, there are two main types at present predominant; (A) in which there are 7 veins, 5 and 6 separate, and 7 not anastomosing with 6; and (B) in which there are 8 veins, 6 and 7 stalked, 8 anastomosing with 7. These form the two principal subdivisions of the group; it will be seen that (A) differs from the type by the loss of a vein (normal vein 5 which is obsolete, existing only as a slight fold), and (B) by the stalking of 6 and 7, and anastomosing of 8 with 7. Probably, therefore, the hindwings of the ancestral form were relatively broader than in either of these, since both changes are such as would be likely to result from a contraction of space. This difference of method indicates unmistakeably that the development of the *Geometrina* has proceeded on two distinct main branches, the types of which will be found to correspond with the *Ennomidæ* and *Larentidæ* respectively, as I have defined them. Comparing the forewings of the same types, it will appear that in the *Larentidæ* vein 10 always anastomoses with 9, and 11 with 10, whilst in the *Ennomidæ* they are often separate; in the *Larentidæ* also vein 11 often coincides wholly with 10 on lower portion, so that it appears to rise from the upper margin of a simple areole, or even from 9 above areole; this structure, which obviously implies a greater remoteness from the type, is hardly ever found in the *Ennomidæ*. In the *Larentidæ*, therefore, the single areole resulting from this latter modification marks a later development, and the first three sections of that family are of more recent origin than the other two. So also the *Acidalidæ*, which have this same character, are later as a whole than the *Larentidæ*, from which they differ by vein 8 of the hindwings tending to free itself from 7, a reversionary but more recent development. Instances of peculiar structure in the *Larentidæ* occur; thus in *Parysatis* and *Tatosoma* vein 8 of the hindwings is wholly distinct from 7, but connected with it by a bar in middle; this bar must undoubtedly be produced by the lateral extension of a former anastomosis, and as the genera are not otherwise closely allied, it must have arisen independently in each case. A bar at first sight similar is found in *Elvia* and *Pasiphila* connecting vein 12 of the forewings with the areole, but in this case it is simply vein 11 which runs into 12 instead of to the costa. Both these structures must be more recent than the type. Finally there are the two genera representing in New Zealand the families *Boletobidæ* and *Lyrceidæ*; in both of these the hindwings have 8 veins, but 8 is free from 7, the neuration of the forewings being similar to that of the *Ennomidæ*; these are therefore only separated from the *Ennomidæ* by the full complement of veins in the hindwings, and are consequently a more ancient form, certainly the oldest in New Zealand; probably the hindwings of *Lyrcea* are almost exactly those of the ancestral form of the group.

At the end of the *Geometrina* I have added the solitary species which represents in New Zealand the *Siculina*, since it is sometimes mistaken for a Geometrid. The neuration is of a much simpler type; all the veins of the forewings are separate, except 8 and 9, which are short-stalked; all the veins of the hindwings are also separate, and 8 is free. On referring to my description of the theoretical type-ancestor of the *Geometrina*, it will be seen that this genus only differs from it by the separation of vein 7 from the stalk of 8 and 9. I think, then, that this group—both small and restricted in distribution—is undoubtedly to be regarded as one allied to but distinct from the *Geometrina*, and as representing a still earlier stage in development than even the progenitor of that group. Further back than this it is not necessary at present to go.

In view of the fragmentary state of our knowledge of the *Geometrina* of other countries, and the erroneous plan of classification so commonly adopted, it is only possible to make a few general observations on the relationship of the New Zealand genera to those found elsewhere. Two genera are much larger than any of the rest—*Larentia* and *Pasithea*, very closely allied moreover to each other—and contain a third of the whole number of species; the species in these genera are as a rule very constant, and almost all frequent the mountain-ranges of the interior, and from their habits are probably in great part grass-feeders. These must form a part of the earliest fauna, which has had time for full specific development, and is attached to the most ancient part of the islands, and one of the earliest orders of flowering plants; if regarded as forms of a single type, they are represented by congeners probably throughout the world. They are thus exactly analogous to *Crambus*, *Scoparia*, and *Œcophora* in other groups, cosmopolitan genera, more largely developed in New Zealand than elsewhere, proportionately to the rest of the fauna ; this greater predominance being due to less active competition. *Azelina* and *Drepanodes* are instances of characteristic South American genera, and I am inclined to believe that almost all the *Ennomidæ* will be found to have a South American affinity ; all these are represented severally by one or two species only, all are dwellers in the forest, and almost all are highly variable. These must be referred to a later immigration, attached to more highly organized plants, and specially connected with South America. Ancient as the date of this must have been it has hardly sufficed for the development of species, though abundant variation has taken place. A parallel case may be found in various genera of the *Tortricina* (e.g. *Adoxophyes*), which display high specific variability, and are probably of contemporaneous origin. The single genus of *Siculina* (*Siculodes*) is also highly characteristic of South America. Four species (*Acidalia rubraria*, *Hippolyte rubropunctaria*, *Asthena pulchraria*, and *Arsinoë subochraria*) are common to Australia and Tasmania, as well as New Zealand, being equally abundant in both regions. There is no doubt of their natural occurrence. Indeed, it is curious that they were all among the first species described from the islands. But they are all characteristically Australian, and have probably found their way thence to New Zealand in comparatively recent times. All are rather variable, but not more so than might be expected in species of the requisite flexibility of constitution. A fifth (*Detunda egregia*) is stated by Felder to occur in Australia. It is, however, a characteristically New Zealand species, and it would be impossible to accept the Australian habitat without better evidence than that afforded by a nomadic collection from many countries, in which confusion of labels may so easily have arisen.

Most of the other genera are small, and at present of uncertain origin. *Panagra* is characteristically Australian, but is represented by a peculiar species. *Tatosoma* represents a disconnected group now widely scattered, and probably everywhere diminishing; Europe, Borneo, Ceylon, South America, and Australia each furnishing peculiar allied genera. *Statira* and *Dasyuris* are local developments of *Pasithea*. *Cidaria*, the most cosmopolitan genus of the group, though less developed here than *Larentia*, is very closely allied with it, and probably of contemporaneous origin.

The preparation of this paper would have been impossible without the aid of Mr. R. W. Fereday, whose extensive collection furnished most of the material for it. I am indebted to his liberality for numerous specimens, as well as for his assistance in investigating the whole collection, and for most of the localities and dates furnished hereafter, with notes on habits in some

instances. The number of specimens examined is indicated in each instance after the description, but, in the case of the commoner species, these are really a selection from a much larger number not retained. I have examined also a small collection from the Otago Museum, forwarded to me by Professor Parker.

The following is a tabulation of the five families represented; under the head of each family is given a tabulation of the genera comprised in it.

1a. Hindwings with 7 veins .. .. 5. *Ennomidæ.*
1b. „ „ 8 „
2a. Vein 8 of hindwings connected with 7 near transverse vein .. 2. *Larentidæ.*
2b. „ „ „ „ free, or very shortly anastomosing with 7 near base.
3a. Vein 11 of forewings separate .. .. 3. *Boletobidæ.*
3b. „ „ „ „ not separate.
4a. Areole double .. .. 4. *Lyrceidæ.*
4b. „ single .. .. 1. *Acidalidæ.*

1. ACIDALIDÆ.

Antennæ of male not pectinated. Forewings with vein 11 rising out of 10, areole simple, 12 free. Hindwings with 8 veins, 8 free or touching 7 near base only.

Hardly represented in New Zealand; of the two species found, one is very abundant in Australia, whence it has doubtless immigrated, the other is not yet known from elsewhere.

1a. Veins 6 and 7 of hindwings separate .. .. 2. *Acidalia.*
1b. „ „ „ „ „ „ from a point or stalked .. .. 1. *Theoxena.*

1. Theoxena, n. g.

Palpi moderate, triangularly scaled, porrected. Antennæ in male biciliated with long tufts of cilia (5). Forewings with vein 6 from below 9, 7 from angle of areole, 10 out of 9 above 7, 11 anastomosing shortly with 9, 12 free, closely approximated to 11 on areole. Hindwings with veins 6 and 7 from a point or short-stalked, 8 free, closely approximated to 7 from base to near transverse vein.

1. *Theox. scissaria*, Gn.

(*Panagra scissaria*, Gn., E.M.M., v., 43.)

Male.—23–25 mm. Forewings narrow, hindmargin rather strongly sinuate; dull white, slightly sprinkled with dark fuscous; a curved dark fuscous median streak from inner margin near base almost to apex, sharply defined above, suffused beneath; a black dot in disc, and a row of dots on hindmargin. Hindwings elongate, narrow, apex broadly projecting; white; a blackish dot in disc, and a row on hindmargin.

Constant, and very different from anything else.

Christchurch, and towards foot of Mount Hutt (Mr. R. W. Fereday); a plain-frequenting species, occurring in January; ten specimens.

2. ACIDALIA, Tr.

Palpi moderate, triangularly scaled, porrected. Antennæ in male biciliated with long tufts of cilia (4–5). Forewings with vein 6 from below 9, 7 from above areole, 10 out of 9 above 7, 11 anastomosing shortly with 9, 12 free. Hindwings with veins 6 and 7 separate, 8 very shortly anastomosing with 7 near base.

A very large genus, almost cosmopolitan, but only represented in New Zealand by one species, which must be regarded as an established immigrant from Australia.

2. *Acid. rubraria*, Dbld.

(*Ptychopoda* (?) *rubraria*, Dbld., Dieff. N.Z., ii., 286, Walk., 781; *Fidonia* (?) *acidaliaria*, Walk., 1037; *Acidalia figlinaria*, Gn., ix., 454, pl. xii., 8.)

Male, female.—17–21 mm. Forewings moderate, hindmargin rounded; light ochreous, reddish-tinged, irrorated with blackish; a cloudy dark fuscous irregular dentate slightly curved line about $\frac{1}{4}$, a second in middle, and a third more blackish and followed by a narrow fuscous band at $\frac{3}{4}$; a subterminal row of cloudy fuscous spots; a small black discal spot on second line; a hindmarginal row of black dots, sometimes confluent. Hindwings moderate, hindmargin somewhat projecting in middle; rather more reddish than forewings; a cloudy dark fuscous line before middle; a small black discal spot; three irregular dentate cloudy dark fuscous lines between middle and hindmargin, last two often forming rows of spots; a hindmarginal row of blackish dots, often confluent.

Somewhat variable in intensity of colouring, but not otherwise; no difference between Australian and New Zealand specimens.

Napier, Wellington, Nelson, Christchurch, Mount Hutt, and probably everywhere, except perhaps in the extreme south; also common to New South Wales, Victoria, and Tasmania; in very dry grassy places, in September, January, February, and March, very common; thirty specimens.

2. LARENTIDÆ.

Forewings with areole single or double, vein 11 anastomosing with or rising out of 10, 12 free, rarely receiving 11. Hindwings with 8 veins, 8 anastomosing with 7 from near base to near transverse vein, rarely connected only by a bar near transverse vein, 6 and 7 almost always stalked.

The genera represented from five natural groups or sections.

1a. Areole single.
- 2a. Vein 8 of hindwings connected with 7 by a bar near transverse vein .. sect. A.
- 2b. " " anastomosing strongly with 7.
  - 3a. Vein 11 of forewings separate from 12 .. .. sect. B.
  - 3b. " " running into 12 .. .. sect. C.

1b. Areole double.
- 2a. Vein 8 of hindwings connected with 7 by a bar near transverse vein .. sect. D.
- 2b. " " anastomosing strongly with 7 .. .. .. sect. E.

Section A.

This includes *Parysatis* only.

Section B.

1a. Antennæ of male minutely ciliated .. .. 4. *Hippolyte.*
1b. ,, ,, bipectinated.
  2a. Vein 11 of forewings rising out of 9.
    3a. Vein 6 of forewings out of 9 .. .. 10. *Harpalyce.*
    3b. ,, ,, from below 9 .. .. 7. *Thyone.*
  2b. Vein 11 of forewings out of margin of areole.
    3a. Vein 6 of forewings from a point with or below 9.
      4a. Vein 7 of forewings from considerably above areole .. 11. *Stratonice.*
      4b. ,, ,, from below angle of areole .. .. 5. *Epiphryne.*
    3b. Vein 6 of forewings rising out of 9.
      4a. Vein 7 of forewings from considerably above areole .. 9. *Eurydice.*
      4b. ,, ,, from angle of areole .. .. .. 6. *Hermione.*
      4c. ,, ,, from below angle of areole .. .. 8. *Panopæa.*

Section C.

1a. Antennæ of male bipectinated .. .. 12. *Elvia.*
1b. ,, ,, biciliated .. .. 13. *Pasiphila.*

Section D.

Contains only the singular genus *Tatosoma.*

Section E.

1a. Antennæ of male bipectinated.
  2a. Thorax more or less densely hairy beneath .. .. .. 21. *Pasithea.*
  2b. ,, not hairy.
    3a. Vein 6 of forewings rising out of 9 .. .. 20. *Larentia.*
    3b. ,, ,, from a point with 9 .. .. .. 17. *Epyaxa.*
1b. Antennæ of male not pectinated.
  2a. Thorax hairy beneath.
    3a. Antennæ of male dentate .. .. 23. *Dasyuris.*
    3b. ,, ,, filiform .. .. 22. *Statira.*
  2b. Thorax not hairy.
    3a. Antennæ of male dentate.
      4a. Palpi very long, attenuated .. .. 25. *Panagra.*
      4b. ,, moderate .. .. 18. *Arsinoe.*
    3b. Antennæ of male filiform.
      4a. Vein 6 of forewings rising out of 9 .. .. .. 19. *Cidaria.*
      4b. ,, ,, from a point with or below 9.
        5a. Palpi very slender and short .. .. 15. *Asthena.*
        5b. ,, moderate or long, densely scaled.
          6a. Vein 7 of forewings from angle of areole .. .. 16. *Scotosia.*
          6b. ,, ,, from below angle of areole .. 24. *Cephalissa.*

Section A.

3. Parysatis, n. g.

Palpi short, arched, roughly scaled beneath. Antennæ in male——?, in female bipectinated (*a* 3, *b* 5). Forewings with vein 6 from below 9, 7 from below angle of areole, 10 very shortly anastomosing with 9, 11 out of 10 considerably before angle of areole, 12 free. Hindwings with veins 6 and 7 stalked, 8 separate, united to 7 before transverse vein by an oblique bar.

This singular genus is of quite uncertain affinity, and stands at present alone. The simple areole, and connecting bar of 7 and 8, can only have arisen by modification of the normal type of this family, to which it must be referred. It is also the only New Zealand genus except *Detunda* in which the female has pectinated antennæ; but this character recurs in a few exotic genera not otherwise allied.

3. *Parys. porphyrias*, n. sp.

Female.—20 mm. Forewings moderate, costa sinuate in middle, apex almost acute, hindmargin deeply excavated on upper half and more shortly on lower third, so as to project bluntly below middle; yellow-ochreous, irregularly mixed with brown and purplish; veins clearly marked with fuscous; two slender ochreous-brown transverse lines, dilated on costa, first before middle, bent inwards near costa, second beyond middle, almost straight; beyond second a broad purplish shade, except near costa, dilated beneath to reach hindmargin; hindmargin purple: cilia white on excavations. Hindwings moderate, hindmargin shortly sinuate near inner angle; pale ochreous mixed with fuscous and purplish; a fuscous transverse line before middle; a very broad purplish hindmarginal band.

Probably variable in colour; it is however the only species of the family, except *Harpalyce humeraria*, in which the hindmargin of the forewings is angulated.

I took one fine specimen amongst forest in the Otira Gorge, at 1,700 feet, in January.

SECTION B.

As all the genera in this section are small, I give a tabulation of all the species together, which may assist in their ready determination.

1a. Apex of forewings distinctly projecting.
  2a. Hindmargin of forewings angulated .. .. .. 11. *Harp. humeraria.*
  2b. „ „ bowed.
    3a. Hindwings grey-whitish .. .. 9. *Eur. cymosema.*
    3b. „ yellowish-ochreous .. .. .. 10. *Harp. megaspilata.*
1b. Apex of forewings not projecting.
  2a. Hindwings ochreous-yellow.
    3a. Forewings fuscous .. .. 12. *Strat. catapyrrha.*
    3b. „ ochreous-yellow .. .. 7. *Thyon. abrogata.*
  2b. Hindwings not ochreous-yellow.
    3a. Forewings without distinct lines .. .. .. 6. *Herm. xanthaspis.*
    3b. „ with numerous lines.
      4a. Lines straight, very oblique .. .. .. 8. *Panop. verriculata.*
      4b. „ dentate, parallel to hindmargin.
        5a. Discal dot of forewings minute .. .. 4. *Hipp. rubropunctaria.*
        5b. „ „ „ forming a small spot 5. *Epiphr. undosata.*

4. Hippolyte, n. g.

Palpi short, very slender, porrected. Antennæ in male minutely ciliated ($\frac{1}{4}$). Forewings with vein 6 rising out of 9, 7 from hardly below angle of areole, 10 anastomosing strongly with 9, 11 out of 10 somewhat before angle of areole, 12 free. Hindwings with veins 6 and 7 stalked, 8 anastomosing with 7 from near base to near transverse vein.

4. *Hipp. rubropunctaria*, Dbld.

(*Ptychopoda rubropunctaria*, Dbld., Dieff. N.Z., ii., 287; *Asthena risata*, Gn., ix., 438; *Asthena mullata*, Gn., E.M.M., v., 42; *Acidalia pulchraria*, Butl. Cat., pl. iii., 18 (nec. Dbld.).)

Male, female.—19–22 mm. Forewings moderate, hindmargin slightly bowed; whitish-ochreous, slightly rosy-tinged; twelve slender rosy or rosy-fuscous dentate slightly curved striæ, leaving a clear space between sixth and seventh on costal half; first, sixth, and eighth dotted with black on veins; a larger black dot on sixth above middle; lower half of sixth to eighth sometimes clouded with blackish-grey; a small reddish spot on ninth in middle; a row of black dots on hindmargin. Hindwings moderate, hindmargin somewhat projecting in middle; colour, striæ, and black dots as in forewings.

Variable in respect of the absence or presence of a blackish suffusion of lower half of the median lines; Australian and New Zealand specimens are quite similar.

Larva 10-legged, cylindrical, rather stout, segmental divisions incised; pale dull green, sometimes suffused with pink, brown, purple, or dark green; dorsal purplish-brown, suffused, central line whitish; spiracular whitish, broadly margined above with purplish-brown; segmental divisions pale yellowish-brown. Feeds on *Haloragis alata* (*Haloragaceæ*). Pupa in a slight earth-covered cocoon.

Palmerston (Wanganui), Nelson, Christchurch, Dunedin, from September to March, amongst bush; also common in New South Wales, Victoria, and Tasmania; eighteen specimens. The description of the larva was furnished me by Mr. R. W. Fereday, who bred the species.

5. Epiphryne, n. g.

Palpi short, slender, porrected, shortly haired beneath. Antennæ in male bipectinated (*a* 7, *b* 10). Forewings with vein 6 from a point with 9, 7 from somewhat below angle of areole, 10 very shortly anastomosing with 9, 11 out of 10 considerably before angle of areole, 12 free. Hindwings with veins 6 and 7 stalked, 8 anastomosing with 7 from near base to near transverse vein.

5. *Epiphr. undosata*, Feld.

(*Cidaria undosata*, Feld., cxxviii., 2.)

Male, female.—21–24 mm. Forewings moderate, hindmargin rounded; pale yellow, sometimes suffused more or less entirely with light brownish; costa generally suffused with light brown; eight or nine slender irregular somewhat curved dentate fuscous striæ, variable in strength and intensity; fifth hardly dentate and sometimes obsolete, leaving a rather wide space between fourth and sixth; a small blackish spot on fifth above middle; hindmargin fuscous. Hindwings moderate, hindmargin somewhat projecting in middle; colour and striæ as in forewings, but first three and fifth striæ absent; a small blackish discal dot.

Very variable in the presence and extent of the light brownish suffusion.

Wellington, Christchurch, Mount Hutt, Dunedin; very common in bush, from August to February, and in May; thirty specimens.

6. HERMIONE, n. g.

Palpi short, slender, porrected, roughly scaled beneath. Antennæ in male bipectinated (*a* 5, *b* 7). Forewings with vein 6 rising out of 9, 7 from angle of areole, 10 shortly anastomosing with 9, 11 out of 10 considerably before angle of areole, 12 free. Hindwings with veins 6 and 7 short-stalked, 8 anastomosing with 7 from near base to near transverse vein.

Nearly allied to *Epiphryne*.

6. *Herm. xanthaspis*, n. sp.

Male, female.—27–30 mm. Forewings moderate; hindmargin hardly bowed; bright yellow; costa suffused with reddish-fuscous, and marked with five short oblique darker marks; a transverse oval dark fuscous spot in disc above middle, sometimes touching costal suffusion; a transverse row of very faint fuscous dots from last costal mark. Hindwings moderate, hindmargin slightly projecting in middle; very pale whitish-yellow; two strongly curved transverse rows of very faint fuscous dots between middle and hindmargin.

Apparently constant.

Lake Guyon, in February and March (Mr. R. W. Fereday); six specimens.

7. THYONE, n. g.

Face with a slight cone of projecting scales. Palpi moderate, straight, porrected, shortly rough-scaled above and beneath. Antennæ in male bipectinated (*a* 6, *b* 8). Forewings with vein 6 from slightly below 9, 7 from somewhat below angle of areole, 10 out of 9 below 8, 11 anastomosing rather shortly with 9, 12 free. Hindwings with veins 6 and 7 stalked, 8 anastomosing with 7 from near base to near transverse vein.

7. *Thyon. abrogata*, Walk.

(*Aspilates abrogata*, Walk., 1075; *Fidonia* (?) *servularia*, Gn., E.M.M., v., 43.)

Male, female.—22–27 mm. Forewings moderate, hindmargin slightly rounded; ochreous-yellow; generally eight cloudy blackish somewhat bent transverse lines, variable in strength, often more or less wholly obsolete, especially towards base, usually in female; eighth generally rather thick, interrupted above and below middle; sometimes a large blackish discal dot on fifth above middle; a narrow blackish hindmarginal band: cilia white, base grey. Hindwings moderate, hindmargin slightly projecting in middle; colour and markings as in forewings, but lines always obsolete towards base.

Variable in the strength or obsolescence of the dark transverse lines, but very different from any other species.

Christchurch, and Castle Hill (2,500 feet), in February and March, in waste ground; common; seventeen specimens.

8. Panopæa, n. g.

Palpi short, porrected, second joint roughly scaled beneath, terminal joint moderate. Antennæ in male bipectinated (*a* 8, *b* 10). Forewings with vein 6 rising out of 9, 7 from below angle of areole, 10 anastomosing rather shortly with 9, 11 out of 10 considerably before angle, 12 free. Hindwings with veins 6 and 7 long-stalked, 8 anastomosing with 7 from near base to near transverse vein.

8. *Panop. verriculata*, Feld.

(*Cidaria verriculata*, Feld., cxxxi., 20.)

Male, female.—32–36 mm. Forewings moderate, hindmargin rounded; pale whitish-ochreous; about eighteen fine straight very oblique fuscous striæ, parallel to a line from apex to before middle of hindmargin, obscurely dotted with blackish on veins; ninth to eleventh rather darker and stronger than rest, twelfth rather fainter; a large black discal dot above middle. Hindwings moderate, hindmargin rather flattened; markings as in forewings, but ninth stria obsolete.

Constant. A beautifully perfect instance of imitative colouring; the fine parallel dotted striæ are precisely similar to those of the long drooping dead leaves of the *Cordyline*, on which the insect always sits; Mr. Fereday informs me that it is careful to place its wings so that the striæ are parallel with those of the leaf. There is no affinity whatever between this species and *Scotosia gobiata*, Feld., the points of resemblance being purely superficial and acquired for similar purposes.

Christchurch and Dunedin, always on *Cordyline*, in October, November, February, March, and May; fifteen specimens.

9. Eurydice, n. g.

Face with a strong cone of scales. Palpi moderately long, porrected, roughly scaled. Antennæ in male bipectinated (6). Forewings with vein 6 rising out of 9, 7 from considerably above angle of areole, 10 anastomosing strongly with 9, 11 out of 10 rather before angle of areole, 12 free. Hindwings with veins 6 and 7 stalked, 8 anastomosing with 7 from near base to near transverse vein.

9. *Eur. cymosema*, n. sp.

Male, female.—25–29 mm. Forewings moderate, hindmargin rather strongly sinuate; brown-whitish, sometimes more or less suffused with brown; numerous fine dark fuscous sinuate subdentate lines; three before middle and four beyond middle more blackish, generally partially suffused with brown, leaving a clear median space on costal half, in which is a transverse blackish discal dot; hindmargin suffusedly greyish; a suffused oblique dark fuscous subapical streak. Hindwings moderate, hindmargin irregularly crenulate, somewhat projecting in middle; grey-whitish; several subdentate grey lines, only distinct towards inner margin; a dark grey discal dot.

Variable only in the degree of brownish suffusion; in the markings of the forewings it agrees almost exactly with some forms of *Harp. megaspilata*, but, apart from structure, may be always known by the whitish hindwings, and rather larger size.

Dunedin; ten specimens sent to Mr. Fereday by Captain Hutton.

10. HARPALYCE, n. g.

Face with a cone of projecting scales. Palpi rather long, triangularly scaled, porrected. Antennæ in male bipectinated (5–7), Forewings with vein 6 rising out of 9, 7 from angle of areole, 10 out of 9 below 8, 11 shortly anastomosing with 9, 12 free. Hindwings with veins 6 and 7 stalked, 8 anastomosing with 7 from near base to near transverse vein.

Closely allied to *Eurydice*.

10. *Harp. megaspilata*, Walk.

(*Larentia* (?) *megaspilata*, Walk., 1198; *Cidaria assata*, Feld., cxxxi., 4; *Cidaria nehata*, Feld., cxxxi., 6; *Larentia* (?) *rufescens*, Butl., Cist. Ent., ii., 502.)

Male, female.—20–25 mm. Forewings moderate, apex rounded, hindmargin strongly sinuate; whitish-ochreous, reddish-fuscous, or grey; about eighteen transverse curved dentate fuscous or dark fuscous striæ; seventh to twelfth usually darker or blackish, diverging so as to leave a clear pale or sometimes whitish space between eighth and ninth towards costa or throughout, containing a blackish discal dot above middle; a fuscous or blackish blotch towards hindmargin beneath apex. Hindwings moderate, hindmargin sinuate above middle, obtusely projecting in middle; pale yellowish-ochreous, sometimes fuscous-tinged; towards inner margin indistinctly striated with fuscous.

Very variable in colour, and also in the discal approximation of the median lines; the form of the forewings is, however, rather peculiar and easily recognized.

Makatoku (Hawke's Bay), Wellington, Nelson, Christchurch, Mount Hutt, Dunedin, and probably throughout the islands; common amongst bush, from December to March; forty-five specimens.

11. *Harp. humeraria*, Walk.

(*Macaria* (?) *humeraria*, Walk., 940; *Lozogramma obtusaria*, Walk., 985; *Cidaria flexata*, Walk., 1421; *Cidaria obtruncata*, Walk., 1421; *Sestra fusiplagiata*, Walk., 1751; *Itama* (?) *cinerascens*, Feld., cxxxi., 1.)

Male, female.—29–34 mm. Forewings moderate, apex acute, hindmargin excavated on upper half, acutely projecting in middle; varying from light grey to light reddish-fuscous; about eighteen irregular dentate darker striæ, sometimes partially obsolete; first three, seventh and eighth, and eleventh to thirteenth usually more distinct and blackish; seventh and eighth closely approximated, forming a small blackish or reddish spot on inner margin, sometimes partially suffused with blackish; eleventh to thirteenth closely approximated, widely remote from eighth, parallel to hindmargin; a blackish discal dot; sometimes a broad purplish-grey median band; sixteenth sometimes spotted with blackish towards costa; a hindmarginal row of blackish dots. Hindwings moderate, upper angle broadly projecting, hindmargin shortly projecting in middle; varying from whitish-grey to very pale reddish-fuscous, faintly striated with darker.

Very variable in colour, but always distinguishable by the peculiar form of wing.

Wellington, Christchurch, Mount Hutt; common amongst bush, in January, February, April, and May; probably generally distributed; twenty specimens.

I cannot certainly verify the synonyms quoted from Walker for this species; I judge from Mr. Butler's remarks that all these names refer to one species, but am not sure that it is this; he does not allude to Felder's figure, which is certainly a variety of this.

11. Stratonice, n. g.

Palpi rather long, porrected, second joint with very long spreading hairs beneath, terminal joint long, smooth, almost concealed. Antennæ in male bipectinated (*a* 5, *b* 7). Forewings with vein 6 from hardly below 9, 7 from considerably above areole, 10 anastomosing very strongly with 9, 11 out of 10 rather before angle of areole, 12 free. Hindwings with veins 6 and 7 stalked, 8 anastomosing with 7 from near base to near transverse vein.

The palpi of this genus resemble those of *Pasithea*.

12. *Strat. catapyrrha*, Butl.

(*Fidonia* (?) *catapyrrha*, Butl., Proc. Zool. Soc. Lond., 1877, 392, pl. xliii., 2.)

Male, female.—16–21 mm. Forewings rather narrow, hindmargin rounded; light ochreous-brown, irregularly mixed with whitish, and densely irrorated with blackish; a curved blackish line near base, followed by a whitish line, two approximated dark fuscous lines, a second whitish line, and a slender fuscous fascia, marked with blackish on anterior edge and on veins, all parallel; a small blackish discal dot; a cloudy blackish line beyond middle, dilated on costa, preceded by a fainter line, and bordered posteriorly by a white line, central third forming a broad bidentate projection; an indistinct whitish dentate subterminal line, preceded by a dark fuscous shade. Hindwings rather elongate, hindmargin rounded; deep ochreous-yellow, base mixed with dark fuscous; an angulated median line, an irregular subterminal fascia, and hindmargin dark fuscous. Forewings beneath yellow, with two blackish posterior streaks from costa, and a reddish spot beneath apex; hindwings beneath reddish, disc longitudinally whitish, with irregular median and subterminal blackish bands.

Constant; it would be interesting to know the cause of the beautiful colouring of the under-surface, which is probably protective.

Mr. R. W. Fereday found this species common in the grassy bed of a dry lagoon near Lake Guyon, in February and March; I beat a specimen from bush in the Otira Gorge, at 1,800 feet, in January. Twenty specimens.

SECTION C.

12. ELVIA, Walk.

Face smooth. Palpi rather long, straight, porrected, densely rough-scaled above and beneath, terminal joint short. Antennæ in male stout, flattened, bipectinated ($2\frac{1}{2}$). Thorax somewhat crested. Forewings with vein 6 from a point with 9, 7 from angle of areole, 10 anastomosing moderately with 9, 11 out of 10, running shortly into 12. Hindwings with veins 6 and 7 stalked, 8 anastomosing with 7 from near base to near transverse vein.

13. *Elv. glaucata*, Walk.

(*Elvia glaucata*, Walk., 1431, Feld., cxxxii., 25; *Elvia donovani*, Feld., cxxxii., 5.)

Male.—22–24 mm. Forewings moderate, costa sinuate, hindmargin irregular, somewhat projecting above middle; whitish-ochreous, usually more or less wholly suffused with bluish-green or bluish-grey; dark markings varying from somewhat darker green to dark bluish-grey, but black markings constant; a straight dark fascia near base, bent inwards on margins, posteriorly edged with black; a narrow angulated cloudy dark fascia beyond this; an irregular angulated dark fascia before middle, edged with black anteriorly; a somewhat curved subdentate cloudy dark line beyond middle, beyond which is a similar black line, interrupted below middle, dilated on costa; a broad dark hindmarginal band, sometimes containing a pale subapical space, and an incomplete ochreous-whitish subterminal line. Hindwings moderate, hindmargin dentate, with a longer tooth before middle; pale whitish-ochreous, hindmargin sometimes green; basal third and a median line pale iridescent grey; a sinuate row of black dots beyond middle, generally distinct only on inner margin; an incomplete grey or greenish subterminal line.

Very variable in colour and distinctness of marking. A singular-looking species; at rest the wings are not flat, but peculiarly folded longitudinally.

Christchurch, Akaroa, and Dunedin; common amongst bush, from December to February; fifteen specimens.

13. PASIPHILA, n. g.

Face with a cone of scales. Palpi rather long, roughly scaled above and beneath, porrected. Antennæ in male biciliated with fascicles of cilia (2½). Forewings with vein 6 from a point with 9, 7 from below angle of areole, 10 anastomosing strongly with 9, 11 out of 10, running shortly into 12. Hindwings with veins 6 and 7 stalked, 8 anastomosing with 7 from near base to near transverse vein.

Nearly allied to *Eupithecia*, Curt.

14. *Pasiph. bilineolata*, Walk.

(*Eupithecia* (?) *bilineolata*, Walk., 1246; *Eupithecia* (?) *muscosata*, Walk., 1246; *Eupithecia indicataria*, Walk., 1708; *Eupithecia inexpiata*, Walk., 1708, Butl., Cat., pl. iii., 19; *Eupithecia semialbata*, Walk., 1708; *Eupithecia cidariaria*, Gn., E.M.M., v., 62; *Eupithecia fumipalpata*, Feld., cxxxi., 33; *Cidaria aquosata*, Feld., cxxxii., 38; *Helastia charybdis*, Butl., Cist. Ent., ii., 503; *Helastia calida*, Butl., Cist. Ent., ii., 504.)

Male, female.—16–24 mm. Forewings moderate, costa sinuate or arched, hindmargin rounded, crenulate; whitish, whitish-ochreous, reddish-ochreous, light fuscous, greyish, or green, sometimes coloured with alternate bands; numerous irregular sinuate dentate dark fuscous or green lines, sometimes partially obsolete; some beyond middle are angulated in disc; sometimes a broad median band suffused with fuscous, and irregular spots towards anal angle, middle of hindmargin, and on costa before apex; sometimes disc wholly occupied by a very large irregular transverse snow-white blotch. Hindwings short or moderate, hindmargin rounded, crenulate, sometimes emarginate towards inner angle; varying from whitish to fuscous or dark grey; a dark fuscous discal dot; numerous curved dentate dark fuscous and green lines, only distinct towards inner margin, one beyond middle stronger and blackish.

Extraordinarily variable; the shape of wing varies a good deal, and the colour infinitely; the lines are, however, always identical in form when perceptible. All the forms are connected by insensible gradations, and I consider it certain that there is only one New Zealand species of this genus. The varieties do not appear local as a rule, but Mr. R. W. Fereday found a constant dark bluish-grey variety frequenting rock-faces on Mount Hutt at 2,500 feet; it is without doubt a variety only.

Masterton, Wellington, Nelson, Christchurch, Mount Hutt, Dunedin, and probably throughout the islands; on tree-trunks, fences, rocks, etc., from November to March and in June, resting with the wings expanded as in *Eupithecia;* eighty-four specimens.

SECTION D.

14. TATOSOMA, Butl.

Face smooth. Palpi long, straight, porrected, shortly rough-scaled, terminal joint short. Antennæ in male simple, stout, gradually dilated from base to near apex, apex attenuated. Abdomen in male very excessively elongate. Hindwings in male deeply excised near inner margin, inner marginal lobe folded into a long pocket, fringed with hairs. Forewings with vein 6 rising out of 9, 7 from or above angle of areole, 10 anastomosing moderately with 9, 11 anastomosing moderately with 10, 12 free. Hindwings with veins 6 and 7 separate, 8 free, united with 7 before transverse vein by an oblique bar.

This singular genus is a remnant of a widely diffused but now fragmentary group, to which belong also *Lobophora* (Europe), *Rhopalodes* (South America), *Sauris* (Ceylon), and *Remodes* (Borneo). In all the hindwings of the male are peculiarly modified, usually much diminished in size, and with inner margin formed into a distinct lobe, the object of which is unknown. A similar structure is found only in one or two genera of *Tortricina*. *Rhopalodes* is the nearest genus to this, but vein 5 is said to be obsolete, and the lobe does not form a pocket; in *Sauris* the areole is simple, and the antennæ thickly scaled; in *Remodes* the areole is also simple, the antennæ flattened and scaled, and the inner margin is furnished with three superposed lobular folds, so that it represents the extreme of development in this direction.

NOTE.—As terminations in *-soma* are often erroneously regarded as neuter by entomologists ignorant of the classical languages, it may be worth mentioning that such names as *Tatosoma*, *Leptosoma*, etc., can by their formation be nothing but the feminine of adjectives.

1a. Forewings green.
  2a. With four transverse lines .. .. 15. *lestevata.*
  2b. ,, numerous lines .. .. 16. *transitaria.*
1b. Forewings whitish-ochreous .. .. 17. *agrionata.*

15. *Tat. lestevata*, Walk.

(*Cidaria lestevata*, Walk., 1416; *Sauris ranata*, Feld., cxxxi., 11.)

Male.—34–35 mm. Forewings moderate, costa arched, hindmargin very oblique, bowed above middle; yellowish-green, deeper beyond markings; four irregular subdentate black lines, angularly sinuate, first towards base, second before middle, third beyond middle, fourth broken and ill-defined, subterminal; a deeper green discal dot; extreme costal edge spotted with blackish. Hindwings short; greenish-ochreous-whitish; a grey discal dot.

A beautiful and conspicuous species.

I have only seen two specimens, sent to Mr. Fereday by Mr. T. H. Potts, who took them near Christchurch.

16. *Tat. transitaria*, Walk.

(*Cidaria transitaria*, Walk., 1419; *Sauris mistata*, Feld., cxxxi., 12.)

Male, female.—26–35 mm. Forewings moderate, hindmargin rounded or very faintly sinuate; ochreous-whitish, irregularly suffused with dull light olive-green; a black furcate streak along inner margin towards base; numerous irregularly sinuate and dentate dark fuscous striæ, irregularly marked with blackish; a more conspicuous one beyond middle, partially edged with white posteriorly, twice shortly angulated on upper half, and deeply concave on lower half. Hindwings in male small, in female rather small; in male pale greyish-ochreous, in female greyer and darker.

Apparently constant.

Wellington, Christchurch, and Dunedin, amongst bush, in January and May; Mr. R. W. Fereday has taken it at sugar; ten specimens.

17. *Tat. agrionata*, Walk.

(*Cidaria agrionata*, Walk., 1417; *Cidaria tipulata*, Walk., 1417; *Cidaria inclinataria*, Walk., 1418; *Cidaria collectaria*, Walk., 1419.)

Male, female.—31–34 mm. Forewings elongate, costa rounded, hindmargin very obliquely rounded, somewhat sinuate below middle; whitish-ochreous; numerous irregular dentate dark fuscous striæ; a dark fuscous median band, broad on upper half and with sinuate margins, suddenly contracting and narrow on lower half, margins nearly straight. Hindwings in male much reduced, small, elongate, in female rather small; grey, paler towards base.

Apparently constant except in intensity of markings.

Christchurch aud Akaroa (Mr. R. W. Fereday), in January, and from March to May, amongst bush; eight specimens.

Section E.

15. Asthena, Hb.

Face smooth. Palpi short, slender, porrected. Antennæ in male slender, filiform, shortly ciliated (½). Forewings with vein 6 from a point with 9, 7 from angle of areole, 10 anastomosing moderately with 9, 11 anastomosing moderately with 10, 12 free. Hindwings normal.

A genus occurring also in Europe, America, Australia, and perhaps generally.

1a. Lines of wings green .. .. 18. *pulchraria.*
1b. „ „ purplish-grey .. .. 19. *schistaria.*

18. *Asth. pulchraria*, Dbld.

(*Acidalia pulchraria*, Dbld., Dieff. N.Z., ii., 286; *Chlorochroma plurilineata*, Walk., 563, 676; *Asthena ondinata*, Gn., ix., 438, pl. xix., 4, Butl. Cat., pl. iii., 20; *Cidaria ondinata*, Feld., cxxviii., 17.)

Male, female.—24–26 mm. Forewings moderate, hindmargin more or less rounded; greenish-whitish; numerous light bluish-green slightly curved dentate striæ; a darker green discal dot; costa narrowly fuscous. Hindwings moderate, hindmargin somewhat projecting in middle; colour, striæ, and discal dot as in forewings, but striæ absent towards base.

Variable in form of wing, principally in convexity of hindmargin; occasionally the fuscous suffusion of the costa is very slight. From Tasmania I have a form which is brighter and yellower green, with the lines and hindmargin straighter.

Hawke's Bay, Wellington, Arthur's Pass (2,600 feet), and Dunedin, amongst bush, in January; also from Tasmania and South-east Australia ten specimens.

19. *Asth. schistaria*, Walk.

(*Acidalia schistaria*, Walk., 782; *Asthena subpurpureata*, Walk., 1588; *Acidalia tuhuata*, Feld., cxxviii., 5.)

Male, female.—23–26 mm. Forewings moderate, hindmargin rounded or faintly sinuate; grey-whitish; numerous purplish-grey slightly curved dentate striæ; a dark fuscous discal dot; a stria before middle and another beyond middle generally darker or partially blackish, sometimes broadly suffused on lower half; a hindmarginal row of very numerous dark fuscous dots. Hindwings moderate, hindmargin in male rounded, in female projecting in middle; colour and markings as in forewings.

Variable in intensity of colouring and in the presence of the median suffusion.

Wellington, Christchurch, Akaroa, Dunedin, especially frequenting *Leptospermum*, from January to March; twenty-one specimens. I do not know that this species is found in Australia, but should think it very probable. It only differs from the preceding in colour, but I have seen no approach to any connecting forms.

16. Scotosia, Stph.

Face with more or less projecting scales. Palpi moderate, roughly triangular-scaled, porrected. Antennæ in male stout, serrate, shortly ciliated ($\frac{1}{2}$). Thorax slightly crested. Forewings with vein 6 from a point with or below 9, 7 from angle of areole, 10 anastomosing moderately with 9, 11 anastomosing rather strongly with 10, 12 free. Hindwings normal.

1a. Anterior lines of forewings more oblique than hindmargin .. 20. *gobiata.*
1b. " " " less " " " .. 21. *deltoidata.*

20. *Scot. gobiata*, Feld.

(*Cidaria gobiata*, Feld., cxxxi., 2; *Phibalapteryx simulans*, Butl., Cist. Ent., ii., 506; *Phibalapteryx undulifera*, Butl., Cist. Ent., ii., 506; *Phibalapteryx anguligera*, Butl., Cist. Ent., ii., 507; *Phibalapteryx rivularis*, Butl., Cist. Ent., ii., 507.)

Male, female.—25–37 mm. Forewings moderate, hindmargin rounded, crenulate; pale whitish-ochreous; very numerous fine slightly dentate ochreous-fuscous striæ parallel to a line from ⅘ of inner margin to apex, but somewhat bent near costa, and tending to form darker dots on veins; one about ⅓, a second before middle, and a third slightly beyond middle generally more conspicuous and partially marked with blackish, except towards costa, third often more irregular and with a variable projecting median tooth; a minute black discal dot on second, sometimes enlarged into a small round spot; a sinuate dark fuscous or blackish line from middle of disc to apex, suffused beneath. Hindwings moderate, hindmargin slightly rounded, crenulate; colour, transverse striæ, and discal dot as in forewings.

Very variable, but always easily recognizable.

Wanganui, Wellington, Nelson, Christchurch, Dunedin, amongst bush, common from November to June; thirty-four specimens.

21. *Scot. deltoidata*, Walk.

(*Coremia deltoidata*, Walk., 1321; *Cidaria inclarata*, Walk., 1411; *Cidaria perductata*, Walk., 1412; *Cidaria congressata*, Walk., 1412; *Cidaria conversata*, Walk., 1413; *Cidaria descriptata*, Walk., 1414; *Cidaria bisignata*, Walk., 1415; *Cidaria aggregata*, Walk., 1415; *Cidaria congregata*, Walk., 1415; *Cidaria plagifurcata*, Walk., 1416; *Coremia pastinaria*, Gn., E.M.M., v., 64; *Cidaria inopiata*, Feld., cxxxii., 3; *Cidaria monoliata*, Feld., cxxxii., 8; *Cidaria perversata*, Feld., cxxxii., 14, 24.)

Male, female.—30–36 mm. Forewings moderate, hindmargin slightly rounded, straight, or somewhat concave, more or less crenulate; ochreous-brown; numerous dark grey or dark fuscous somewhat irregular shortly dentate striæ; a narrow dark fuscous fascia before middle, and a rather broader one beyond middle, more or less approximated, sometimes both cut below middle by a broad biconcave bar of ground-colour; included median band often grey; a small black transverse discal spot; often first fascia preceded and second fascia followed by a narrow whitish or white fascia; a very obscure whitish subterminal line. Hindwings moderate, hindmargin rounded, crenulate; light brownish-ochreous, greyer towards base and inner margin; numerous obscure incomplete dark grey striæ.

Extremely variable, yet not so as to justify so long a list of synonyms.

Wellington, Christchurch, Mount Hutt, Dunedin, Lake Wakatipu, and probably throughout the islands, abundant from December to February; fifty-two specimens. Mr. R. W. Fereday informs me that this species is now scarce near Christchurch, where it was formerly very abundant, having been nearly exterminated by the increase of birds.

17. EPYAXA, n. g.

Face with a short cone of scales. Palpi moderate, triangularly scaled, porrected. Antennæ in male bipectinated (5–7). Forewings with vein 6 from a point with 9, 7 from or somewhat below angle of areole, 10 anastomosing moderately with 9, 11 anastomosing moderately with 10, 12 free. Hindwings normal.

1a. Central band with a very strong broad abrupt projection .. .. 25. *chlamydota.*
1b. " " " small angular or rounded "
  2a. Hindwings whitish-ochreous .. .. 24. *semifissata.*
  2b. " grey.
    3a. Anterior edge of central band nearly straight .. .. .. 23. *orophyla.*
    3b. " " " " strongly concave .. .. 22. *rosearia.*

22. *Ep. rosearia*, Dbld.

(*Cidaria rosearia*, Dbld., Dieff. N.Z., ii., 285, Butl. Cat., pl. iii., 13; *Coremia ardularia*, Gn., E.M.M., v., 63; *Coremia inamœnaria*, Gn., E.M.M., v., 63.)

Male, female.—25–28 mm. Forewings moderate, hindmargin very faintly sinuate; in male pale whitish-grey, faintly ochreous-tinged, in female generally more ochreous and sometimes yellowish; numerous very indistinct darker striæ, dotted with blackish on veins; a small rather darker basal patch, its outer edge sharply angulated above middle; a rather darker moderately broad median band, partially mixed with fuscous, its margins sometimes blackish on upper half, containing a paler space above middle, in which is an elongate transverse black dot; anterior edge of band rather deeply sinuate-concave, posterior edge shortly and obtusely projecting in middle and towards costa, somewhat concave on lower half; hindmargin suffusedly darker; a short dark grey suffused oblique subapical streak: in female all markings are only rather darker than ground-colour. Hindwings moderate, hindmargin rounded; whitish-grey, faintly striated with darker.

The female is variable in ground-colour, the male very constant.

Christchurch, Akaroa, Dunedin; very common, especially at light, in March and from May to September, so that it is essentially a winter species; fifty-five specimens.

C. ardularia, Gn., is the male, and *C. inamœnaria*, Gn., the female of this species; *C. subidaria*, Gn., quoted by Butler as a synonym, is an Australian species and not identical.

23. *Ep. orophyla*, n. sp.

Male, female.—28–33 mm. Forewings moderate, hindmargin very faintly sinuate; grey, slightly fuscous-tinged, and obscurely striated with whitish, sometimes with blackish dots on veins; a blackish line near base, irregularly bent near costa; a moderately broad median band enclosed by two fuscous blackish-edged fasciæ, sometimes confluent on lower half, their inward margins dentate; anterior edge of band almost straight, posterior edge rather sharply angulated in middle, more shortly towards costa; a short suffused dark fuscous subapical streak. Hindwings moderate, hindmargin rounded; light grey, faintly ochreous-tinged, very faintly striated.

Quite constant, and the sexes alike; larger and greyer than the preceding, from which it is immediately distinguished by the straight anterior edge of the median band.

Dunedin, Castle Hill (2,500 feet), Mount Hutt, Lake Wakatipu (4,000 feet); a southern and mountain species, frequenting open ground, in December and January; twenty-eight specimens.

24. *Ep. semifissata*, Walk.

(*Coremia semifissata*, Walk., 1320; *Coremia ypsilonaria*, Gn., E.M.M., v., 64; *Cidaria delicatulata*, Gn., E.M.M., v., 94.)

Male, female.—26–28 mm. Forewings moderate, hindmargin faintly sinuate; in male whitish, striated with fuscous-grey, veins dotted with blackish, in female whitish-ochreous, striæ dark fuscous; a blackish line towards base, with a short acute tooth or angulation beneath costa; a moderately broad median band enclosed by two fuscous blackish-edged fasciæ, confluent on lower half, including a small blackish discal dot, and marked on submedian vein with whitish-ochreous; anterior edge of band sinuate-concave, posterior edge more or less sharply angulated in middle, somewhat rounded towards costa; a darker hindmarginal suffusion, terminated above by a short suffused dark fuscous subapical streak. Hindwings moderate, hindmargin rounded; light yellowish-ochreous, base sometimes greyish-tinged, and with faint greyish striæ.

Constant; the female more ochreous-tinged, and the markings darker and more defined than in male.

Christchurch, Mount Hutt, Dunedin, amongst open bush, from November to April, very common; fifty-one specimens.

Here also Guenée has described the sexes as distinct species.

25. *Ep. chlamydota*, n. sp.

Male, female.—27–29 mm. Forewings moderate, hindmargin rather strongly sinuate, crenate; very pale whitish-ochreous; a small pale greyish-purple basal patch, margined by a strongly outwards-curved or angulated fuscous fascia, becoming blackish posteriorly; three or four parallel light ochreous-fuscous lines, partially confluent towards costa; a broad light greyish-purple median band, margined on both sides by a fuscous blackish-edged fascia, becoming dark fuscous externally; its anterior edge irregularly concave, posterior edge with a broad truncate projection in middle, beneath which is a short triangular indentation; a fuscous pale-circled discal dot; an indistinct purplish hindmarginal fascia, darker above and attenuated to apex, and preceded by an irregular reddish-ochreous suffusion, extending to costa. Hindwings moderate, hindmargin projecting in middle, crenate; deep ochreous-yellow, hindmargin more reddish-tinged, base paler; sometimes suffused with light purplish-grey, except an ochreous-yellow subterminal fascia.

Apparently somewhat variable in colour.

Wellington, Christchurch, and Akaroa, amongst bush, in November and January; three specimens in the collections of Mr. R. W. Fereday and the Otago Museum.

18. ARSINOE, n. g.

Face with projecting scales. Palpi moderate, triangularly scaled, porrected. Antennæ in male stout, strongly dentate, teeth moderately ciliated ($\frac{2}{3}$). Forewings with vein 6 rising out of 9, 7 from angle of areole, 10 anastomosing moderately with 9, 11 anastomosing strongly with 10, 12 free. Hindwings normal.

This genus occurs also in Australia.

1a.	Hindwings rounded	26. *subochraria.*
1b.	„ dentate	27. *prionota.*

26. *Ars. subochraria*, Dbld.

(*Aspilates* (?) *subochraria*, Dbld., Dieff. N.Z., ii., 285; *Camptogramma subochraria*, Butl., Cat., pl. iii., 16; *Camptogramma strangulata*, Gn., x., 423; *Camptogramma fuscinata*, Gn., E.M.M., v., 92.)

Male, female.—25–28 mm. Forewings moderate, hindmargin rounded; yellow, faintly striated with darker; costa narrowly suffused with purplish-fuscous; a well-defined black discal dot; a narrow purplish-fuscous sinuate fascia or line beyond middle, posteriorly well-defined; anteriorly suffused, and dilated on inner margin; a suffused fuscous hindmarginal band, preceded by one or two faint dentate fuscous striæ. Hindwings moderate, hindmargin rounded; yellow, paler towards base, more ochreous or reddish-tinged posteriorly.

Var. *fuscinata*. All wings more or less strongly suffused with light purplish-fuscous, fascia darker.

Constant except in respect of the fuscous suffusion.

Wanganui, Nelson, Christchurch, Mount Hutt, Dunedin; very common in open ground, frequenting the tussock-grass, from November to April; common also in Tasmania and Victoria; forty-eight specimens. The variety *fuscinata* is worth naming, as it appears to be confined to New Zealand; Mr. Fereday states it to have been formerly locally abundant in the swampy plains; but it shades gradually into the type.

27. *Ars. prionota*, n. sp.

Male, female.—27–31 mm. Forewings moderate, hindmargin rounded, in male crenate, in female dentate; light-ochreous; numerous indistinct sinuate dentate fuscous or dark fuscous striæ; in male costa and hindmargin suffused with dull light green; a broad median band indistinctly suffused with dark fuscous, in female hardly perceptibly, the lines forming its posterior edge bent in middle into a rather strong indented projection; in male an indistinct dark fuscous subterminal suffusion; an indistinct dark fuscous discal dot. Hindwings moderate, hindmargin rounded, dentate; ochreous-whitish; some irregular incomplete dark fuscous lines towards inner margin; a dark fuscous hindmarginal line.

Probably variable in colour and suffusion.

Castle Hill (2,500 feet) and Dunedin; three specimens in Mr. Fereday's collection, received from Mr. J. D. Enys and Capt. Hutton.

19. Cidaria, Tr.

Face with a more or less developed cone of scales. Palpi moderate or short, roughly triangular-scaled, porrected. Antennæ in male stout, serrate, shortly ciliated ($\frac{1}{4}$–$\frac{1}{2}$). Thorax sometimes crested posteriorly. Forewings with vein 6 rising out of 9, 7 almost from angle of areole, 10 anastomosing moderately with 9, 11 anastomosing moderately with 10, 12 free. Hindwings normal.

An extensive genus, probably of universal distribution.

1a. Posterior edge of central band very acutely indented below angulation .. .. 29. *rixata.*
1b. Posterior edge of central band not acutely indented.
 2a. Forewings green.
  3a. Median band purplish .. .. 30. *purpurifera.*
  3b. „ „ green.
   4a. Hindwings grey-whitish .. .. 32. *callichlora.*
   4b. „ more or less tinged with reddish-ochreous .. 31. *similata.*
 2b. Forewings not green.
  3a. Lines dentate .. .. 33. *chaotica.*
  3b. „ not dentate .. .. 28. *triphragma.*

28. *Cid. triphragma*, n. sp.

Male.—26–27 mm. Forewings moderate, hindmargin strongly sinuate; pale dull greyish-purple; a very small darker basal patch, outer edge strongly convex, margined by a dark fuscous fascia, posteriorly whitish-edged; a dark fuscous fascia before $\frac{1}{3}$, irregularly outwards-curved, posteriorly suffused, anteriorly sharply defined and whitish-edged; a minute blackish discal dot; a dark fuscous fascia beyond middle, forming a strong angle in middle, upper and lower halves both inwards-curved, anteriorly suffused, posteriorly sharply defined and whitish-edged. Hindwings moderate, hindmargin somewhat irregular, projecting in middle; whitish-ochreous mixed with pale purplish; an angulated darker band before middle.

A very distinct species, probably not variable.

Blenheim; two specimens received by Mr. Fereday from Mr. Skellon.

29. *Cid. rixata*, Feld.

(*Cidaria rixata*, Feld., cxxxii., 1; *Coremia squalida*, Butl., Cist. Ent., ii., 505.)

Male, female.—24–32 mm. Forewings moderate, hindmargin sinuate, crenulate; rather dark ashy-grey, somewhat mixed partially with light olive-green; numerous irregular dentate dark fuscous striæ, except on a median space, containing a black discal dot; basal third somewhat mixed with whitish, with two cloudy angulated whitish striæ at ⅓, partially suffused with greenish, and two others less angulated rather nearer base; beyond the posterior pair the dark striæ coalesce on lower half to form a blackish fascia; a double whitish line considerably beyond middle, dentate anteriorly, sinuate near costa, obtusely bent outwards in middle, emitting a long sharp tooth inwards below middle; beyond these a third parallel less distinct whitish or greenish line; a very sharply dentate whitish subterminal line, closely approaching this on lower half, anteriorly suffusedly blackish-margined; an oblique suffused blackish subapical spot. Hindwings moderate, hindmargin rounded, crenulate; in male whitish-ochreous, becoming greyish towards base, in female light grey; a grey discal dot; an obscure angulated median band somewhat darker, or represented by several incomplete striæ; an obscure grey dentate subterminal line.

Constant; immediately recognizable from all other species of the family in New Zealand by the very fine acute indentation of the posterior margin of the median band below middle.

Wellington, Mount Hutt, and Otira Gorge (1,600 feet), common amongst bush in January; twenty-four specimens.

30. *Cid. purpurifera*, Fereday.

(*Cidaria purpurifera*, Fereday, N.Z. Journ. Sc., 1883, .)

Male, female.—28–31 mm. Forewings moderate, hindmargin faintly sinuate, crenulate; dull rather light olive-green; two obscure irregular dentate blackish striæ near base, second followed by whitish scales; two irregular sinuate dentate blackish striæ at ⅓, curved outwards above middle, suffusedly confluent on lower half, first slightly whitish-margined anteriorly; two other very irregular dentate blackish striæ beyond middle, forming a broad subquadrate projection in middle third, which is wholly suffused with dark fuscous, second posteriorly white-margined, more broadly towards costa; between these two pairs of striæ the included median band is dull greyish-purple; a dentate white subterminal line; an oblique blackish subapical spot, white-margined above. Hindwings moderate, hindmargin rounded, crenulate; light brownish-ochreous.

Constant; a very elegant species.

Mount Hutt, in wooded gullies, common in December and January (Mr. R. W. Fereday); sixty specimens.

31. *Cid. similata*, Walk.

(*Cidaria similata*, Walk., 1413; *Cidaria timarata*, Feld., cxxxii., 19.)

Male, female.—29–33 mm. Forewings moderate, hindmargin rounded, crenulate; whitish-fuscous, suffused almost throughout with rather bright green; numerous irregular shortly dentate dark fuscous striæ, towards base angulated above middle; two pairs before middle converging and confluent on lower half into a narrow fascia, spotted with blackish, and posteriorly markedly concave; two other pairs of more irregular twice sinuate striæ beyond middle also converging similarly but less strongly; a broken subdentate white subterminal line, preceded by fuscous spots. Hindwings moderate, hindmargin rounded, crenulate; whitish-ochreous, more reddish-ochreous towards inner margin, with numerous incomplete dentate obscure grey striæ.

Constant; the thorax is rather strongly crested.

Christchurch and Dunedin, usually at rest on moss-grown tree-trunks, from November to March; seventeen specimens.

32. *Cid. callichlora*, Butl.

(*Cidaria callichlora*, Butl., Cist. Ent., ii., 509.)

Male.—31 mm. Forewings moderate, hindmargin rounded, crenate; yellowish green, irregularly suffused with rather darker green; numerous irregular dentate blackish lines; two of these before middle and three at $\frac{2}{3}$ suffused with blackish on lower half, indicating a median band, of which the posterior edge forms a short bidentate projection in middle, and a short simple projection towards costa; a slightly paler subterminal line preceded by an irregular blackish suffusion; a small blackish discal dot. Hindwings moderate, hindmargin rounded, crenate; grey-whitish; several indistinct grey lines, only perceptible near inner margin; a black hindmarginal line.

Probably constant.

Christchurch, in March (Mr. R. W. Fereday); two specimens.

33. *Cid. chaotica*, n. sp.

Male, female.—25–29 mm. Forewings moderate, hindmargin rounded, crenulate; dark fuscous, slightly mixed with pale ochreous, or with a very broad pale ochreous median band; numerous dentate blackish or dark fuscous striæ; two adjacent ochreous-fuscous or partially whitish-ochreous blackish-margined lines at $\frac{1}{3}$, followed by a row of white dots; two similar lines at $\frac{3}{4}$, sinuate beneath costa, with a strong bidentate angulation below middle, almost touching hindmargin, and preceded by a row of white dots; an obscure blackish discal dot; a small whitish-ochreous mark on costa before apex; a blackish interrupted hindmarginal line. Hindwings moderate, hindmargin rounded, crenulate; light ochreous-grey; several grey striæ towards inner margin; an obscure darker discal dot.

Apparently variable in colour and suffusion; distinguished however from all New Zealand species of the family by the approximation of the posterior margin of the central band to the hindmargin, which the angulation almost touches.

Akaroa, Mount Hutt, Arthur's Pass (2,600 feet), and Dunedin, amongst bush, in January and February; five specimens.

20. LARENTIA, Tr.

Face with a more or less developed cone of scales. Palpi moderate, roughly triangular-scaled, porrected. Antennæ in male bipectinated (*a* 3–5, *b* 6–8). Thorax not hairy beneath. Forewings with vein 6 rising out of 9, 7 from (rarely above) angle of areole, 10 anastomosing moderately with 9, 11 anastomosing moderately with 10, 12 free. Hindwings normal.

Also a cosmopolitan genus, largely represented in New Zealand.

1a. Hindwings distinctly yellow.
  2a. Forewings with clear white markings.
    3a. With six white fasciæ .. .. 38. *clarata.*
    3b. „ two white lines .. .. 34. *stinaria.*
  2b. Forewings without white markings.
    3a. Forewings clear yellow.
      4a. With numerous dentate brown lines .. .. .. 44. *prasinias.*
      4b. „ four rows of dots .. .. 40. *chlorias.*
    3b. Forewings whitish-ochreous or brownish-ochreous.
      4a. Median projection of central band bidentate .. .. 43. *helias.*
      4b. „ „ „ „ rounded .. .. 50. *bulbulata.*
1b. Hindwings not yellow.
  2a. Forewings suffused with green .. .. 39. *beata.*
  2b. Forewings not green.
    3a. Posterior lines of forewings more oblique than hindmargin 35. *præfectata.*
    3b. „ „ „ not more oblique.
      4a. Anterior lines of forewings absent .. .. 36. *nephelias.*
      4b. „ „ „ present.
        5a. Central band without median projection.
          6a. Cilia barred .. .. 41. *ægrota.*
          6b. „ unicolorous .. .. 42. *psamathodes.*
        5b. Central band with median projection.
          6a. Projection simple.
            7a. Forewings dark fuscous-grey .. .. .. 49. *anthracias.*
            7b. „ light greyish-ochreous .. .. 37. *cataphracta.*
          6b. Projection bidentate.
            7a. Hindmargin of forewings deeply sinuate .. 46. *obarata.*
            7b. „ „ not sinuate.
              8a. Species large .. .. 47. *petropola.*
              8b. „ moderate or small.
                9a. With a clear white line beyond median band .. .. 45. *chionogramma.*
                9b. Without „ „ „ „ „ .. 48. *cinerearia.*

34. *Lar. stinaria*, *Gn.*

(*Camptogramma stinaria*, Gn., E.M.M., v., 92.)

Male, female.—24–28 mm. Forewings moderate, hindmargin somewhat sinuate; rather deep ochreous-yellow, somewhat suffused with fuscous on median band except towards costa, and on hindmargin; a white posteriorly blackish-margined line from inner margin at ¼ to disc before middle; a white anteriorly blackish-margined transverse line beyond middle, moderately sinuate. Hindwings moderate, hindmargin rounded; rather deep ochreous-yellow.

Constant and very distinct.

Christchurch, Dunedin, and at the foot of Mount Hutt, frequenting *Carex subdola* in December and January (Mr. R. W. Fereday); twenty specimens.

35. *Lar. præfectata*, Walk.

(*Acidalia præfectata*, Walk., 781; *Acidalia subtentariæ*, Walk., 1610; *Acidalia abscònditaria*, Walk., 1611, Butl. Cat., pl. iii., 21.)

Male, female.—36–41 mm. Forewings moderate, hindmargin hardly rounded; dull grey-whitish; several very faint grey striæ towards base, tending to form dots on veins; a small dark grey discal dot; a nearly straight grey line from beyond middle of hindmargin to costa before apex, dotted with dark grey on veins; rather before this is a very faint grey parallel line, and between it and hindmargin are four straight cloudy grey lines, gradually converging towards costa. Hindwings moderate, hindmargin rounded; dull grey-whitish, with a median grey line, and six posterior faintly subdentate hardly curved grey lines.

Quite constant.

Christchurch, in November, frequenting swampy places (Mr. R. W. Fereday); twenty-three specimens.

36. *Lar. nephelias*, n. sp.

Male, female.—32–34 mm. Forewings moderate, in female narrower and more elongate, hindmargin rounded; pale whitish-grey, slightly ochreous-tinged; an indistinct suffusion of dark fuscous scales before middle; a small dark fuscous discal dot; a rather irregular cloudy dark fuscous line beyond middle, sinuate beneath costa, shortly angulated in middle; a very faint stria beyond this; a hindmarginal band composed of two rows of cloudy partially confluent dark fuscous spots, separating on costa: cilia pale whitish-grey. Hindwings moderate, in female narrower, hindmargin rounded; ground-colour as in forewings, with a few grey scales posteriorly.

A remarkable-looking species.

I took two fine specimens above Arthur's Pass (4,600 feet) in January.

37. *Lar. cataphracta*, n. sp.

Female.—29–31 mm. Forewings moderate, hindmargin slightly rounded; pale greyish-ochreous; markings white, black-margined, sometimes obsolete on costa; a basal patch and two curved slender fasciæ towards base, their margins dentate; a variable central fascia, sometimes rather broad and even throughout, but generally with margins approximated or confluent below middle, margins hardly dentate; a cloudy fuscous parallel line beyond this; a rather narrow fascia at ¾, shortly angulated in middle and towards costa, margins entire; beyond this a cloudy fuscous parallel line; a dentate white subterminal line; a short cloudy white oblique subapical streak, beneath blackish-margined: cilia whitish, sometimes barred with dark fuscous. Hindwings moderate, hindmargin rounded; extremely pale greyish-ochreous; cilia as in forewings.

Variable in the form of the central fascia, and in the distinctness of the bars of the cilia, which are sometimes wholly absent. I have not seen the male, but the species is so apparently allied to the following, that there can be little doubt of its position.

Arthur's Pass (3,000 feet), Lake Guyon, and Lake Wakatipu (4,000 feet), amongst grass, from December to March; seven specimens.

38. *Lar. clarata*, Walk.

(*Larentia clarata*, Walk., 1197, Butl. Cat., pl. iii., 14; *Cidaria pyramaria*, Gn., E.M.M., v., 93.)

Male, female.—28–35 mm. Forewings moderate, hindmargin rounded; light brownish-ochreous; markings white, margined by dentate blackish lines, sometimes obsolete on costa; a small basal patch; two narrow curved fasciæ towards base; a moderate median fascia, contracted or often obsolete in middle by coalescence of its margins, containing a strongly-marked black discal dot; a narrow irregular fascia beyond middle, sinuate beneath costa, rather strongly angulated in middle; a sinuate dentate blackish stria rather before this, and a second beyond it; a well-marked subterminal line; cilia white, barred with dark fuscous. Hindwings moderate, hindmargin rounded; ochreous-yellow; cilia as in forewings.

Variable only in the form of the central fascia; always easily separable from the preceding by the yellow hindwings and more dentate markings.

Castle Hill (2,500 feet), Mount Hutt, and Dunedin, in open grassy places, in December and January; thirty specimens.

39. *Lar. beata*, Butl.

(*Cidaria beata*, Butl., Proc. Zool. Soc. Lond., 1877, 397, pl. xliii., 6.)

Male, female.—22–28 mm. Forewings moderate, hindmargin rounded; olive-green, irregularly mixed with whitish-yellowish, tending to form transverse striæ; a narrow strongly-curved blackish-green fascia near base, anteriorly suffused, posteriorly irregularly dentate and whitish-margined; a darker or blackish-green median band, margined on both sides by first a blackish and then a white line, both margins irregularly dentate, anterior margin concave, posterior margin projecting beneath costa, and with a strong bidentate angulation in middle; within the median band is often a clear white space on costal half, and sometimes a smaller one on inner margin; generally a black discal dot; a dentate white subterminal line, anteriorly dark-margined: cilia with basal half yellowish, apical half white, barred with blackish. Hindwings moderate, hindmargin rounded; whitish-ochreous, sometimes slightly greenish-tinged, with an obscure row of grey spots before hindmargin; cilia as in forewings.

Variable in the presence or extent of the median white markings; allied to the preceding.

Christchurch, Akaroa, Mount Hutt, Dunedin, Lake Wakatipu, commonly amongst bush, from December to February, in April and June; twenty-five specimens.

40. *Lar. chlorias*, n. sp.

Male.—30 mm. Forewings moderate, hindmargin hardly rounded; bright yellow; base of costa dark fuscous-purple; a curved row of three very small dark purple-fuscous spots about ¼, and another of four spots before middle, costal spots larger; a triangular purple blotch on costa before apex, reaching half across wing, anteriorly margined by a strongly sinuate bluish-black streak; a row of three dark purple-fuscous dots from apex of this to inner margin, and a subterminal row of six similar dots; cilia yellow. Hindwings moderate, hindmargin rounded; rather paler than forewings, with two curved posterior rows of cloudy purple-fuscous dots.

A very beautiful and conspicuous species.

I took one fine specimen in a wooded gully near Castle Hill, at 3,100 feet, in January.

41. *Lar. ægrota*, Butl.

(*Selidosema ægrota*, Butl., Cist. Ent., ii., 499.)

Male, female.—26–31 mm. Forewings moderate, hindmargin rounded; pale brownish-grey; basal third with about eight fine dentate slightly curved dark grey striæ; a black discal dot; four similar striæ placed together beyond middle; two others more indistinct forming a subterminal line, beyond which the hindmargin is slightly darker: cilia barred with blackish and whitish. Hindwings moderate, hindmargin rounded; slightly paler than forewings, without markings; cilia pale brownish-grey, sometimes barred.

Only varying slightly in depth of colouring; the isolation of the four postmedian striæ is a good point.

Christchurch and Dunedin, in November, February, and March; twelve specimens.

42. *Lar. psamathodes*, n. sp.

Male, female.—30–33 mm. Forewings moderate, hindmargin slightly rounded, crenulate; whitish-ochreous, slightly brownish-tinged; numerous fine almost straight subdentate fuscous lines parallel to hindmargin, indistinct towards base, darker posteriorly; a black discal dot; an indistinct whitish subterminal line, preceded by a dark fuscous shade; a hindmarginal row of large black dots in pairs. Hindwings moderate, hindmargin slightly rounded, crenulate; very pale whitish-ochreous-grey; several grey lines, only distinct near inner margin; a hindmarginal row of large black dots in pairs.

Constant; an inconspicuous species.

Wellington and Dunedin; received by Mr. R. W. Fereday from Captain Hutton, and in the collection of the Otago Museum; eight specimens.

43. *Lar. helias*, n. sp.

Male.—30 mm. Forewings moderate, hindmargin rounded; very pale whitish-ochreous; costa and hindmargin ochreous-yellow; three or four obscure fuscous striæ towards base; a dark fuscous dentate strongly curved line at $\frac{1}{3}$; a moderately broad reddish-ochreous-brown median fascia, contracted beneath, anterior edge almost straight and marked with a blackish dot above middle, posterior edge irregularly dentate, and shortly projecting below middle; a yellowish-ochreous line parallel and a little beyond this; fuscous-margined, followed by a slender irregular fuscous fascia, separated from the ochreous-yellow hindmarginal fascia by a dentate pale line; cilia pale fuscous-reddish. Hindwings moderate, hindmargin rounded; ochreous-yellow, paler towards base; a dark grey discal dot; cilia pale fuscous-reddish.

Very distinct.

Dunedin, in January; two specimens.

44. *Lar. prasinias*, n. sp.

Male, female.—26–29 mm. Forewings moderate, hindmargin slightly sinuate; bright yellow; numerous cloudy confused dentate brownish striæ; a moderately broad rather dark fuscous median band, including a large ill-defined clear yellow patch on upper half, containing a black dot; its margins dentate, anterior margin concave, posterior margin moderately angulated in middle, sinuate above; a subterminal row of small dark fuscous spots; cilia yellow, barred with dark fuscous. Hindwings moderate, hindmargin rounded; pale yellow; basal half finely and obscurely striated with bluish-grey; hindmargin reddish-tinged, with a subterminal row of small grey spots.

Constant; a very elegant insect.

Castle Hill, taken by Mr. J. D. Enys; seven specimens.

45. *Lar. chionogramma*, n. sp.

Male.—28 mm. Forewings moderate, hindmargin slightly rounded, crenate; pale greyish-ochreous, irrorated with dark fuscous, forming indistinct irregular striæ; the suffusion of these forms a rather broad median band, its margins dentate, anterior margin concave, interruptedly white-edged, posterior margin with a short bidentate median projection, white-edged, more strongly and conspicuously on upper half; a black white-circled discal dot; a dentate white subterminal line, preceded by a dark suffusion. Hindwings moderate, hindmargin somewhat projecting obtusely in middle, crenulate; pale grey irrorated with darker; a median band of four dark grey lines; hindmargin suffused with dark grey, including a whitish dentate subterminal line.

Probably constant; although inconspicuous, not like any other.

Mount Hutt, in a wooded gully in December (Mr. R. W. Fereday); two specimens (not good).

46. *Lar. obarata*, Feld.

(*Cidaria obarata*, Feld., cxxxii., 33.)

Male, female.—20–26 mm. Forewings moderate, hindmargin very strongly sinuate, crenulate; grey-whitish, sometimes more greyish or ochreous-tinged; a basal patch of four outwards-curved subdentate blackish-grey lines, sometimes suffused together; beyond these are two similar lines, often obsolete except on costa; two dark fuscous lines before middle and three beyond middle, sometimes suffused with grey to form a median band, its anterior edge irregularly concave, posterior edge strongly blackish on upper half, subdentate, with a moderately strong bidentate median projection; a small blackish discal dot; three or four indistinct dentate grey lines beyond this, often obsolete except on costa; cilia barred with dark fuscous. Hindwings moderate, hindmargin irregularly sinuate, crenate; grey-whitish; several angulated grey lines between ⅓ and hindmargin; sometimes basal ⅔ wholly suffused with grey; cilia spotted with dark fuscous.

Somewhat variable in colour and suffusion.

Wellington, Christchurch, and at the foot of Mount Hutt; a plain-frequenting species, especially attached to gorse-hedges (Mr. R. W. Fereday), from November to January; thirty specimens.

47. *Lar. petropola*, n. sp.

Male, female.—39 mm. Forewings moderate, hindmargin rounded; dark grey, densely irrorated with bluish-whitish; costa broadly suffused with ochreous-whitish anteriorly; a very obscure curved ochreous-whitish line towards base, anteriorly dark-margined; two obscure curved subdentate adjacent whitish lines about $\frac{1}{3}$, followed by a dark line; a blackish discal dot; a very irregular dentate curved dark grey line beyond middle, followed by two adjacent whitish lines; a sharply dentate obscure whitish subterminal line, anteriorly dark-margined. Hindwings moderate, hindmargin rounded; markings as in forewings, but more obscure, paler and more suffused towards base.

A fine species, with a peculiar bluish tinge.

I took two specimens at rest on rock-faces in the Otira Gorge, at 1,800 feet, in January, and saw others.

48. *Lar. cinerearia*, Dbld.

(*Cidaria* (?) *cinerearia*, Dbld., Dieff. N.Z., ii., 286; *Larentia* (?) *invexata*, Walk., 1199, Butl. Cat., pl. iii., 11; *Larentia semisignata*, Walk., 1200; *Larentia inoperata*, Walk., 1201; *Larentia punctilineata*, Walk., 1202, Butl. Cat., pl. iii., 12; *Cidaria dissociata*, Walk., 1734; *Cidaria semilisata*, Walk., 1735; *Larentia corcularia*, Gn., E.M.M., v., 61; *Larentia infantaria*, Gn., E.M.M., v., 62; *Helastia eupitheciaria*, Gn., E.M.M., v., 95; ? *Cidaria sphæriata*, Feld., cxxxi., 14.)

Male, female.—16–25 mm. Forewings moderate, hindmargin rounded; ochreous-whitish or grey-whitish, irrorated with grey; numerous dark grey or dark fuscous regular dentate striæ, tending to form dots on veins; two adjacent near base, two others before middle, and three beyond middle darker and more conspicuous, especially on upper half, where they are often marked with blackish; a small blackish discal dot; the three post-median lines twice irregularly sinuate in and above middle; a blackish interrupted hindmarginal line. Hindwings moderate, hindmargin rounded; pale grey, from $\frac{1}{3}$ to hindmargin faintly marked with dentate angulated darker striæ.

Varies considerably in size, colour, and strength of marking; but I can find no point of distinction to justify the separation of any form as a distinct species. Three main forms occur; one large, greyer, and more uniform, without strong markings; a second of middle size, whiter and generally strongly marked, sometimes bluish-tinged, only found in the hills; and a third small, greyish but ochreous-tinged, strongly marked; these are connected by scarcer intermediate forms, and are, I believe, due to the direct effect of food and situation. The larva feeds on lichens.

Christchurch, Castle Hill (3,000 feet), Dunedin, Lake Wakatipu (3,500 feet), and probably generally, at rest on walls, fences, rocks, etc., from December to March, very common; fifty-four specimens.

49. *Lar. anthracias*, n. sp.

Male.—24–25 mm. Forewings moderate, hindmargin sinuate; dark fuscous, faintly striated, more or less sprinkled with whitish; a curved blackish line near base, posteriorly obscurely whitish-margined; a curved obscure whitish fascia at $\frac{1}{3}$, blackish-margined and bisected by a blackish line; a well-defined black discal dot; a white fascia, partially mixed with fuscous, beyond middle, anteriorly strongly blackish-margined, posteriorly more obscurely, and bisected by a blackish line, somewhat irregular, moderately angulated in middle; an obscure dentate yellowish or whitish subterminal line; an interrupted black hindmarginal line. Hindwings moderate, hindmargin rounded; dark fuscous; two nearly straight lines before middle faintly darker; a faint paler or sometimes whitish sinuate fascia beyond middle, margined and bisected with darker.

Varies slightly in distinctness of pale markings.

Mount Hutt, and Lake Wakatipu (5,400 feet), on the open mountain sides, in December and January; twelve specimens.

50. *Lar. bulbulata*, Gn.

(*Cidaria bulbulata*, Gn., E.M.M., v., 94.)

Male, female.—20–24 mm. Forewings moderate, hindmargin rounded; dark ochreous-fuscous, irregularly mixed and striated with ochreous-whitish; a curved whitish line towards base, and another at $\frac{1}{3}$; a double whitish line beyond middle, strongly sinuate in and above middle; in the included median space are two irregular strongly dentate dark fuscous lines, more or less wholly coalescing to form irregular rings, upper one largest and containing a dark fuscous dot; beyond the double whitish line is a more obscure parallel line; a strongly dentate ochreous-whitish subterminal line. Hindwings moderate, hindmargin rounded; orange, faintly striated on inner margin: cilia dark grey, tips pale.

Constant, except in the forms of the median rings.

Christchurch, Castle Hill (2,400 feet), and Dunedin; common in grassy places, in September, January, and March; twenty-five specimens.

21. Pasithea, n. g.

Face roughly haired. Palpi moderate, second joint with long or very long spreading hairs beneath, terminal joint moderate or rather long, often concealed. Antennæ in male bipectinated (*a* 3–8, *b* 5–10). Thorax beneath more or less strongly clothed with long hairs. Forewings with vein 6 rising out of 9, 7 almost from angle of areole, 10 anastomosing moderately with 9, 11 anastomosing moderately or very shortly with 10, 12 free. Hindwings normal.

Essentially distinguished from *Larentia* by the hairy under-surface of thorax.

1a. Forewings with well-defined white markings.
  2a. Hindwings dark fuscous with white or yellowish markings.
    3a. Hindwings reddish beneath .. .. 56. *callicrena.*
    3b. „ yellowish „
      4a. Apical half of cilia wholly white .. .. 53. *mechanitis.*
      4b. „ „ barred with dark fuscous.
        5a. Subterminal line very shortly dentate .. .. 55. *strategica.*
        5b. „ „ subdentate .. .. .. 54. *paradelpha.*
  2b. Hindwings orange or pale yellowish.
    3a. Hindwings with a dark fuscous subterminal fascia.
      4a. Forewings with a narrow central orange fascia .. .. 57. *perornata.*
      4b. „ without central fascia .. .. 58. *niphocrena.*
    3b. Hindwings without dark subterminal fascia .. .. .. 51. *insignis.*
1b. Forewings without white markings.
  2a. Hindwings dark fuscous or grey.
    3a. Cilia barred .. .. 52. *orphnæa.*
    3b. „ unicolorous .. .. 63. *omichlias.*
  2b. Hindwings orange.
    3a. Wings beneath with a sharply marked straight central line 59. *ferox.*
    3b. Central line not straight.
      4a. Central line of hindwings slightly and evenly curved .. 60. *zopyra.*
      4b. „ „ „ twice sinuate.
        5a. Basal half of hindwings almost wholly dark fuscous 61. *vulcanica.*
        5b. „ „ „ not dark fuscous .. .. 62. *brephos.*

51. *Pas. insignis*, Butl.

(*Aspilates insignis*, Butl., Proc. Zool. Soc. Lond., 1877, 393, pl. xliii., 1.)

Male.—30–33 mm. Forewings moderate, hindmargin rounded; ochreous-brown; a slightly curved white streak from base of inner margin to disc beyond middle, beneath dark-margined, posterior extremity connected with a very obscure whitish line from costa near base; a nearly straight white transverse streak from before apex to before anal angle, anteriorly dark-margined. Hindwings moderate, hindmargin unevenly rounded; deep ochreous-yellow, brownish-tinged; base mixed with dark fuscous; a suffused brown hindmarginal band.

Female.—24–27 mm. Wings rather narrower than in male; forewings pale whitish-ochreous, finely sprinkled with dark fuscous, especially towards base; markings as in male. Hindwings whitish-yellowish, base sprinkled with dark fuscous.

Constant; a strikingly distinct species.

Castle Hill, about 4,000 feet; common on the bare mountain side, in January; twenty-six specimens.

52. *Pas. orphnæa*, n. sp.

Female.—28–30 mm. Forewings moderate, hindmargin rounded; dark fuscous, mixed with yellowish and whitish, which tend to form alternate fasciæ; a discal dot and numerous curved irregularly dentate blackish lines, varying in strength and intensity; cilia barred with blackish and whitish. Hindwings moderate, hindmargin rounded; dark fuscous; a blackish discal dot; a cloudy whitish irroration forming a double curved fascia beyond middle, and a dentate subterminal line; cilia as in forewings.

Imitative in colour of the dark lichen-grown rocks.

I took three specimens almost on the summit of Ben Lomond, Lake Wakatipu, at 5,600 feet, in January.

53. *Pas. mechanitis*, n.sp.

Male, female.—19–23 mm. Forewings moderate, hindmargin rounded; dark fuscous, densely irrorated and median band almost wholly suffused with yellow; a nearly straight yellow or whitish line towards base, anteriorly strongly blackish-margined; an irregularly curved white line at $\frac{1}{3}$, posteriorly strongly blackish-margined; a small blackish discal dot; an irregularly angulated slender dark fuscous median line, beyond which is another almost confluent with next line; a white line beyond middle, anteriorly strongly blackish-margined, strongly angulated in middle, subdentate beneath; a slender very sharply dentate irregular yellow subterminal line; cilia with basal half dark grey, apical half wholly white. Hindwings dark fuscous, base irrorated with yellow; an irregular obscure yellow fascia before middle; a white sinuate median line, sometimes yellow above; subterminal line and cilia as in forewings.

Constant, except that the white markings tend to be suffused with yellow.

Arthur's Pass (3,100 to 4,600 feet), and Mount Hutt, common in grassy places on the mountains, from January to March; fifteen specimens.

54. *Pas. paradelpha*, n.sp.

Male.—21–23 mm. Forewings moderate, costa straight, hindmargin rounded; dark fuscous, densely and finely strewn with yellowish and a few whitish scales; a curved cloudy whitish line towards base, anteriorly blackish-margined; a slightly bent whitish line at $\frac{1}{3}$, posteriorly blackish-margined; sometimes a small blackish discal dot, and slender curved median line; a clearly marked white line beyond middle, anteriorly strongly blackish-margined, shortly and obtusely angulated in middle, and inner margin shortly toothed above and below middle; an irregular sinuate subdentate whitish-yellowish subterminal line: cilia with basal half dark grey, apical half sharply barred with dark fuscous and white. Hindwings somewhat elongate, hindmargin rounded; dark fuscous; basal half irrorated with pale yellowish; a very obscure curved whitish shade before middle; a well-defined strongly-curved white median line; a very irregular subdentate whitish-yellowish subterminal line; cilia as in forewings.

Easily separated from the preceding by the barred cilia, the absence of any clear yellow colouring, the less prominent angulation of the post-median line, and the more elongate wings.

I found the species common amongst grass on Ben Lomond, Lake Wakatipu, at about 5,000 feet, in December; five specimens.

55. *Pas. strategica*, n. sp.

Female.—35 mm. Forewings moderate, hindmargin rounded; dark fuscous, thinly irrorated with yellowish; a slender straight oblique white fascia towards base; a narrow somewhat irregular slightly curved white fascia before middle; a narrow whitish median fascia, broadly suffused with yellowish, bent above middle; a rather narrow well-defined white fascia beyond middle, sharply angulated in disc; a sharply dentate white subterminal line; cilia barred with white and dark fuscous. Hindwings moderate, hindmargin rounded; dark fuscous, base irrorated with yellowish; a somewhat sinuate whitish fascia suffused with yellowish before middle; a white strongly angulated fascia beyond middle; subterminal line and cilia as in forewings. Hindwings beneath suffused with golden-yellow; markings as above.

A fine and conspicuous species.

Lake Guyon, in January; one specimen in Mr. Fereday's collection, received from Mr. Travers.

56. *Pas. callicrena*, n. sp.

Female.—34 mm. Forewings moderate, hindmargin rounded; blackish, irregularly suffused with light reddish; markings ochreous-whitish, dark-margined; a slender somewhat sinuate oblique fascia towards base; a moderate twice sinuate fascia before middle; a moderately broad subdentate fascia beyond middle, sinuate above middle; a sharply dentate subterminal line: cilia reddish-whitish, barred with dark fuscous. Hindwings moderate, hindmargin rounded; dark grey; a very obscure whitish line before middle; a moderate whitish fascia beyond middle, sinuate-curved in middle; subterminal line and cilia as in forewings; beneath ground-colour reddish.

Probably constant; very handsome.

Mr. R. W. Fereday took one fine specimen at the head of Lake Wakatipu, high up the mountains, above the forest-level, amongst grass in January.

57. *Pas. perornata*, Walk.

(*Fidonia perornata*, Walk., 1672.)

Male, female.—23–25 mm. Forewings moderate, hindmargin rounded; dark fuscous; base narrowly orange mixed with white; four slender orange fasciæ, generally partially white except third; first straight; second parallel but dentate; beyond second a short straight parallel orange streak from costa; third median, irregularly sinuate, sometimes partially obsolete; fourth dentate, sharply angulated in middle; an irregular dentate bright orange line near hindmargin. Hindwings moderate, hindmargin rounded; orange; base mixed with dark fuscous; an oblique line near base, a sometimes double irregular sharply angulated line before middle, an irregular dentate interrupted subterminal fascia, and a row of partially confluent spots on hindmargin dark fuscous.

Tolerably constant.

Wellington, Lake Coleridge, and at the foot of Mount Hutt, in grassy places, during February and March (Mr. R. W. Fereday); eighteen specimens.

58. *Pas. niphocrena*, n. sp.

Female.—24–25 mm. Forewings moderate, hindmargin rounded; rather dark fuscous, mixed and obscurely striated with orange; a curved white subdentate line before $\frac{1}{4}$, anteriorly blackish-margined; a similar white line beyond $\frac{1}{4}$, posteriorly blackish-margined; space between these sometimes suffused with orange; a slender irregularly dentate white fascia beyond middle, rather strongly angulated in middle, anteriorly blackish-margined, posteriorly closely followed by a dentate orange line; a dentate orange line near hindmargin, dilated on costa. Hindwings moderate, hindmargin rounded; orange, lighter anteriorly; basal half dark fuscous mixed with orange, its outer edge irregularly curved; a dentate subterminal fascia and narrow hindmarginal fascia dark fuscous, sometimes obscure.

Possibly when the male is known this may prove to be a *Dasyuris.*

I took two specimens on the mountain-side above Arthur's Pass at 4,500 feet, in January.

59. *Pas. ferox*, Butl.

(*Fidonia ferox*, Butl., Proc. Zool. Soc. Lond., 1877, 392, pl. xlii., 8.)

Female.—24 mm. Forewings moderate, hindmargin rounded; fuscous, partially greyish-tinged; a dark ochreous-fuscous nearly straight dentate stria about $\frac{1}{5}$, between which and base are three others fainter; an obscure discal dot; a dark ochreous-fuscous nearly straight dentate stria in middle, between which and hindmargin are seven or eight similar striæ becoming gradually more strongly curved. Hindwings moderate, hindmargin rounded; bright orange; base mixed with dark fuscous; a straight strongly marked median line, an obscure parallel line beyond it, three fine subdentate curved lines parallel with hindmargin, and a hindmarginal line dark fuscous. Forewings and hindwings beneath orange; markings of both as in hindwings above, but the four posterior lines separated by yellowish-whitish interspaces.

The pale terminal band of the undersurface is a peculiar feature.

Castle Hill, taken by Mr. J. D. Enys; two specimens.

60. *Pas. zopyra*, n. sp.

Male.—19 mm. Forewings moderate, hindmargin rounded; dark fuscous-grey with a bluish tinge, with numerous regular dentate transverse striæ and a discal dot darker. Hindwings bright deep orange; basal third dark fuscous, its outer edge rather sharply angulated; two parallel hardly bent lines towards middle, a subdentate subterminal line, and a slender hindmarginal fascia dark fuscous. Forewings and hindwings beneath orange; forewings with an irregular curved line before middle, four parallel sinuate-curved lines beyond middle, subterminal and hindmarginal fasciæ dark fuscous; hindwings with a strongly sinuate-curved line at ⅓, indistinct curved median and subterminal lines, and slender hindmarginal fascia dark fuscous.

Constant; the smallest species of the group.

Mount Hutt, on the shingle in the bed of a gully in January (Mr. R. W. Fereday); six specimens.

61. *Pas. vulcanica*, n. sp.

Female.—22 mm. Forewings moderate, hindmargin rounded; dark fuscous-grey, somewhat mixed with whitish; numerous irregular dentate darker striæ; an irregular curved slender blackish fascia towards base; an irregular blackish fascia before middle; another beyond middle, forming two rather strong rounded projections in and above middle; cloudy subterminal and hindmarginal fasciæ. Hindwings moderate, hindmargin rounded; deep orange; basal half wholly dark fuscous, its outer edge twice deeply sinuate; a line near and parallel to this, an irregular dentate subterminal fascia, and a hindmarginal fascia partly confluent with it, dark fuscous. Forewings and hindwings beneath light orange, with two parallel twice obtusely angulated lines beyond middle, subterminal and hindmarginal dentate fasciæ, also two straight incomplete anterior lines in forewings, and a sinuate anterior line in hindwings dark fuscous.

Easily recognizable by the dark basal half of the hindwings.

I found this species settling on the roads near Makatoku, Hawke's Bay, in March; Mr. Fereday has it from the Kaweka range in the same district, taken in January; three specimens.

62. *Pas. brephos*, Walk.

(*Fidonia* (?) *brephosata*, Walk., 1037, Butl. Cat., pl. iii., 14; *Larentia catocalaria*, Gn., E.M.M., v., 62; *Fidonia brephos*, Feld., cxxix., 5; *Fidonia enysii*, Butl., Proc. Zool. Soc. Lond., 1877, 391, pl. xlii., 9.)

Male, female.—23–25 mm. Forewings moderate, hindmargin rounded; brownish-grey, with dark fuscous markings; numerous irregular dentate transverse striæ; two before middle and three beyond middle more strongly marked, the latter forming two irregular projections in and above middle; a discal dot; cloudy subterminal and hindmarginal shades. Hindwings moderate, hindmargin rounded; bright orange; base mixed with dark fuscous; a straight line about $\frac{1}{3}$, two parallel sinuate lines in middle, a curved subterminal line, and a dentate hindmarginal fascia dark fuscous; all the lines vary in intensity, and one or other is often obsolete. Forewings and hindwings beneath orange, with a discal dot, two parallel angulated lines beyond middle, an irregular subterminal fascia and dentate hindmarginal fascia dark fuscous, often partially obsolete.

Varies slightly in the distinctness of the dark markings.

Castle Hill (3,000 feet), Arthur's Pass (3,000 feet), Lake Wakatipu (3,000 feet), Invercargill (sea-level), Nelson, and Mount Hutt, especially settling on roads or bare ground, from December to March; thirty specimens. I have corrected Walker's barbarously-formed name.

63. *Pas. omichlias*, n. sp.

Male.—25–26 mm. Forewings moderate, hindmargin rounded; dark grey, irrorated with whitish; several obscure dark fuscous lines towards base; a slender curved dark fuscous fascia before middle; a blackish discal dot; a somewhat broader irregular subdentate dark fuscous fascia beyond middle, forming a short bidentate projection in middle, and a shorter simple projection towards costa; sometimes two pale lines beyond this, and a pale subterminal line; a blackish-grey hindmarginal line; cilia pale grey. Hindwings moderate, hindmargin rounded; rather dark grey; three faintly indicated darker median lines alternating with paler; a blackish-grey hindmarginal line; cilia whitish-grey.

A dull-looking species, resembling a small *Statira hectori*, and might be passed over for *Larentia cinerearia*.

Castle Hill, taken by Mr. J. D. Enys, "high up" (probably about 5,000 feet); two specimens.

22. Statira, n. g.

Face roughly haired. Palpi moderate, porrected or ascending, with long or very long spreading hairs beneath, terminal joint moderate, nearly concealed. Antennæ in male filiform, simple, pubescent. Thorax hairy beneath. Forewings with vein 6 rising out of 9, 7 almost from angle of areole, 10 anastomosing moderately with 9, 11 anastomosing strongly with 10, 12 free. Hindwings normal.

1a. Hindwings orange.
  2a. Postmedian line of hindwings curved, parallel to median .. 65. *anceps.*
  2b. " " " angulated, remote in middle from median .. .. 64. *homomorpha.*
1b. Hindwings dark fuscous with whitish lines .. .. 66. *hectori.*

64. *Stat. homomorpha*, n. sp.

Male.—28 mm. Forewings moderate, costa rather abruptly arched near base, hindmargin slightly rounded; dark fuscous-grey, with numerous irregular darker striæ; a pale curved fascia towards base, mixed with whitish and bisected by a dark line; a second about $\frac{1}{3}$; a third beyond middle, irregularly dentate and sinuate; an obscure pale subterminal line. Hindwings moderate, hindmargin rounded; bright orange; basal space up to first line mixed with dark fuscous; a nearly straight line about $\frac{1}{3}$, a second more obscure beyond and parallel to it, a third irregularly angulated and subdentate beyond middle, a narrow irregular interrupted subterminal fascia, and a dentate hindmarginal fascia dark fuscous. Forewings and hindwings beneath orange, with a straight line before middle, an angulated line beyond middle, an interrupted subterminal fascia, and a hindmarginal fascia blackish; two additional anterior incomplete lines in forewings.

Readily identified by the postmedian line of the hindwings.

Mount Hutt, in January (Mr. R. W. Fereday); five specimens.

65. *Stat. anceps*, Butl.

(*Fidonia anceps*, Butl., Proc. Zool. Soc. Lond., 1877, 392, pl. xliii., 3.)

Male.—27–30 mm. Forewings moderate, costa moderately arched, hindmargin slightly rounded; dark fuscous-grey, irrorated with bluish-whitish; the absence of the irroration produces numerous irregular dentate sinuate darker striæ; two before middle and two beyond middle more strongly marked, enclosing a moderately broad clear space, containing a blackish discal dot; a darker subterminal shade, and another on hindmargin. Hindwings moderate, hindmargin rounded; rather deep ochreous-yellow; basal space up to first line mixed with dark fuscous; a straight line about $\frac{1}{3}$, two somewhat curved parallel median lines, an irregular partially-interrupted subterminal fascia, and a hindmarginal fascia dark fuscous. Forewings and hindwings beneath yellow, with a straight line before middle, an angulated line beyond middle, an interrupted subterminal fascia, and a hindmarginal fascia blackish.

Constant; less intensely coloured than its allies.

Nelson, Arthur's Pass (3,000 feet), and Castle Hill (3,100 feet), in January, settling on bare ground and roads; twelve specimens.

66. *Stat. hectori*, Butl.

(*Euclidia hectori*, Butl., Proc. Zool. Soc. Lond., 1877, 387, pl. xlii., 4.)

Male.—33 mm. Forewings moderate, costa abruptly arched near base, hindmargin almost straight or slightly rounded; dark fuscous-grey, irrorated with bluish-whitish; markings obscurely blackish; an irregular curved dentate line near base; a strongly-marked irregular twice sinuate line about $\frac{1}{3}$, closely followed by a similar less marked line; a small discal spot;

a band of three parallel irregular dentate twice sinuate lines beyond middle, posterior two partially confluent, last strongest; hindmargin broadly and suffusedly darker: cilia barred with dark fuscous and white. Hindwings moderate, hindmargin rounded; dark fuscous, base irrorated with bluish-whitish; a curved cloudy whitish line before middle, a second in middle, a third more irregular and distinct beyond middle, and a fourth, slender and irregular, towards hindmargin. Forewings and hindwings beneath whitish, with four irregular fasciæ and a hindmarginal band dark fuscous.

Tolerably constant.

Lake Wakatipu (on the summit of Ben Lomond, 5,700 feet) and Mount Hutt, in December and January, flying rather actively about the face of precipices; eight specimens.

23. Dasyuris, Gn.

Face with projecting hairs. Palpi moderate, porrected, roughly scaled beneath, terminal joint short. Antennæ in male rather stout, dentate, shortly ciliated (½). Thorax hairy beneath. Forewings with vein 6 rising out of 9, 7 almost from angle of areole, 10 anastomosing moderately with 9, 11 anastomosing moderately with 10, 12 free. Hindwings normal.

Established by Guenée for the single species here included in it; closely allied to *Pasithea*. The name *Dasyurus* is employed amongst the *Mammalia;* it is not primarily desirable to employ two names so similar as *Dasyurus* and *Dasyuris*, but as they are not identical, there is no valid reason for changing them when once given.

67. *Das. partheniata*, Gn.

(*Dasyuris partheniata*, Gn., E.M.M., v., 93.)

Male, female.—27–28 mm. Forewings moderate, hindmargin rounded; pale yellowish-orange, markings rather dark fuscous; basal space mixed with dark fuscous, bordered by an irregular fascia, angulated sharply in middle; a narrow fascia before middle, and a broader fascia beyond middle, between which is a transverse line, and a discal dot; posterior edge of second fascia with a moderately sharp angulation in middle, a shorter one towards costa, and irregularly dentate throughout, first fascia and median line parallel to this; an irregular subterminal fascia, and another along hindmargin, sometimes partially confluent beneath, their margins dentate: cilia barred with whitish and dark fuscous. Hindwings moderate, hindmargin rounded; deep orange; base mixed with dark fuscous; an angulated median line, a slender irregularly dentate or interrupted subterminal fascia, and a slender dentate hindmarginal fascia dark fuscous; cilia as in forewings.

Tolerably constant; a pretty species.

At the foot of Mount Hutt, amongst tussock-grass, in March (Mr. R. W. Fereday); sixteen specimens.

24. CEPHALISSA, n.g.

Face smooth. Palpi rather long, straight, porrected, triangularly scaled. Antennæ in male slender, minutely ciliated (¼). Forewings with vein 6 from a point with 9, 7 from below angle of areole, 10 anastomosing shortly with 9, 11 anastomosing shortly with 10, 12 free. Hindwings normal.

It is rather doubtful to which genus this is most allied.

68. *Ceph. siria*, n. sp.

Male, female.—16–18 mm. Forewings moderate, costa sinuate, hindmargin strongly sinuate; rather dark reddish-fuscous, markings darker; a narrow curved fascia towards base, posteriorly obscurely edged with yellowish-white; a median band, moderately broad on costa, much narrower towards inner margin, both margins obscurely edged with yellowish-white, only distinct on costa, anterior margin sinuate, posterior margin sinuate, somewhat projecting in middle; an indistinct suffusion towards apex. Hindwings moderate, hindmargin irregular, obtusely projecting in middle; bright deep orange, tinged with reddish-fuscous on hindmargin; cilia dark fuscous.

Constant; specifically quite isolated.

Dunedin; received by Mr. R. W. Fereday from Capt. Hutton, and probably a mountain species; six specimens.

25. PANAGRA, Gn.

Face loosely haired. Palpi long, straight, porrected, attenuated. Antennæ in male dentate, ciliated (1). Forewings with vein 6 rising below 9, 7 from below angle of areole, 10 anastomosing strongly with 9, 11 anastomosing strongly with 10, 12 free. Hindwings normal.

This genus seems specially characteristic of Australia, where there are many species; the New Zealand species is very different from any other known to me.

69. *Pan. falcatella*, Walk.

(*Samana falcatella*, Walk., xxvii., 197.)

Male.—31 mm. Forewings moderate, costa almost straight, apex acute, hindmargin sinuate; whitish-ochreous, slightly yellowish-tinged; a longitudinal fine black streak from near base to middle of disc, above edged with a faint brownish suffusion; a short black longitudinal dot in disc above and beyond middle; a narrow black streak from near middle of inner margin to near apex, attenuated at each end, posteriorly edged with a faint brownish suffusion; a row of minute black dots on hindmargin. Hindwings moderate, apex obtusely projecting, hindmargin bent below middle; white; a black discal dot; a row of minute black dots on hindmargin.

A very distinct species.

I have only seen one specimen, received by Mr. R. W. Fereday from Captain Hutton, probably taken in the neighbourhood of Dunedin.

3. BOLETOBIDÆ.

Forewings with areole simple, 11 separate, 12 free. Hindwings with 8 veins, 6 and 7 separate, 8 free, approximated to 7 towards base.

A very small family, probably approaching extinction, inhabiting mountains in Europe and probably other restricted localities.

26. Cacopsodos, Butl.

Face smooth. Palpi long, straight, porrected, roughly scaled above and beneath. Antennæ in male pectinated on inner side only. Forewings with vein 6 from a point with 9, 7 from angle of areole, 10 anastomosing moderately with 9, 11 separate, approximated to 10 in middle, 12 free. Hindwings with veins 6 and 7 separate, 8 free, closely approximated to 7 from base to near transverse.

I have not seen the male; if Butler's description of the antennæ is correct, it is the only New Zealand genus with uniserial pectinations.

70. *Cac. niger*, Butl.

(*Cacopsodos niger*, Butl., Proc. Zool. Soc. Lond., 1877, 395, pl. xliii., 4.)

Female.—13 mm. Forewings rather narrow, costa sinuate, hindmargin sinuate; white, slightly mixed with grey; inner margin narrowly grey; a slender black fascia almost at base; a slender black fascia at ⅓, dentate inwards above middle, dilated on costa; a slender black fascia beyond middle, sharply angulated in middle, dilated on costa, connected below middle with preceding fascia by a suffused bar; close beyond this a rather broad parallel grey fascia; an indistinct grey subterminal line. Hindwings moderate, hindmargin rounded; dark grey.

Butler described his species from a single male, which was very much darker than this, almost wholly suffused with dark grey, but I have no doubt of the identity of the species, which probably varies a good deal.

I took a single specimen near Lake Wakatipu in December, at about 1,500 feet.

4. LYRCEIDÆ.

Forewings with areole double, 11 anastomosing with 10, 12 anastomosing with 11. Hindwings with 8 veins, 6 and 7 separate, 8 free, not approximated to 7.

I have been obliged to form this family for the single included genus, which is allied to the *Ennomidæ*, but differs essentially from them. It is of a decidedly primitive type, and approaches in the hindwings nearly to the ancestral form of the group.

27. Lyrcea, Walk.

Face smooth. Palpi rather short, slender, arched, appressed to face. Antennæ in male filiform, simple. Forewings with vein 6 from below 9, 7 from below angle of areole, 10 anastomosing shortly with 9, 11 anastomosing shortly with 10, 12 anastomosing shortly with 11. Hindwings with veins 6 and 7 separate, 8 free, not approximated to 7.

71. *Lyrc. alectoraria*, Walk.

(*Lyrcea alectoraria*, Walk., 259; *Aspilates* (?) *primata*, Walk., 1076, Butl. Cat., pl. iii., 4; *Endropia mixtaria*, Walk., 1506, Butl. Cat., pl. iii., 5; *Amilapis* (?) *acroiaria*, Feld., cxxiii., 6; *Lyrcea varians*, Butl., Cist. Ent., ii., 496.)

Male, female.—34–44 mm. Forewings moderate, apex acute, sharply projecting, hindmargin obtusely angulated in middle, often crenulate; light ochreous or brownish-ochreous, irregularly irrorated with dots of slightly darker or blackish scales; extreme costal edge generally blackish or rosy; faint indications of a darker curved line before middle, a sinuate median line, and an angulated line beyond middle, almost obsolete; generally a distinct blackish discal dot; sometimes a round silvery-white spot below middle, and another above and beyond middle, margined with dark fuscous, often bisected by a dark vein; often several suffused blackish spots towards apex and hindmargin. Hindwings moderate, hindmargin crenulate, somewhat projecting in middle; colour and markings as in forewings, lines usually obsolete.

Exceedingly variable in almost every respect.

Wellington, Christchurch, Dunedin, amongst bush, from September to January, and in April and May; thirty-eight specimens.

5. ENNOMIDÆ.

Forewings with areole double, single, or absent, 12 free or anastomosing with 11. Hindwings with 7 veins (normal vein 5 absent), 5 and 6 separate, 7 free, approximated to 6 towards base.

An extensive family of universal distribution, but not reaching any degree of development in New Zealand. Most of the species occurring are highly variable. As the genera are all small, I give a tabulation of all the species together, besides that of the genera.

1a. Antennæ of male bipectinated.
  2a. Vein 12 of forewings anastomosing with 11.
    3a. Vein 11 of forewings separate .. .. 29. *Zylobara.*
    3b. " " " anastomosing with 10 .. .. 31. *Boarmia.*
  2b. Vein 12 of forewings free.
    3a. Vein 11 of forewings obsolete .. .. 28. *Hybernia.*
    3b. " " " present.
      4a. Vein 11 of forewings anastomosing with 10 .. 34. *Declana.*
      4b. " " " separate.
        5a. Vein 10 of forewings touching 9.
          6a. Terminal joint of palpi short, conical .. 30. *Pseudocoremia.*
          6b. " " " long, clavate, exposed 33. *Detunda.*
        5b. Vein 10 of forewings separate .. .. .. 32. *Barsine.*

1b. Antennæ of male not pectinated.
  2a. Vein 12 of forewings touching or anastomosing with 11.
    3a. Vein 11 separate .. .. 38. *Stratocleis.*
    3b. „ anastomosing with 10 .. .. 37. *Amastris.*
  2b. Vein 12 of forewings free.
    3a. Vein 11 separate.
      4a. Coxæ and femora densely haired beneath .. .. 36. *Phyllodoce.*
      4b. „ „ „ not hairy .. .. 39. *Azelina.*
    3b. Vein 11 rising out of 10.
      4a. Antennæ of male simple .. .. 40. *Drepanodes.*
      4b. „ „ dentate, ciliated .. .. .. 35. *Atossa.*

SPECIFIC TABULATION.

1a. Hindmargin of forewings distinctly angulated.
  2a. With a strong acute subapical tooth .. .. .. 88. *Azel. fortinata.*
  2b. Without „ „ „ „
    3a. Apex strongly projecting.
      4a. Posterior line straight .. .. 89. *Drep. muriferata.*
      4b. „ „ curved .. .. 87. *Strat. streptophora.*
    3b. Apex slightly projecting.
      4a. Lines represented by dots .. .. 85. *Am. encausta.*
      4b. „ entire, distinct.
        5a. Forewings with a distinct subapical tooth .. 86. *Strat. gallaria.*
        5b. „ without „ „ „ .. 84. *Phyll. nelsonaria.*
1b. Hindmargin of forewings rounded.
  2a. Forewings with rough scales.
    3a. With an angular black basal spot.
      4a. Hindmargin spotted with black .. .. .. 79. *Det. atronivea.*
      4b. „ not spotted .. .. 80. *Det. egregia.*
    3b. Without an angular black basal spot.
      4a. Hindwings wholly white .. .. 83. *At. niveata.*
      4b. „ partially greyish or ochreous.
        5a. Costal strigulæ of forewings direct .. .. 81. *Decl. floccosa.*
        5b. „ „ „ oblique .. .. 82. *Decl. crassitibia.*
  2b. Forewings smooth.
    3a. Hindwings fuscous or ochreous-fuscous.
      4a. Postmedian line parallel to hindmargin .. .. 78. *Bars. panagrata.*
      4b. „ „ much more oblique than hindmargin .. .. 77. *Boarm. dejectaria.*
    3b. Hindwings pale ochreous or yellowish.
      4a. Postmedian line dentate.
        5a. Forewings greenish-tinged .. .. .. 76. *Pseud. melinata.*
        5b. „ ochreous-tinged .. .. .. 74. *Zyl. productata.*
      4b. Postmedian line regular .. .. 75. *Pseud. lupinata* ♂.
    3c. Hindwings whitish.
      4a. Hindwings suboblong .. .. 73. *Zyl. fenerata.*
      4b. „ rounded .. .. 75. *Pseud. lupinata* ♀.
    3d. Hindwings pale grey irrorated with dark fuscous .. 72. *Hyb. indocilis.*

28. HYBERNIA, Latr.

Face smooth. Palpi short, roughly scaled, porrected. Antennæ in male bipectinated (5–6). Female semiapterous. Forewings with vein 6 from below 9, 7 out of 9, 10 separate, 11 obsolete (probably coincident with 10), 12 free. Hindwings normal.

A small genus, occurring also in Europe; the only one in New Zealand in which the female is semiapterous, or vein 11 of the forewings absent.

72. *Hyb. indocilis*, Walk.

(*Zermizinga indocilisaria*, Walk., 1530; *Hybernia boreophilaria*, Gn., E.M.M., v., 61.)

Male.—25–34 mm. Forewings moderate, hindmargin rounded, crenulate; pale fuscous-grey, closely irrorated with dark fuscous; a somewhat irregular curved cloudy dark fuscous line at $\frac{1}{4}$; an irregular median line; a third beyond middle, twice sinuate; a fourth towards hindmargin, sometimes followed by a very obscure whitish dentate subterminal line; a blackish hindmarginal line. Hindwings moderate, hindmargin somewhat obtusely projecting in middle, crenulate; colour as in forewings; a curved obscure line before middle; a dark fuscous discal dot; a distinct hardly sinuate dark fuscous line beyond middle; an obscure darker subterminal shade; a blackish hindmarginal line.

Female.—12–14 mm. Wings exceedingly narrow, apex suddenly dilated, angles acute, hindmargin dentate; colour and markings as in male, but lines black and sharply marked.

Tolerably constant.

Christchurch and the plains near, from July to January. Mr. R. W. Fereday states that the male is found plentifully amongst *Leptospermum*, at rest on the bare ground, and the female on the stems; thirty-five specimens. I have corrected Walker's inadmissibly barbarous name.

29. ZYLOBARA, Butl.

Face with somewhat projecting scales. Palpi moderate, roughly scaled, porrected. Antennæ in male bipectinated (9–12). Forewings with vein 6 from below 9, 7 out of 9, 10 and 11 separate, 12 anastomosing shortly with 11. Hindwings normal; 1 *a* distinct.

73. *Zyl. fenerata*, Feld.

(*Rhyparia fenerata*, Feld., cxxxi., 7; *Zylobara fenerata*, Butl., Cist. Ent., ii., 498.)

Male.—33–35 mm. Forewings moderate, hindmargin unevenly rounded, crenulate; very pale whitish-grey, slightly ochreous-tinged, irrorated with dark fuscous; scattered dark fuscous marks indicating several fragmentary dentate lines and a discal spot; a double cloudy dark fuscous dentate subterminal line, distinct throughout; a row of large black dots on hindmargin. Hindwings oblong, inner margin extremely short, lower margin long, oblique, hindmargin short, rounded, crenulate, with a more prominent tooth near lower margin ; grey-whitish, hindmargin irrorated with grey.

Probably varies somewhat in the distinctness of the lines. The male is always recognizable by the peculiarly-shaped hindwings ; but I believe that the female will be found to have them of the ordinary form, and will be best distinguished from allied species by the strong dentation of the lines.

Palmerston (Wanganui), Makatoku (Hawke's Bay), and Christchurch, amongst forest, at rest on tree-trunks, in March ; seven specimens.

74. *Zyl. productata*, Walk.

(*Larentia productata*, Walk., 1197; (?) *Selidosema pungata*, Feld., cxxxi., 23 ; *Selidosema* (?) *fragosata*, Feld., cxxxi., 29.)

Male.—33–34 mm. Forewings moderate, hindmargin rounded ; whitish, more or less irrorated with fuscous and dark fuscous, sometimes forming numerous fine short strigulæ ; a narrow curved cloudy dark fuscous fascia a little before median band ; the dark fuscous irroration forms a broad median band, sometimes wholly suffused with dark fuscous, margined by whitish lines, anterior edge concave, posterior edge shortly dentate and more or less angulated above middle ; in one specimen this band is reduced to a large costal spot ; a dentate white subterminal line, preceded by an incomplete row of cloudy dark fuscous spots ; a suffused oblique dark fuscous subapical spot ; a row of black dots on hindmargin. Hindwings moderate, hindmargin rounded ; pale ochreous-yellow, darker posteriorly, towards base irrorated with grey ; a grey discal spot.

Varies very much in the distribution of the dark fuscous colouring ; the female will probably have whitish hindwings.

Wellington and Dunedin, in January ; eleven specimens.

30. Pseudocoremia, Butl.

Face smooth. Palpi rather short, roughly scaled, porrected. Antennæ in male bipectinated (5–9). Forewings with 6 from below 9, 7 from below angle of areole, 10 shortly touching 9, 11 separate, 12 free, 1*a* running into 1. Hindwings normal ; 1*a* distinct.

Closely allied to the preceding genus.

75. *Pseud. lupinata*, Feld.

(*Cidaria lupinata*, Feld., cxxxi., 19 ; *Pseudocoremia lupinata*, Butl., Cist. Ent., ii., 496 ; *Pseudocoremia suavis*, Butl., Cist. Ent., ii., 497 ; *Pachycnemia usitata*, Butl., Cist. Ent., ii., 501.)

Male, female.—29–35 mm. Forewings moderate, hindmargin rounded ; grey-whitish, often partially suffused with pale fuscous, irrorated with dark fuscous ; two parallel curved dark fuscous lines towards base ; a sinuate dark fuscous line somewhat before middle, sometimes broadly dilated with blackish on lower half or throughout; generally a small transverse discal spot; two parallel strongly sinuate dark fuscous lines somewhat beyond middle, upper half concave anteriorly, lower half concave posteriorly; two parallel dentate dark fuscous subterminal lines, sometimes blotched with blackish above middle and on inner margin; sometimes all these lines obsolete, and often a cloudy dark fuscous longitudinal streak near and parallel to inner margin; a row of black dots on hindmargin. Hindwings moderate, hindmargin rounded; in male pale whitish-ochreous-yellow, in female whitish, posteriorly more or less irrorated with grey.

Excessively variable; but the postmedian lines (when visible) have always the same characteristic form, different from any of the allied species. The posterior tibiæ of male are furnished with a long pencil of hairs.

Christchurch, Akaroa, Mount Hutt, Dunedin, amongst bush, often at rest on tree-trunks, in January and June; fifty-four specimens.

76. *Pseud. melinata*, Feld.

(*Numeria melinata*, Feld., cxxix., 9; *Pseudocoremia indistincta*, Butl., Proc. Zool. Soc. Lond., 1877, 394, pl. xliii., 8.)

Male, female.—26–34 mm. Forewings moderate, hindmargin rounded; in male white, in female whitish-grey, irrorated with blackish, and often dark olive-green; markings strong, blackish, generally suffused with dull olive-green; two irregular dentate curved or angulated parallel lines towards base; a sinuate line before middle, very variable in strength and intensity; two dentate sinuate parallel lines somewhat beyond middle, second sometimes obsolete; two dentate parallel subterminal lines, first much more strongly marked; a hindmarginal row of black dots. Hindwings moderate, hindmargin rounded; in male whitish-ochreous, in female light brownish-ochreous; often partially or wholly irrorated with grey; base or hindmargin sometimes suffused with grey; generally a grey discal dot, subterminal line, and hindmarginal row of dots.

Very variable; the dull greenish tinge, however, is very characteristic.

Wanganui, Wellington, Christchurch, Castle Hill (2,600 feet), Arthur's Pass, (3,000 feet), and Dunedin, probably everywhere, amongst bush, from January to March; fifty-one specimens.

31. BOARMIA, Tr.

Face with somewhat projecting scales. Palpi rather short, somewhat arched, roughly scaled. Antennæ in male bipectinated (2–3). Forewings with vein 6 from below 9, 7 from below angle of areole, 10 out of 9 above origin, anastomosing again very shortly with 9, 11 anastomosing shortly with 10, 12 anastomosing shortly with 11. Hindwings normal.

An extensive genus, of world-wide distribution.

77. *Boarm. dejectaria*, Walk.

(*Boarmia dejectaria*, Walk., 394; *Boarmia attracta*, Walk., 394; *Boarmia exprompta*, Walk, 395; *Tephrosia patularia*, Walk., 422, Butl. Cat., pl. iii., 8; *Tephrosia scriptaria*, Walk., 422; *Scotosia erebinata*, Walk., 1358; *Scotosia stigmaticata*, Walk., 1359; *Scotosia lignosata*, Walk., 1361; *Gnophos pannularia*, Gn., E.M.M., v., 42; *Scotopteryx maoriata*, Feld., cxxvi., 4; *Hemerophila* (?) *sulpitiata*, Feld., cxxvi., 7; *Hemerophila caprimulgata*, Feld., cxxvi., 12.

Male, female.—31–54 mm. Forewings moderate, hindmargin varying from crenate to strongly dentate; ochreous-fuscous, irregularly mixed and more or less suffused with dark fuscous, tending to form small fine strigulæ; a curved dentate dark fuscous line at $\frac{1}{3}$; a small dark fuscous discal spot, sometimes centred with pale bluish-grey, sometimes forming an ocellated ring; an obscure darker irregular median shade; a curved dentate dark fuscous line beyond middle, more oblique than hindmargin; a very obscurely darker dentate subterminal line; often a small snow-white spot before middle of hindmargin. Hindwings moderate, hindmargin varying from crenate to strongly dentate; colour and lines as in forewings.

Exceedingly variable; the variation in form of wing is curious.

Taranaki, Makatoku (Hawke's Bay), Wellington, Christchurch, Dunedin, amongst forest, from November to March; thirty-seven specimens.

32. Barsine, n.g.

Head tufted between antennæ, face with a slight cone of scales. Palpi moderate, densely scaled, porrected. Antennæ in male bipectinated (5–6). Forewings with vein 6 from below 9, 7 out of 9, 10 and 11 separate, 12 free. Hindwings normal.

78. *Bars. panagrata*, Walk.

(*Scotosia panagrata*, Walk., 1360; *Angerona menanaria*, Walk., 1500; *Epirrhanthis (?) antipodaria*, Feld., cxxvi., 3; *Hyperythra desiccata*, Butl., Cist. Ent., ii., 495; *Hyperythra arenacea*, Butl., Cist. Ent., ii., 495.)

Male, female.—33–44 mm. Forewings moderate, hindmargin rounded, crenate, apex faintly projecting; ochreous-fuscous, more or less mixed or suffused with dark fuscous; a dark fuscous curved dentate line at $\frac{1}{3}$; a small transverse whitish ochreous or sometimes white discal spot, suffusedly margined with dark fuscous; a very obscure darker twice sinuate median shade; a dark fuscous dentate line at $\frac{2}{3}$, curved outwards above middle; before the first line and beyond the second are often whitish-ochreous bands, tending to form several spots; an obscure dark fuscous dentate subterminal line. Hindwings moderate, hindmargin rounded, crenate; colour and markings as in forewings, but first and subterminal lines obsolete.

Very variable.

Masterton, Christchurch, and Akaroa, from March to May, amongst bush; twenty-three specimens.

33. DETUNDA, Walk.

Face roughly haired. Palpi moderate, second joint ascending, densely rough-haired beneath, terminal joint slender, clavate, porrected. Antennæ in male bipectinated (4–5), in female also shortly bipectinated (1½). Forewings with rough scales. Forewings with vein 6 from a point with or out of 9, 7 from below angle of areole, 10 from areole or out of 9, anastomosing shortly with 9, 11 separate, 12 free. Hindwings normal, 3 and 4 separate. Femora densely hairy beneath.

This and the two following genera are sometimes mistaken for *Noctuæ*; the neuration shows that there is no real connection. The peculiar palpi are also noteworthy, being alike in all three genera. *D. egregia* has vein 6 of the forewings rising out of 9, 10 also out of 9, and veins 6 and 7 of the hindwings extremely closely approximated at base; in *D. atronivea* these points do not occur.

79. *Det. atronivea*, Walk.

(*Detunda atronivea*, Walk., Suppl., ii., 619; *Chlenias* (?) *manxifera*, Fereday, Trans. N.Z. Inst., xii. (1879), 268, pl. ix., 1.)

Male, female.—43–52 mm. Forewings elongate-triangular, costa almost straight, slightly sinuate, hindmargin rounded, crenate; white; costa marked with small quadrate black spots, inner margin with irregular transverse black marks, hindmargin with elongate semi-oval black spots; a black basal spot beneath costa, with a strong posterior projection, and a shorter one beneath; a brown black-margined fascia near base, twice strongly angulated; an irregular black fascia from before middle of costa to beyond middle of inner margin, interrupted above middle; an irregular brown black-margined fascia from middle of costa to anal angle, anterior edge with irregular projections above and below middle, posterior edge emitting an irregular branch to costa before apex, black margin strong and partially broken beneath into disconnected spots. Hindwings moderate, hindmargin rounded, crenate; grey, darker posteriorly; a faint darker median shade; a fine well-marked irregular dark grey line towards hindmargin, with a sharply angulated median projection.

A most striking and conspicuous species; the markings vary somewhat in detail.

Wellington and Napier; five specimens received by Mr. Fereday from correspondents.

80. *Det. egregia*, Feld.

(*Chlenias egregia*, Feld., cxxxi., 24; Fereday, Trans. N.Z. Inst., xii., 268, pl. ix., 2.)

Male, female.—43–47 mm. Forewings elongate-triangular, costa almost straight, slightly sinuate, apex somewhat projecting, hindmargin otherwise rounded, crenate; white; inner and hindmargins somewhat suffused with grey, tending to form transverse strigulæ; costa very shortly spotted with fuscous; a blackish spot at base beneath costa, with a very strong posterior projection, and a shorter one beneath; a brown fascia near base, parallel to hindmargin, posteriorly black-margined, anterior edge straight, posterior edge twice sinuate-concave; a small blackish mark on inner margin beyond middle; an irregular brown partially black-margined fascia from costa before middle to anal angle, anterior edge with a short median projection ending in a transverse blackish mark, posterior edge emitting from middle an irregular moderately broad branch to costa before apex. Hindwings moderate, hindmargin rounded, crenate; grey, paler towards base; three faint discal dots and a sinuate line beyond middle indistinctly darker.

Appears to vary very little.

From the *female* of a pair taken *in cop.* Mr. Fereday obtained eggs which hatched out in February, but the young larvæ refused all kinds of food-plants offered, and died. At this stage they were 10-legged, very slender, dark purplish-brown, almost black; spiracular creamy-white, wrinkled; head shining pale brown.

Christchurch, Akaroa, and the Otira Gorge, in November and January (Mr. R. W. Fereday); four specimens. Felder gives it from Australia; this certainly requires confirmation.

34. Declana, Walk.

Face rough. Palpi rather long, second ascending, roughly scaled, with long hairs beneath, terminal joint long, slender, clavate, porrected. Antennæ in male bipectinated ($2\frac{1}{2}$–5). Femora and under-side of thorax clothed with very dense long hairs. Forewings with rough scales. Forewings with vein 6 from below 9, 7 from angle of areole, 10 rising out of 9 and anastomosing again moderately with 9, 11 anastomosing moderately with 10, 12 free. Hindwings normal, veins 3 and 4 sometimes stalked.

D. floccosa has veins 3 and 4 of the hindwings stalked, *D. crassitibia* separate.

81. *Decl. floccosa*, Walk.

(*Declana floccosa*, Walk., xv., 1649; *Argua scabra*, Walk., xxviii., 448; *Chlenias verrucosa*, Feld., cxxxi., 22; *Declana feredayi*, Butl., Proc. Zool. Soc. Lond., 1877, 398, pl. xliii., 5; *Declana nigrosparsa*, Butl., Cist. Ent., ii., 500.)

Male, female.—34–38 mm. Forewings elongate, somewhat oblong, rather dilated posteriorly, hindmargin rounded, crenate; very pale whitish-grey; costa and inner margin marked with short direct blackish strigulæ; often numerous scattered dark fuscous or black strigulæ, especially below middle of disc; some of the raised scales beyond first and second lines and along dorsal vein are often ochreous-yellow; a slender dark fuscous often obscure line towards base, irregularly angulated above middle; a second similar line beyond middle, twice deeply sinuate; both these sometimes marked with dark fuscous or blackish blotches; a sinuate cloudy dark grey median shade, often obsolete; a similar shade from apex, parallel and near to second line. Hindwings moderate, hindmargin shortly dentate; whitish-grey; a cloudy fascia before middle, and a broad hindmarginal band often darker grey.

Very variable; normally coloured in imitation of lichens.

Christchurch, amongst bush and coming freely to sugar, in August, November, and from March to June (Mr. R. W. Fereday); thirty specimens.

82. *Decl. crassitibia*, Feld.

(*Amphitape crassitibia*, Feld., cix., 10 (♀).)

Male.—33–36 mm. Thorax with a strong crest curved forwards. Abdomen longer and stouter than in *D. floccosa*, sometimes largely developed, with large anal tuft. Forewings as in *D. floccosa*, but costa somewhat more sinuate; whitish or pale ochreous, often partially suffused with brownish, especially towards apex; costa with numerous fine oblique black strigulæ; a short blackish longitudinal mark from base; an irregularly curved double dark fuscous or blackish line towards base, and a similar twice inwards sinuate line at $\frac{2}{3}$; both these vary very much in shape, tending to be sharply angulated towards each other and even connected on submedian fold; second margined on upper half posteriorly by a fuscous suffusion, more blackish on costa, followed by a pale apical space; generally two rows of blackish marks towards hindmargin. Hindwings as in *D. floccosa*; white or pale whitish-ochreous, hindmargin slightly suffused with fuscous.

Female.—Forewings with apex more projecting; grey-whitish, very finely irrorated with dark grey; costal strigulæ as in male; other markings obsolete, or represented by a few blackish dots. Hindwings fuscous-grey, paler towards base.

Very variable, and the sexes are also very different; but the species may always be recognized by the fineness and obliquity of the costal strigulæ.

Blenheim and Dunedin, received by Mr. Fereday from Mr. Skellon and Captain Hutton; eight specimens.

35. ATOSSA, n. g.

Face roughly haired. Palpi moderate, second joint ascending, densely rough-haired beneath, terminal joint long, slender, clavate, porrected. Antennæ in male stout, dentate, minutely ciliated. Femora densely hairy beneath. Forewings with rough scales. Forewings with vein 6 from below 9, 7 from angle of areole, 10 anastomosing shortly with 9, 11 rising out of 10 before angle of areole, 12 free. Hindwings normal, veins 3 and 4 from a point.

Nearly allied to the preceding.

83. *At. niveata*, Butl.

(*Declana niveata*, Butl., Cist. Ent., ii., 500.)

Male.—30 mm. Forewings elongate-triangular, costa somewhat sinuate, hindmargin rounded, dentate; dull white, faintly irrorated with grey; costa marked with short indistinct dark grey direct strigulæ; an irregular line towards base, and another twice angulated about ⅔, obscurely indicated by dark grey scales; some scattered dark grey strigulæ before hindmargin. Hindwings moderate, hindmargin crenate, angularly projecting in middle; wholly white.

I took one fine specimen at rest on a tree-trunk near Dunedin, in February.

36. Phyllodoce, n. g.

Face shortly rough-haired. Palpi moderate, arched, ascending, shortly rough-scaled, terminal joint short. Antennæ in male rather stout, pubescent. Coxæ and femora densely rough-haired beneath. Forewings with vein 6 from below 9, 7 from below angle of areole, 10 shortly touching 9, 11 separate, 12 free. Hindwings normal.

84. *Phyll. nelsonaria*, Feld.

(*Gonodontis* (?) *nelsonaria*, Feld. cxxiii., 3; *Gonodontis felix*, Butl., Proc. Zool. Soc. Lond. 1877, 389, pl. xlii., 10.)

Male.—38–39 mm. Forewings moderate, apex rather projecting, hindmargin rather strongly angulated in middle, upper half appearing concave, somewhat crenulate; fuscous, reddish-fuscous or ochreous, tending to form short transverse darker and lighter strigulæ; some small irregular white marks on costal edge; an irregular curved and rather strongly dentate whitish line about ¼, posteriorly dark-margined; a small pale-centred dark fuscous or reddish-fuscous discal spot; a straight whitish line about ¾, anteriorly dark-margined. Hindwings moderate, hindmargin rounded, unevenly crenate; pale reddish-fuscous, more or less irrorated with grey; a small grey discal spot; a slightly curved grey line beyond middle.

Varies considerably in colour.

Nelson and Dunedin; four specimens.

37. Amastris, n. g.

Face smooth. Palpi short, rough-haired beneath, porrected. Antennæ in male stout, serrate, shortly ciliated (½). Forewings with vein 6 from below 9, 7 from below angle of areole, 10 rising out of 9 above origin, anastomosing again shortly with 9, 11 anastomosing shortly with 10, 12 anastomosing shortly with 11. Hindwings normal.

85. *Am. encausta*, n. sp.

Male, female.—29–33 mm. Forewings moderate, costa arched at base, apex almost acute, hindmargin obtusely projecting somewhat above middle, upper part slightly concave; varying from pale whitish-grey, slightly purplish-tinged, to light reddish-ochreous-brown, generally with numerous scattered fuscous or dark fuscous strigulæ, sometimes forming an irregular suffusion in disc and along hindmargin, and on an incomplete subterminal band; three short dark fuscous streaks from costa, first and third oblique, second less defined, direct; from third often a sinuate row of dark fuscous dots to inner margin. Hindwings moderate, hindmargin slightly crenulate; pale whitish-ochreous-yellow; sometimes a row of darker dots beyond middle.

Varies much in colour.

Makatoku (Hawke's Bay), Nelson, Christchurch, Otira Gorge (1,500 feet), Castle Hill (2,500 feet), and Mount Hutt, from January to March, amongst bush; thirty-one specimens.

It seems improbable that this common species should have escaped description. I suspect therefore it will be found among Walker's list, but as I have no authority for its identification I have been compelled to attach a name to it.

38. STRATOCLEIS, n. g.

Face with a slight cone of scales. Palpi rather long, porrected, roughly scaled. Antennæ in male stout, subdentate, minutely ciliated (¼). Forewings with vein 6 from below 9, 7 from below angle of areole, 10 very shortly touching 9, 11 free, 12 very shortly touching 11. Hindwings normal.

86. *Strat. gallaria*, Walk.

(*Selenia gallaria*, Walk., 185, Butl. Cat., pl. iii., 6, 7; *Euchlæna* (?) *palthidata*, Feld., cxxxii., 21, 22.)

Male.—26–27 mm. Forewings moderate, costa strongly arched towards base, apex acute, hindmargin shortly dentate below apex and above middle, thence straight, oblique; whitish-ochreous, slightly suffused with pale reddish-fuscous, and thinly sprinkled with blackish, basal and apical thirds sometimes wholly reddish-fuscous; a curved dark fuscous line at ⅓, strongest on costa, angulated above and below middle, preceded by a much fainter parallel line; an irregular curved fuscous median line, sometimes indistinct, darkest on costa, angulated below costa and indented inwards below middle; a minute black discal dot beyond middle; a nearly straight dark fuscous oblique line beyond middle, sometimes followed by a pale posteriorly dark-margined dentate line; two short cloudy irregular blackish lines from inner margin beyond this; a short upwardly oblique cloudy dark fuscous mark on hindmargin above middle. Hindwings moderate, hindmargin rounded; ground-colour as in forewings, posterior half sometimes reddish-fuscous; sometimes a faint irregular darker line before middle; a minute blackish discal dot; a straight dark fuscous line rather beyond middle, on inner margin followed by a cloudy dark fuscous spot.

Variable in colour and strength of marking.

Palmerston (Wanganui), Makatoku (Hawke's Bay), Christchurch, in February and March; eight specimens.

87. *Strat. streptophora*, n. sp.

Male, female.—32–34 mm. Forewings moderate, costa somewhat arched towards base, apex strongly projecting but hardly acute, hindmargin somewhat irregular, with a strong shortly bidentate projection in middle; pale whitish-ochreous-yellow, coarsely irrorated with ochreous-brown; four dark ochreous-fuscous lines; first towards base, irregular, shortly angulated near inner margin; second before middle, straight, rather broad; a black discal dot; third beyond middle, strongly curved, oblique; fourth subterminal, curved, followed by a row of crescentic white dark-margined spots. Hindwings moderate, hindmargin crenate, with two more prominent teeth in middle; ochreous-whitish, hindmargin more ochreous; some scattered grey and ochreous scales; a dark grey discal dot; a subterminal row of grey partially obsolete spots.

Probably varies much in colour and intensity of markings.

Otira Gorge (1,600 feet) and Dunedin, in January, amongst bush; four specimens.

39. Azelina, Gn.

Face with some projecting hairs. Palpi rather long, obliquely ascending, roughly scaled, attenuated. Antennæ in male thick, simple. Forewings with vein 6 from below 9, 7 from below angle of areole, 10 very shortly touching 9, 11 separate, 12 free. Hindwings normal.

A genus of some extent, specially characteristic of South America. Guenée made a separate genus (*Polygonia*) of the New Zealand species, but without any point of distinction.

88. *Azel. fortinata*, Gn.

(*Polygonia fortinata*, Gn., E.M.M., v., 41; *Caustoloma* (?) *ziczac*, Feld., cxxxii., 4.)

Male, female.—33–38 mm. Forewings moderate, costa sinuate, apex acute, projecting, hindmargin with a strong sharp tooth a little below apex, and a broader subdentate projection in middle; rather light reddish-fuscous; a dark reddish-fuscous curved line at $\frac{1}{3}$, emitting two strong sharp angulations posteriorly; a dark reddish-fuscous discal dot; a dark reddish-fuscous line beyond middle, shortly and obtusely angulated outwards above and below middle. Hindwings moderate, hindmargin with two short teeth beneath apex, and a strong bidentate projection in middle; colour as in forewings, but basal half much paler; a faint darker line near base; an irregular dark reddish-fuscous line slightly beyond middle, bounding the pale area.

Constant.

Nelson, Akaroa, and Mount Hutt, in January and February (Mr. R. W. Fereday); twelve specimens.

40. DREPANODES, Gn.

Face with cone of scales. Palpi moderate, triangularly scaled, porrected. Antennæ in male moderate, simple. Forewings with vein 6 from below 9, 7 from below angle of areole, 10 very shortly touching 9, 11 rising out of 10 before angle of areole, 12 free. Hindwings normal.

Also a characteristic South American genus. The single New Zealand species is very similar to some South American forms.

89. *Drep. muriferata*, Walk.

(*Gargaphia muriferata*, Walk., 1635; *Panagra ephyraria*, Walk., 1761; ? *Zanclognatha* (?) *cookaria*, Feld., cxxiii., 26; *Zanclognatha* (?) *haastiaria*, Feld., cxxiii., 32.)

Male, female.—30–34 mm. Forewings moderate, apex falcate, hindmargin bowed in middle; ochreous-brown; costa marked with short fine blackish strigulæ; some scattered black scales towards base and beyond line; a short oblique cloudy dark fuscous mark on costa at $\frac{1}{3}$, two white dots placed transversely in disc above middle, surrounded by a darker suffusion; a straight dark ochreous-fuscous line or row of dots from costa a little before apex to inner margin beyond middle; a cloudy dark grey curved shade from apex, becoming obsolete above middle. Hindwings moderate, hindmargin rounded; ochreous-brown; a white discal dot; a straight dark ochreous-fuscous median line.

Varies probably considerably in colour. The hindmargin of the forewings is represented in Felder's figure of *Z. cookaria* as distinctly angulated; I have seen no case of this.

Taranaki, Christchurch, Dunedin, amongst forest, in February and March; five specimens.

SICULINA.

SICULIDÆ.

Being only acquainted with one genus, I can give no enlarged characters for these higher groups. It will be sufficient to point out that the separation of vein 7 of the forewings from the stalk of 8 and 9, and the 16-legged larva, remove the genus from the *Geometrina*, whilst the separation of veins 7 and 8 of the hindwings distinguishes it no less clearly from the *Pyralidina*.

41. Siculodes, Gn.

Face densely scaled, subconical. Palpi short, porrected, densely scaled, terminal joint short. Antennæ in male rather stout, dentate, shortly ciliated ($\frac{1}{4}$). Forewings with 12 veins, 8 and 9 short-stalked, rest separate. Hindwings with 8 separate veins, 6 and 7 approximated towards base, 8 free, approaching 7 in middle.

Hitherto only known from South America, where it attains considerable development.

90. *Sic. subfasciata*, Walk.

(*Morova subfasciata*, Walk., Suppl., ii., 523; *Cacœcia gallicolens*, Butl., Cat., 46.)

Male, female.—24–27 mm. Forewings elongate-triangular, costa rather strongly sinuate, suddenly and strongly bent near apex, apex rectangular, hindmargin strongly sinuate; reddish-ochreous, often suffused with reddish-fuscous; reticulated throughout with reddish-fuscous or dark fuscous; three indistinct darker fasciæ, tending to become obsolete towards inner margin; first about $\frac{1}{3}$, curved; second beyond middle, dilated above, furcate on costa; third subterminal, slender, furcate on costa. Hindwings moderate, hindmargin sinuate so as to project broadly in middle; colour and reticulation as in forewings; an indistinct darker fascia near base, and a broader one in middle.

Variable in depth of colouring.

Larva 16-legged, living in gall-like swellings of the stem of *Parsonsia (Apocyneæ)*, according to Mr. Fereday; I have seen the empty galls said to be produced by this species. Pupa in the same position. An accurate description of this larva and its habits would be of much value.

Christchurch, Akaroa, and Dunedin, amongst bush, in January and February; ten specimens.

Appendix I.

The following have been described or figured as New Zealand species, and are not yet identified; probably most are synonyms of species previously described; a few seem to have been recorded in error; there may perhaps be two or three additional species among them. They are numbered consecutively with the others, for convenience of reference in the index.

91. *Ennomos ustaria*, Walk., 1519.

92. *Ischalis thermochromata*, Walk., 1750.

93. *Panagra hypenaria*, Gn., Butl. Cat., pl. iii., 10. This is a well-known Australian species, of which I have seen no New Zealand specimen; it is probably stated to occur by error.

94. *Panagra promelanaria*, Walk., 1666, Butl. Cat., pl. iii., 17. Probably another error; it appears to refer to a very common Australian species.

95. *Panagra venipunctata*, Walk., 1666. This should be identical with the preceding.

96. *Aspilates euboliaria*, Walk., 1684. Type said to be lost; I conjecture this is a synonym of *Ars. subochraria*, Dbld.

97. *Larentia subductata*, Walk., 1198.

98. *Larentia infusata*, Walk., 1199.

99. *Larentia lucidata*, Walk., 1200.

100. *Larentia* (?) *quadristrigata*, Walk., 1200; *Larentia interclusa*, Walk., 1202.

101. *Coremia robustaria*, Walk., 1320.

102. *Coremia plurimata*, Walk., 1321.

103. *Coremia* (?) *inductata*, Walk., 1322.

104. *Camptogramma correlata*, Walk., 1330, Butl. Cat., pl. iii., 15.

105. *Phibalapteryx suppressaria*, Walk., 1721.

106. *Scotosia denotata*, Walk., 1361; *Scotosia humerata*, Walk, 1362; *Phibalapteryx parvulata*, Walk., 1721.

107. *Scotosia subobscurata*, Walk., 1358.

108. *Scotosia subitata*, Walk., 1362.

109. *Cidaria* (?) *rudisata* (!), Walk., 1420.

110. *Chalastra pellurgata*, Walk., 1430.

111. *Cidaria ascotata*, Feld., cxxxi., 9.

112. *Cidaria adonata*, Feld., cxxxi., 31. Perhaps = *Larentia cinerearia*, Dbld.

113. *Microdes toriata*, Feld., cxxxi., 34. Appears to me to be a common Australian species, and is probably stated to occur by error.

114. *Cidaria semilineata*, Feld., cxxxi., 36. Perhaps = *Pasiphila bilineolata*, Walk.

115. *Larentia* (?) *falcata*, Butl., Cist. Ent., ii., 501.

116. *Coremia heliacaria*, Gn., x., 420. An Australian species, stated by Butler to occur, but probably on an erroneous identification.

117. *Melanthia arida*, Butl., Cist. Ent., ii., 505. The description appears unintelligible, and I conceive that some words have dropped out.

118. *Coremia casta*, Butl., Cist. Ent., ii., 553.

APPENDIX II.

Captain Hutton collected and published in the Transactions of the New Zealand Institute notices of the larvæ of several species of the *Geometrina*: it is however impossible to be sure that the species were correctly identified, and I have therefore thought it best to add these notes in the form of an appendix, referring them to the species to which they seem to belong; they will serve as aids to future discovery.

Pasiphila bilineolata, Walk. (A) Larva brown, rough, segments transversely wrinkled; 6th, 7th, and 8th segments with a pair of dorsal papillæ, those of 7th much largest. On *Clematis indivisa*; bred in April. (B) Larva black, smooth, with a more or less interrupted white lateral line; varies in colour, sometimes reddish; head brown. On *Veronica salicifolia*; bred in November.

Asthena schistaria, Walk. (A) Larva smooth, dull green; dorsal thin, white; subdorsal narrow, yellow; a white lateral band, more or less black-edged; head dark green. (B) Larva pale brown, longitudinally marked with darker; a curved black mark, convex backwards, on back over last pair of prolegs. On *Leptospermum ericoides*; bred in March.

Scotosia gobiata, Feld. (A) Larva shining, brown marbled with grey; a large tubercle on back, preceded by a small one. On *Leptospermum scoparium*; bred in March. (B) Larva brown; a single tubercle on segment in front of prolegs. On *Leptospermum ericoides;* bred in November and December.

Epyaxa rosearia, Dbld. Larva smooth, green or yellowish-green; a few scattered yellow hairs; segmental divisions yellow. On *Rumex* and *Sonchus;* bred in March.

Hybernia indocilis, Walk. Larva grey, marbled with brown; a few black hairs; dorsal spots white, black-margined. Bred in April.

Pseudocoremia lupinata, Feld. Larva olivaceous brown; second (?) segment greenish; a few long black hairs; a large dorsal papilla on 8th segment. Bred in May.

Barsine panagrata, Walk. Larva light green, sometimes marbled with light pink; spiracular white, shaded with red above; spiracles bright orange; a pair of brown spots on each segment. On *Aristotelia.*

Declana floccosa, Walk. Larva 12-legged; skin wrinkled, with a row of pectinated tufts on each side; a few black hairs; brown, reticulated with yellowish, or variegated with green and brownish-purple; spiracles yellow, black-margined; a pair of small tubercles on 12th segment (? 13th). On *Aristotelia* and *Ulex:* bred in July.

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Art. III.—*Notes on a Native Species of* Mantis. By T. H. Potts. With a descriptive Note by Professor Hutton.

[Read before the Philosophical Institute of Canterbury, 7th January, 1883.]

This insect has been observed in several localities during the last three years. It appears to be widely distributed in this island. We first heard of it as having been taken in a garden at Riccarton, a short distance from Christchurch. Soon afterwards, through the kindness of Mr. Nalder, specimens were obtained at Akaroa. It has been found at Amberley, forty miles north of Christchurch. Walter Potts, in the month of April last, discovered it on some flowers in a garden so far south as Clyde, which lies inland in the Otago Lake District, and plentifully in and about Cromwell.

The young emerge in the spring months in numbers; from a single egg-case perhaps as many as twenty or more may appear. We have known them make their way out early in September, at intervals throughout that month and part of the next till the 24th October. At first they are of a pale pea-green or pale green on the limbs and under-parts, above brown or purplish-black, with the eyes very prominent, and a bluish spot on the anterior limbs. The bright green larvæ sometimes appear crowded together when forcing their way through the lids of the egg-cases. At this time they measure some 5 or 6 lines in length. As soon as they have quitted their prison-homes they exhibit great activity in their movements, swiftly coursing hither and thither; perhaps at no other period of their existence do they display so much restlessness.

The body is usually so carried that the lower part of the abdomen just clears the ground; only the two lower pairs of limbs are generally required for locomotion, the anterior pair are kept folded. It may be noticed that the posterior pair of limbs are most robust, and longer than the middle pair. The insect in its larval state not only runs with great swiftness, but it can leap several inches at a bound, a feat that is rarely performed. In running the body is kept nearly upright. At the same time that we note the energy of its movements, it must not be omitted that there are seasons in which it displays an almost inexhaustible power of "masterly inactivity." These times of quiet, when it remains so long motionless, or nearly so, may be a part of its tactics for securing the presence of victims within reach of its fatal arms. The most difficult feat it is seen to perform is the recovery of its proper position when lying on its back on a plane surface, often for a long time it kicks and struggles in a very helpless manner. The feet are adapted for travelling over a polished surface, such as glass presents; the figure can be easily depressed so as to appear nearly flat. The anterior limbs, only occasionally used as legs, are kept carefully cleaned, particular attention is paid to the blade-like teeth with which these limbs are armed.

When about making an attack it approaches its intended prey near enough to secure it with a dash, its movements are sometimes slow, deliberate. It stands with its anterior limbs folded with an innocent rather than a menacing air, now and then raising itself or lifting the prothorax in a stealthy, quiet manner, as if to judge accurately of its distance; or the head is turned as the victim moves, and with one swift dart the insect is secured. In considering the manner of the manipulation of its food, it must be remembered that it only consumes living insects; it displays remarkable coolness and positive indifference to the sufferings of its prey. Let us suppose it has caught a house-fly; this is held securely on the teeth of one of the anterior limbs, both arms are used and brought to the long tearing or cutting mandibles; it commences the feast usually by taking off some morsels from the head, the fly struggling, kicking or vibrating its wings; various parts are deliberately severed notwithstanding these strong protests on the part of the fly; some of the parts so cut off are rejected, notably wings and legs, other portions of the wretched fly are cut off into edible morsels. During the progress of the meal, the posterior pair of limbs are held rather wide apart and securely planted to resist the efforts of the struggling fly. The *Mantis* holds on steadily as it feeds, employing both forearms, deliberately plucking its prey away from the mandibles by a downward and forward action; whilst masticating a portion taken off, the anterior limbs are held extended a short distance from the mouth till it is ready for a fresh bite, when the tearing process is repeated. It discloses something of the fastidiousness of the gourmêt in selecting only certain parts of the fly for consumption, much of the carcase being neglected and cast away; occasionally it has considerable difficulty in ridding the teeth of these remains; sometimes these are cast off with a single shake of the limbs, or several attempts are required to effect this; so powerful are the efforts at times that the insect itself recoils bodily. Whilst eating, the fine hair-like antennæ are kept nearly upright, or they are slightly moved forwards and back again to an almost vertical position; the mandibles project from over the mouth; the head is moved and turned freely. In drinking, which is seldom indulged in, the body is bent so that its form is slightly curved.

It is quite possible that so much of the body of the fly is rejected because it has ceased to exist under the tearing of the mandibles; we have never seen the *Mantis* attempt to feed on a dead insect; it may be its special function to exist on living food. The posterior limbs are employed not only to assist in supporting the body, they act also as feelers to ascertain the security of a foothold or to clasp firmly a leaf or spray and thus enable the insect to hang downwards whilst the forearms are folded ready for action.

It will attack any small moving thing that it is likely to be able to hold, such as flies, moths, spiders, etc., we have often seen it with a fly in the teeth of each anterior limb; young of its own kind are devoured as readily as any other food. Its appetite is at times voracious, as we have seen it kill and devour parts of fourteen small flies within a very brief space of time; it can pick a small spider from off its web with singular dexterity. With all its cruelty or ferocity it is timid, retiring from the contact of anything that touches it suddenly; often it retreats before the boisterous blue-bottle-fly. The house-fly is a favourite prey; in pursuit it steadily traverses the smooth surface of window-panes, the structure of the feet allowing it to pass over the lower surface of glass at almost any angle. We have kept many of these insects in a room where they seldom left the windows during the daytime, getting their own food in ample supply. It is worth noticing that flies often approach this terrible enemy as though heedless of its presence, or in some way fascinated by its appearance. When climbing an upright branch the ascent is made in a spiral direction, sometimes all the limbs are used in climbing; should a couple meet suddenly, they at times spar at each other, but as far as we have observed these hostile movements have been unattended by the infliction of any damage.

At the time of its periodical moults it is dull and listless, not caring for food. The casting of the skin, which takes place at intervals during the larval state, is accomplished by throwing itself on the back, when with numberless struggles it wriggles out of its old covering. Gradually the figure of the insect widens and the rudiments of the future wing-processes are developed, these make marked progress after each moult. The cast coverings are discarded in one piece generally, showing the form of the antennæ, of the claws, of the teeth of anterior limbs, etc.

The sexes may be distinguished by a slight difference of form, that of the male is the more slender, the antennæ are more produced; in the perfect insect the wings of the female are not so long in proportion to the rest of the body as those of the male. The perfect insect exhibits also some difference of colouration, the bright light green gives place to a duller tone, the edges of the keeled sides of the prothorax assume a dull amethystine tint, a deeper tinge of a similar hue stains the limbs in various parts, the teeth of the forearms being thus coloured; the blue spot around the auditory organs is very noticeable.

It is particular in cleaning and dressing the head; the action of the fore-limb as used for this purpose, at once reminds one of the manner in which a cat passes its paw over ears and eyes.

The perfect insect does not, except on occasions, walk so nearly erect as in the larval state; it seldom uses its wings or only for a brief flight, we have but rarely seen it make a flying dart at its prey. Its colour harmonizes so well with many kinds of leaves, that it is difficult to distinguish the insect when lodged thereon, this kind of protection has probably caused it to be frequently overlooked. We believe it to be affected by atmospheric changes; when a low temperature prevails it is dull and sluggish; hence the locality of Clyde has been particularly mentioned, as there a considerable range of temperature is experienced.

The reproductive habits seem to offer some peculiar features, which removes it from those of many other forms of insect life, these are therefore given in detail as facts of interest. At or near breeding time the male is restless, the female is ready for pairing in about ten days after assuming her perfect form, and usually receives the male without any previous demonstrations of courtship on the part of her mate, further than a somewhat close companionship; sometimes, yet rarely, the male chases and leaps on the female. The time of congress is prolonged and varies in duration, it frequently occupies from two to four hours; the operation is repeated from day to day; a pair kept secluded in an ample enclosure were observed to be in congress daily from the 11th of January to the 18th, both days inclusive, again on the 20th, on this date separating at 7 p.m.; they were again united at 9 p.m., remaining in that state till 1.30 a.m. on the 21st.

During their union, both insects keep the anterior limbs folded, the male having often all his limbs clear of the ground, yet so bent as to enable him to cling securely to the female, or sometimes partly supported by the base and part of the outer edge of a portion of one of the wings. The wings of the female remain closed; access is sometimes obtained rather sideways, in which case the wings are partly thrust aside. During the operation, in the female a series of brown-coloured stigmata are freely displayed and become apparently inflated or depressed as the female raises or depresses part of her body.

After the abdomen of the female becomes distended, for some days she appears dull and drowsy, with appetite less keen; when about ten days have elapsed, she makes that curious egg-mass, from which the young in due course come forth. The formation of the egg-mass is a very interesting sight, all her limbs are employed in sustaining her during the proceeding; a quick lateral motion of the lower part of the body accompanies the deposit of the bright glittering material which, as it dries, sticks fast to the article on which it is placed. When first extruded, the matter shines or glistens like very minute bright bubbles or granules; it is smoothed and shaped by the distended orifice, whilst the ovipositors are trained over the centre of the top of the mass. The egg-masses measure from ½ inch to more than 1 inch in length, formed of a series of inclined horny cells, with a sloping membranous lid, the spaces between the lids filled with a soft white froth-like substance, the whole series of cells being fastened together on each side by a strong layer of chitine. Each cell is ·05 or ·06 inch in breadth.

After this great labour is completed, the female remains for some hours still as though thoroughly exhausted, her attenuated form shows to what an extent her bulk has been drawn upon to furnish material for the egg-cases. In a short time her vigour and appetite return, and she is again eagerly catching here living prey. After the lapse of a few days, her form again becomes distended, and she is ready for the formation of a fresh egg-mass.

Five or six of these masses are usually made by one female of one pair under observation. The first egg-case was finished on 16th January, at 5 a.m.; a second one was made on the 25th of the same month, at 11.45 p.m. These structures soon lose their brilliancy, and become of a dull whitish colour, which gradually darkens to brown. They are often placed in an irregular group. The female visits them and stands over them at times. In a warm room the young leave the egg-case in about fifty days after the eggs are deposited.

Note by Professor Hutton.

Specimens of the insect, whose habits are here described, were sent by me several years ago to Mr. Wood Mason, but I do not know if it has as yet received a name. The following diagnosis will be sufficient for recognition:—

Animal green; the anterior coxæ and costal vein of the wings yellowish: a bright blue spot on the anterior femora around the auditory organ. Head smooth, wider than the thorax. Prothorax keeled, with a groove on the keel anterior to the suture; rough. Wings of uniform texture. Anterior limbs with the coxæ finely denticulated on each side: lower margin of the femora with 15 teeth, alternately larger and smaller, on the inside, five longer ones on the outside, and four in the median line near the auditory organ, one of which is larger. Tibia with 12 teeth on the inside and 11 smaller ones on the outside, increasing in length distally; the apical tooth very long and curved.

Male.—Length, 1·15; of pronotum, ·37; of elytra, 1·01 inch.

Female.—Length, 1·2; of pronotum, ·32; of elytra, 1·10 inch.

ART. IV.—*Description of a new Species of* Cidaria (Lepidoptera).

By R. W. FEREDAY, M.E.S.L.

[*Read before the Philosophical Institute of Canterbury, 2nd August,* 1883.]

Cidaria purpurifera, n. sp.

Male.—Primaries above with a very broad central belt, having a broad projection extending to near the subterminal line between the first and third median nervules; the outer margin of the projection in the form of a bracket }; central area of the belt traversed by a broad pale purplish band, edged on each side by a thin and very irregular sinuated and indented dark chocolate-brown line; on each side of the purplish band, and occupying the spaces between it and the inner and outer margin of the central belt, is a narrow band of olive-green mottled with dark chocolate-brown, the part within the projected portion of the central belt being entirely filled up with dark chocolate-brown; the outer and inner margin of the central belt irregularly sinuous and indented, and edged with a thin line of dark chocolate-brown; subterminal line white and crenate, and having blotches of dark chocolate-brown between some of its angles; the space between the central belt and the subterminal line olive-green next the central belt, with a very conspicuous suffused white line, broadest between the costa and the projection of the central belt; external border olive-green, suffused near the apex with dark chocolate-brown; a marginal line of dark chocolate-brown lunular spots, edged with white; basal patch olive-green suffused with brown at its outer margin which has angles and indentations similar to those of the inner margin of the central belt; space between basal patch and central belt paler olive-green, suffused with white on its outer margin; an apical costal patch of pale olive-green diminishing from the subterminal line to a point at the apex, and suffused externally with white; central spot absent; cilia chequered with dark chocolate-brown and whitish. Primaries below with a band of three dusky sinuous and dentated parallel lines beyond the middle, the lines dark and distinct on the costa, but fading towards the inner margin of the wing; the space between the outer of the three lines and the base, pale brown; the space beyond the outer line similar to the upper side but paler, and having pale brown in the place of the olive-green; basal half of costa irrorated with dark chocolate-brown; marginal line of lunular spots and chequered fringe as on upper side; a distinct discocellular spot formed by a short transverse streak; in some specimens the markings are much more indistinct and in some almost obliterated.

Secondaries above tawny-ochreous, with three very indistinct transverse sinuous and dentated parallel lines a little before the middle of the wing; outer margin edged with a very thin line of darker ochreous; cilia not chequered, basal half tawny-ochreous, exterior whitish. Secondaries below very pale whitish-brown; basal half irrorated with dark chocolate-brown, and the three transverse lines, and a short abbreviated line, near the anal angle, formed by condensation of such irroration; a very thin lunular marginal dusky line; cilia pale with indistinct dusky chequers.

Thorax, olive-green. *Abdomen*, tawny-ochreous, with anal tuft, and tufted along the sides. *Palpi*, connivent, in form of a beak. *Antennæ* finely serrated.

Length of body, 4‴; Expanse of wings, 11‴—1″ 1‴.

Female.—Appears to differ from the male only in size, form of antennæ, and absence of abdominal tufts. *Antennæ* simple, scarcely pubescent.

Length of body, 4½‴. Expanse of wings, 1″ 1‴—1″ 2‴.

Hab. New Zealand, plentiful in bushy gullies between the eastern spurs of Mount Hutt, Canterbury.

This species is readily distinguished by the purplish belt, brilliant white lines, and bright olive-green of the primaries. In all but colour it much resembles *Cidaria rixata*, Feld. (*Coremia squalida*, Butl.), but is at once distinguishable therefrom by the outer margin of the dark central belt being very deeply indented along the lower branch of the median nervure. *C. rixata* is found in abundance under overhanging banks of river-beds, in bushy gullies where the water has excavated holes and hollows beneath the roots of trees. Poking under these banks with a stick brings them out in numbers, when they fly a little way, and settle again, always in a similar place. *C. purpurifera*, though found in the same locality, does not take to the excavations, but is found by beating the bush and herbage on the banks above; I have taken it in December and January, but not having been to the locality at any other time, cannot say if it is out in any other month.

Art V.—*Further Notes on* Coccidæ *in New Zealand, with Descriptions of new Species.* By W. M. Maskell, F.R.M.S.

[Read before the Philosophical Institute of Canterbury, 4th October, 1883.]

Plates I. and II.

1st Group.—DIASPIDÆ.

Genus, **Aspidiotus**, Bouché.

1. *Aspidiotus aurantii*, mihi.

(Trans., vol. xi., p. 199: vol. xiv., p. 217.)

This must be abandoned as a species. From a communication from M. Signoret, I find that it is identical with *A. coccineus*, Gennadius. A description of this last is to be found, I believe, in a Report to the Minister of Agriculture in Greece. Mr. Comstock, who adopted my name for the insect, in his Report on the Coccidæ of the United States, seems to have been equally unaware with myself of the description of Gennadius. I have always thought that this insect must have been originally introduced from Europe.

2. *Aspidiotus sophoræ*, sp. nov.

Fig. 1.

The puparium is normal in shape, flat and nearly circular, of a bluish-grey tint; diameter about $\frac{1}{24}$ inch.

The female resembles generally *A. nerii* or any other of the genus, having a peg-top shape, the abdominal segments shrinking up into the thoracic portion after gestation. There are five groups of spinnerets, of which the upper group has four orifices, the remainder seven or eight. In some specimens only four groups are to be made out. The edge of the abdomen ends in two conspicuous median lobes, and at each side for a little distance are a number of scaly serrated hairs resembling those of *A. nerii.*

From *Sophora tetraptera.*

Only a few species of *Aspidiotus* are reported as having five groups of spinnerets, the normal number being four, and some having no groups. The present insect seems to resemble generally *A. oxyacanthæ* or *A. tiliæ*, Signoret; but differs in the arrangement of the hairs on the edge of the abdomen.

Genus **Poliaspis**, mihi.

(Trans., vol. xii., p. 293.)

Mr. Comstock, in a monograph of the Diaspidæ (Second Rep. of the Dep. of Entomology of the Cornell University Experiment Station, 1883, p. 126), which he has kindly sent me, adopts this genus, and describes a new American species of it; but remarks that he is "far from feeling sure that the genus will prove to be a natural one." I would urge that it has at least as good a claim as the kindred genus *Leucaspis*, which Mr. Comstock admits without remark. Dr. Signoret, in a letter to me, says of my genus *Poliaspis*—"I think this genus is distinct.

Genus **Mytilaspis**, Targioni-Tozzetti.

(Trans., vol. xi., p. 192.)

1. *Mytilaspis pyriformis*, mihi.

(Trans., vol. xi., p. 192: vol. xiv., p. 215.)

Mr. Comstock (loc. cit., p. 125) asks whether this insect is really a *Mytilaspis*, and seems inclined to refer it rather to *Chionaspis*. I find that in my former papers I have omitted to observe that the male puparium is not greatly different from that of the female, though from my placing it under *Mytilaspis* I inferred this. The male puparium of *Chionaspis* is quite different.

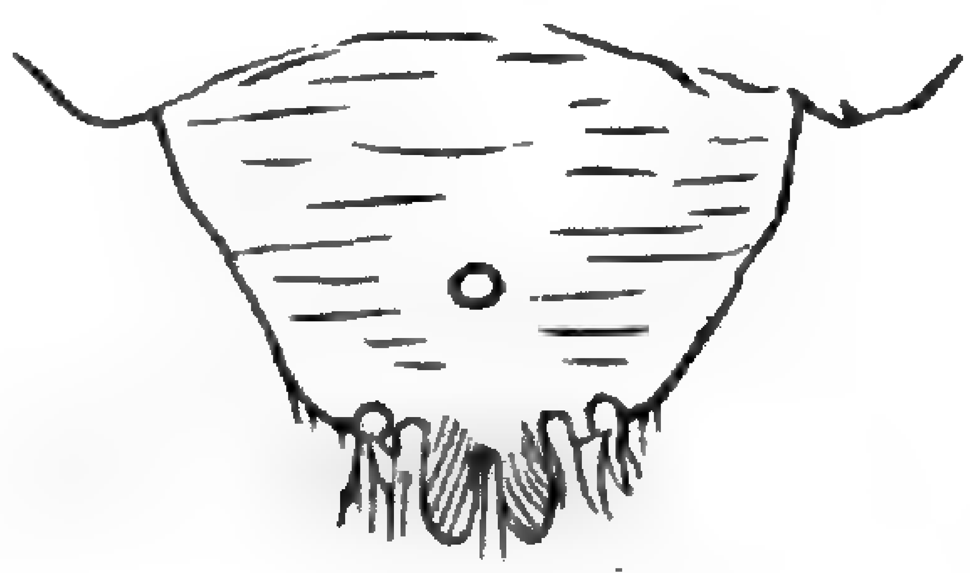
Genus, **Diaspis**, Costa.

(Trans., vol. xi., p. 192.)

1. *Diaspis santali*, sp. nov.

Puparium of female yellowish-grey in colour, sometimes with a greenish tinge, outline oval; very convex: pellicles black, very inconspicuous, placed at one end of the puparium.

Adult female orange-red in colour, reaching $\frac{1}{15}$ inch in length, peg-top shaped; the abdominal segment very small as compared with the rest of the body, and the two next segments slightly overlap it. Abdomen ending in two conspicuous, prominent, median lobes, and at each side of them two semicircular depressions: several branched and serrated hairs in the region of these lobes. There are no groups of spinnerets, nor can I detect any single ones.



There is no wide depression of the edge between the median lobes.

Male puparium elongated, with black pellicle: but I have not seen the insect itself.

On twigs of Maire (*Santalum cunninghamii*), sent me by C. Winkelmann, Esq., from Napier. It is in company with *Rhizococcus fossor*, described below: but the latter is always on the leaves of the plant.

The forms of the male and female puparia show this insect to be a *Diaspis*, though it seems in many respects to resemble rather *Aspidiotus*. I find no described species of the genus possessing the same features in the abdominal segment, especially the absence of spinneret groups. Nor do I think it is a *Chionaspis*.

Genus, **Fiorinia**, Targioni-Tozzetti.

Mr. Comstock (loc. cit., p. 110), discards the above name and calls the genus "*Uhleria*," for the reason, he says, that Targioni, establishing it to include the original species *Diaspis fioriniæ*, changed the specific name to *pellucida*. "According to the rules of nomenclature now generally adopted by zoologists," he says "the original specific name must be restored and a new generic name given." I think this is a great pity if correct, and tends to introduce endless confusion, and prefer to leave the original name as above.

The characteristic feature of this genus is the great size of the female pellicle of the second stage, which almost, or quite, fills the puparium.

1. *Fiorinia minima*, sp. nov.

Figs. 2, 3.

The puparium is oval, being indeed almost altogether made up of the second pellicle, with a narrow edge of fibrous secretion, as shown in the diagram (fig. 3). The first pellicle is comparatively large, and the exuviæ of antennæ are visible on it. These pellicles are, as usual in the Diaspidæ, yellow: the fibrous portion white and very thin. Length of puparium $\frac{1}{36}$ inch nearly.

Adult female of the general form of *Mytilaspis*. The abdominal segment (fig. 2) is somewhat long, the edge broken by a number of deepish curvilinear serrations, and ending in two inconspicuous median lobes, with three others much smaller on each side. From the serrations spring some hairs. There are five groups of spinnerets, but the three upper ones, almost or quite conjoined, form a nearly continuous arch containing 40 to 50 orifices: the two lower groups have 15 to 20. There are several single spinnerets. The adult insect before gestation nearly fills the space covered by the second pellicle: after gestation it shrinks up into very small compass at the cephalic end of the puparium: colour pink.

I have not seen the male insect, but the male puparium is rather longer than that of the female, much narrower, and carinated above.

From *Brachyglottis repanda* and *Panax arboreum*, but the insect seems to be uncommon.

This insect differs from the European *F. pellucida* in its extremely minute size, in the serrations of the abdomen and the number of its hairs, and in the absence of two tubercles seen in the European species between the antennæ of the young insect.

2. *Fiorinia grossulariæ*, sp. nov. ?

Fig. 4.

Puparium irregularly oval, being formed chiefly by the second pellicle, with a narrow edge of fibrous secretion. Length about $\frac{1}{20}$ inch. Pellicles dark yellow.

Adult female (fig. 4) of general form of *Mytilaspis*, but the cephalic end is slightly prolonged into a compressed cylinder. Lateral corrugations five, each bearing at the edge three sharp spines. The edge of the abdominal segment is much broken by serrations and ends in two broadish median lobes with two smaller lobes on each side. Several sharp, long spines are set in pairs along the serrated edge. Groups of spinnerets normal, the three upper forming a continuous arch. Colour of insect dark grey.

I have not seen the male.

This insect was sent to me on some gooseberries from a garden at Amberley by Dr. Morris. I scarcely know what to make of it. From the locality it is hardly likely to be indigenous; but no other insect of the genus is at all like it.

3. *Fiorinia stricta*, sp. nov.

Figs. 5–9.

Puparium very narrow, the length being about five times the width. The second pellicle fills almost the whole of it, half of the first pellicle appearing at the cephalic end, and a very narrow edge of secretion running down the sides, which are almost straight and parallel. The diagram (fig. 6) shows the arrangement. Length of puparium about $\frac{1}{11}$ inch: colour, for the female, almost black; for the male, white.

The first pellicle shows the compressed cylindrical form of the head, spoken of under the last insect, *F. grossulariæ*. Indeed, this appears to be a character common to all the genus *Fiorinia* in this country, with the exception of *F. minima*.

The second pellicle, which forms the puparium, appears to be entire throughout almost all its length. But at the posterior end, as shown in fig. 6, it is cut across by several transverse corrugations dividing it into narrow segments; and the edge, generally semicircular, is sharply serrated, but the serrations are not so deep as in *F. minima*. This pellicle is very strong and hard, and by its dark colour makes the puparium altogether look black.

The adult female is very small in comparison with the second pellicle (fig. 6). After gestation, indeed, it shrinks up at the cephalic end so as to become difficult of detection. It has the general form of *Mytilaspis*, with compressed cylindrical head. The lateral corrugations bear no spines. The abdominal segment (fig. 5) is somewhat elongated, and the edge is broken into a number of protruding, sharp-pointed lobes, giving it the appearance of a comb. There are no median lobes like those of almost all other Diaspidæ. Spinnerets normal of the genus, the three upper groups joined in an arch. Length of adult female before gestation about $\frac{1}{30}$ inch: colour dark brown or purple.

The male paparium is, in shape, similar to that of the female: but of course, as there can be here no second pellicle, it is composed almost altogether of fibrous secretion. Its colour, therefore, is white, with the first pellicle, which is black, at the cephalic end. Length, about $\frac{1}{11}$ inch.

The adult male has the normal form, generally, of the Diaspidæ. The antennæ (fig. 7) have ten joints, of which the first two are very short, the rest long, thin, hairy, and about equal to each other, except the last, which is a little shorter and broader, being irregularly fusiform. Amongst the hairs on this last joint is one a little longer than the rest and bearing a terminal knob. Foot normal (fig. 8); the claw is very slender, and the four knobbed digitules are fine hairs. There is a strong spine at the extremity of the tibia (see fig. 8). The abdominal spike (fig. 9) springs from a tubercle at the end of the abdomen, having a small setiferous tubercle on each side. The haltere is normal.

I have this insect on *Dendrobium* (sent by the Rev. Mr. Colenso), and on *Hedycarya* (sent by C. P. Winkelmann, Esq.), both from Hawke's Bay. I do not think it is common.

There is no mistaking *F. stricta*: the very long and narrow second pellicle, with its segmented extremity and black colour, and the comb-like serrations of the abdominal segment in the adult female, clearly distinguish it from all others. The male, alone, would not suffice for identification: it might easily be taken for a male of *Mytilaspis cordylinidis* or *Chionaspis dubia*, though it may be known from the former by the black colour of its first pellicle, and from the latter by the absence of keels on the puparium.

2nd Group.—LECANIDÆ.

In my first paper (Trans., vol. xi., p. 205) I divided this group into three subsections—*Lecanieæ: Lecanio-diaspidæ: Pulvinarieæ.* In the second of these I included the New Zealand genera *Ctenochiton* and *Inglisia:* and I afterwards added *Lecanochiton.* I am inclined now to propose a new general arrangement of the whole group.

M. Signoret, in his Monograph (Annales de la Soc. Entom. de la France, 25 Mars, 1868, p. 268 et seq.), admitted the subsection Lecanio-diaspidæ, first proposed by Professor Targioni, but confined it to the four genera *Pollinia*, *Planchonia*, *Asterolecanium*, and *Lecaniodiaspis.* Of these, the first three cover themselves with a hard test, the fourth forming a sac of felted matter. He excluded from the subsection the following genera of *covered* Lecanidæ:—*Signoretia*, *Eriopeltis*, *Philippia*, *Vinsonia*, *Ceroplastes*, *Fairmairia*, and placed the two genera *Ericerus* and *Carteria* in a separate position, being somewhat abnormal. Mr. Comstock follows a similar course, describing several species of *Ceroplastes*, but remarking that he has not found any Lecanio-diaspidæ in America (Report of the U.S. Commissioner of Agriculture, 1881: Report of the Entomologist, p. 278, note).

When the subsection was established by Professor Targioni one of its characters was that the females become "apodous in the adult stage." I imagine that it is this which induced M. Signoret and Mr. Comstock to narrow its limits. But I see no sufficient reason for this. The Diaspidæ are not separated from the Lecanidæ because the females become apodous, but because their whole habit differs, by the formation of tests or puparia composed partly of discarded pellicles, by their life-history in these tests, and by the peculiar nature of the abdominal segment in the female. Moreover, there would seem to be no greater reason for selecting the loss of the feet as a character than the loss of the antennæ. Now, in the

Lecanio-diaspidæ of Targioni, *Planchonia* loses its antennæ, *Lecaniodiaspis* keeps them. But it appears to me that there is an organic difference between the secretion of a test, whether of wax, or felt, or cotton, and the absence of any test at all. The difference between the naked genus *Lecanium* and the covered genus *Ceroplastes* is, I take it, much greater than that between *Ceroplastes* and *Vinsonia*.

In my paper of 1878 (Trans., vol. xi., p. 207), I introduced the subsection Lecanio-diaspidæ with an extension of its limits; and I was led to this in great measure because the term itself seemed so apt for expressing the main difference between certain genera and the rest of the Coccid family, that is, the possession of certain characters common to all Lecanidæ together with the formation of tests as in the Diaspidæ (though not necessarily including any pellicles). I then added to the subsection the genera *Ctenochiton* and *Inglisia*, and in my paper of 1881 (Trans., vol. xiv., p. 221) the genus *Lecanochiton*.

There appears to be only one character common to all the Lecanidæ which can be easily and clearly made out. It is the presence, at the abdominal extremity of the female, of a more or less deep cleft, above which, on the dorsal side, are two small protruding (usually more or less triangular) lobes. Other characters, of course, exist, such as the generally monomerous mentum, the usually stationary position of the adult female, the antennæ with almost always (in the adult) six or seven joints, and so on. But these distinctions cannot always be exactly observed. For instance, it is often exceedingly difficult, if not impossible, to tell whether the mentum is monomerous or dimerous. But, as far as my own observation goes, and from the description of M. Signoret and others, I know of no species of Lecanidæ which does not exhibit quite clearly enough the abdominal cleft and its two lobes. In the group Diaspidæ the abdomen has no such appearance: there is sometimes, as in *Chionaspis dubia*, mihi, or *Diaspis rosæ*, Sandberg, a slight median depression, but the whole form of the part is quite distinct. In the group Coccidæ the abdomen either has no appearance of division, as in the *Dactylopii* (see fig. 19*g*., Trans., vol. xi., pl. viii.), or else ends with prominent processes, which I have called "anal tubercles," as in *Eriococcus hoheriæ*, mihi (Trans., vol. xii., pl. vii., figs. 14, 20). I append to this paper (figs. 22, 23, 24, and 25), diagrams to give a comparative view of the three groups.

It follows then that the group to which an insect belongs can be at once discerned by reference to the abdominal extremity. There is one exception to this in the insect producing stick-lac, *Carteria lacca*, where the cleft and lobes are not easily made out; and there are the genera *Kermes*, *Pollinia*, etc., where the adult insect shows the cleft and lobes of Lecanidæ while the young has the anal tubercles of Coccidæ. But exceptions prove the rule.

The number of joints of the antennæ, the number and character of the digitules, and the sheath of the penis in the male, are points on which specific and generic distinctions may well be founded ; but the joints of the antennæ are often difficult to determine, and various observers may imagine seven joints where others see only six and others eight. An instance of this difficulty is given below, under *Ctenochiton perforatus*. With regard to the mentum, it seldom happens that this can be thoroughly well examined in an adult or old female. It is usually stated also that a special character of the Lecanidæ is the immobility of the adult female. But, first, this is certainly not a distinction from the Diaspidæ, for in that group the insects become apodous, and therefore fixed, from an early stage ; and, secondly, no Lecanid is more stationary than *Icerya purchasi*, an undoubted member of the Coccid group ; for this insect, as soon as it begins to form its peculiar ovisac, ceases altogether to move about and simply becomes gradually raised up *a tergo*. In point of fact, with the exception of the abdominal cleft and lobes, there is probably not any character of the Lecanidæ which cannot be found in some one or other of the remaining groups.

This being so, I would confine the distinguishing character of this group to its abdominal features, and would employ for its subsections the nature of, or the absence of, the secretion produced. In this way the following key would show a gradually progressive series, linked with the Diaspidæ by *Lecanochiton* and with the Coccidæ through *Kermes* and *Planchonia*.

2ND. GROUP.

Insects presenting at all stages a cleft at the abdominal extremity, and, above it on the dorsal side, two more or less conspicuous and triangular lobes LECANIDÆ.

Subsection I.

Insects covering themselves with a secretion, composed chiefly of waxy, horny or glassy matter ... LECANIO-DIASPIDÆ.

Test horny, partly formed of the second pellicle ... *Lecanochiton*.

Test waxy, with single fringe of broad segments ... *Ctenochiton*.

Test waxy, produced into radiating branches ... *Vinsonia*.

Test waxy, without fringe or branches ... ... *Ceroplastes*.

Test waxy, elevated, as if double ... ... *Fairmairia*.

Test glassy, conical or elongated, elevated, striated with air-cells ... ... *Inglisia*.

Test agglomerated in a waxy mass containing colonies of insects, male and female ... ... *Carteria*.

Test absent for the female, present and aggregated in a waxy mass for the male ... ... *Ericerus*.

Subsection II.

Insects naked	LECANIEÆ.
Insects propagating without ovisac, arboreal	*Lecanium.*
Insects propagating without ovisac, subterranean, retaining feet and antennæ	*Lecanopsis.*
Insects propagating without ovisac, subterranean, losing feet and antennæ	*Aclerda.*
Insects forming ovisac	*Pulvinaria.*

Subsection III.

Insects covering themselves with a secretion of cottony or felted matter	LECANIO-COCCIDÆ.
Secretion felted, appearing only in the last stage, after gestation	*Signoretia.*
Secretion felted, forming a nearly complete sac, before gestation	*Lecaniodiaspis.*
Secretion felted, forming complete sac	*Philippia.*
Secretion cottony, covering the insect only in its last stage, after gestation	*Lichtensia.*
Secretion cottony, forming complete sac, before gestation	*Eriopeltis.*

The series thus presented would contain all the Lecanidæ proper. Between it and the Coccidæ proper would come a small group, combining the characters of the two, and linking them together, thus:—

3RD GROUP.

Insects presenting at one stage the anal tubercles of Coccidæ, at another the cleft and lobes of Lecanidæ	HEMI-COCCIDÆ.

Subsection I.

Insects naked	KERMITIDÆ.
Insects globular	*Kermes.*

Subsection II.

Insects covering themselves with a secretion of glassy or waxy matter	CRYPTO-KERMITIDÆ.
Test hard, waxy, with single fringe	*Pollinia.*
Test hard, waxy, with double fringe	*Asterolecanium.*

In the foregoing series I have omitted the genus *Physokermes*, Targioni, not being able to make out exactly its distinction from *Lecanium;* also the genus *Planchonia*, because, as stated in my paper of 1881 (Trans., vol. xiv., p. 223), it has the anal tubercles of Coccidæ in all stages. In the case of many of the genera given above, as for instance *Pollinia* and *Asterolecanium*, or *Lecanopsis* and *Aclerda*, I do not know whether the distinctions given by authors are sufficient: but I have not seen all these insects.

COCCIDÆ.

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Of the genera given above, the following have been reported by me as indigenous to New Zealand—*Lecanochiton, Ctenochiton, Inglisia*; and several species of *Lecanium* have been introduced.

Strictly speaking, perhaps *Ctenochiton, Vinsonia, Fairmairia,* and *Inglisia* might properly be united under the same genus *Ceroplastes.* Still there is, I think, a sufficiently marked distinction between the tests of all to allow of their separation; at least, the distinction is quite as marked as that of the genera *Aspidiotus* and *Diaspis* in another group.

Subsection I.—LECANIO-DIASPIDÆ.

1st Genus, **Lecanochiton,** mihi.

1. *Lecanochiton metrosideri,* mihi.

(Trans., vol. xiv., p. 222.)

Figs. 26, 27.

I have found the male of this insect, last year. It has the generally normal form of Lecanidæ, the abdominal spike or sheath of the penis being moderately long, straight, and stoutish. Antennæ (fig. 26) of ten joints, of which the first two are very short, the third much longer and expanded at the tip, the fourth more than twice the length of the third; the remaining six almost equal, about the length of the third, but stouter and rounder, being almost moniliform. All the joints but the first two have hairs. Foot generally normal; the tibia slightly expanded at its tip, with a strong spine; claw slender, with four digitules, fine hairs (fig. 27). Colour dark red; thoracic band inconspicuous. Length, exclusive of spike, about $\frac{1}{40}$ inch. The test is white and glassy.

When describing the female of this species in 1881 I had specimens only from rata trees in Milford Sound, at the extreme south-west of New Zealand. The male above described I found, with a great number of females, on the pohutukawa, near Auckland, almost at the extreme north. This last tree, *Metrosideros tomentosa*, of the same genus as the rata, does not grow, I believe, far south of Auckland. The occurrence of *Lecanochiton* on it is therefore another instance of the persistence of certain Coccids on certain trees. Milford Sound and Auckland are, I suppose, 700 miles apart, but in both the insect attacks the same genus of plant. In the same way *Inglisia leptospermi* may be looked for with almost certainty on the manuka (*Leptospermum*) from one end of the islands to the other, and probably both it and *Lecanochiton* confine themselves to one kind of tree. Some Coccids, as the *Dactylopii*, or *Fiorinia asteliæ*, or *Lecanium hesperidum*, are not so particular.

The antennæ of the male *Lecanochiton* are peculiar, and distinguish it from all Coccids known to me. As a rule, the four or five terminal joints of the male antennæ are elongated, in this insect they are nearly globular. This character, and the employment of the second pellicle in the test of the female, clearly differentiate the species.

2nd Genus, **Ctenochiton**, mihi.

1. *Ctenochiton perforatus*, mihi.

(Trans., vol. xi., p. 208.)

Fig. 28.

I have come to the conclusion that the female antennæ of this insect have only six joints. The point is by no means easy to settle. After the second, which is very short, comes a long joint, which I have hitherto taken for two. At the extremity of this there are three or four hairs, and half-way along its length a hair springing from a very small depression, which seems to run in a ring round the joint, and this ring I have considered as a true division. I think now that it is not so, and that the third joint is really a very long one, almost equal indeed to all the rest of the antenna. Fig. 28 shows the features referred to. The point is of importance in this respect, that one of the characters distinguishing the genus *Ctenochiton* from *Ceroplastes* I have taken to be the seven-jointed antennæ, *Ceroplastes* having six. I have not made a thorough examination lately of the antennæ of *Ctenochiton viridis*. *C. piperis* and *C. spinosus* have, I think, undoubtedly seven joints. In any case, the fringed test is a sufficient distinction of the genus.

2. *Ctenochiton flavus*, sp. nov.

Figs. 10–21.

Female test (fig. 10) golden, waxy, flat beneath, convex above; outline circular or slightly elliptical, with a fringe of broadly triangular segments round the edge. Apex of the test an irregular elongated mass of wax, the remainder divided into two concentric series of plates, the inner series pentagonal with sharp angles, the outer pentagonal with rounded angles and with the outer side forming the base of the segments of the fringe. The inner series forms often irregular lumps of wax.

The adult female (fig. 11) fills the test, shrivelling up after gestation: it is consequently flat beneath, convex above, with general outline of Lecanidæ. The spiracular spines, as shown in figs. 11 and 13, are very long and conspicuous: from their base a double row of minute circular spinneret orifices runs as far as the spiracle, with two or three outlying ones at the base of the spine: and I think a single row of the same kind of orifices runs across the body to the spiracle on the other side. Along the edge of the body there is a series of conical sharp spines (fig. 13): and scattered all over are many tubular projecting spinnerets as shown in the same figure. The abdominal cleft is deep, and the two lobes are conspicuous on the dorsal side: these lobes are not, as usual in the Lecanidæ generally, smooth, but irregular, and each bears at the end three or four strong spines. The antennæ have six joints (fig. 14): but the third joint often looks like two, as there is a sort of false division near its end, with a hair or two, like that noticed above under *C. perforatus*. The last joint has several very long hairs. Feet (figs. 15, 16) normal of the group: the upper digitules fine long hairs, the lower pair very broad. The anal ring (fig. 17) bears a number of long hairs of which eight seem to be conspicuous. The colour of the insect is a golden brown; diameter about $\frac{1}{12}$ inch.

The second stage of the female (fig. 12) is normal of the genus, showing the wavy outline, somewhat strongly marked in many specimens but not conspicuous in others. The spiracular spines are prominent, and a row of conical spines runs round the edge of the body, as in the adult. The test is at first very thin and brittle, and with a fringe of broad, shallow, segments: but afterwards becomes thicker, and in the end, before the change to the final stage, it approaches almost the form of the waxy test of an adult *Ceroplastes.*

The young insect is normal.

The male test (fig. 18) is much narrower than that of the female, having an irregularly rectangular edge with deep curvilinear depressions. It is glassy, white and shining, flat beneath and elevated above, and marked with numerous horizontal striæ. The upper central portion is sometimes flat, sometimes an irregular mass of the glassy secretion. On the lower side there is often a plate of secretion, so that the pupa is almost entirely enclosed. The adult male (fig. 19) is normal of the genus. The legs are very long and slender; the four digitules are fine hairs. At the extremity of the tibia there is a strong spine. Abdominal spike, or sheath of the penis, slightly curved, with a seta on each side of its basal tubercle. Antennæ of ten joints (fig. 20): the first two very short, the rest longer and equal. On the last joint (fig. 21) are several long hairs, of which three are knobbed.

From *Brachyglottis repanda* and *Panax arboreum*, only in the North Island, as yet. Mr. Buchanan, of the Geological Survey, has kindly sent me specimens.

The shape and colour of the test, and the arrangement and form of the spinnerets, differentiate this species from others of the genus. In the prominence of the spiracular spines it resembles *C. elongatus*, mihi: in the row of conical spines round the edge it resembles *C. fuscus*, described below; but both of these are otherwise different.

3. *Ctenochiton fuscus*, sp. nov.

Figs. 29, 30.

Test of the adult female elliptical in outline, flat below, convex above, the elevation being greater than usual; almost black in colour, composed of a thin dark waxy secretion. The fringe is conspicuous, and has the appearance of teeth, the segments being triangular and set somewhat closely together. It attains sometimes a length of nearly $\frac{1}{4}$ inch, a breadth of $\frac{1}{7}$ inch, and a height of $\frac{1}{10}$ inch, being thus rather a large species. The inside of the test is whitish.

The adult female fills the test, and shrivels after gestation into a conical mass, requiring maceration or boiling in potash in order to make out the organs. The antennæ (fig. 29) are not long. I cannot say exactly whether there are six or seven joints (I have figured seven), as they are much confused: on the last joint are several longish hairs. The foot (fig. 30) shows the tibia broadening to its extremity, with two hairs at the tip: the upper digitules are stronger and thicker than usual, and the lower pair end in conspicuously broad plates. On the edge of the body is a row of small conical spines, as in the last species. Colour of the insect almost black.

In the second stage the female is less wavy in outline than in other species of the genus, and in its later period is somewhat thick, with the edges turned inwards. Feet normal: digitules fine. Antennæ short and thick, with six joints, of which the third and fourth are the longest: on the last joint some long hairs. The abdominal lobes are irregularly triangular.

Young insect normal.

I have not seen the male; but its test appears to be narrow, white, and glassy.

From *Brachyglottis repanda*, in the "Dry Bush," near Christchurch.

The black colour both of the test and the female, its large size, and the digitules of the foot, sufficiently distinguish this species. Much of the blackness of Coccids is due to the presence of fungoid growths which always accompany them (I suppose, *Fumago*); but in this case the colour is that of the insect.

4. *Ctenochiton depressus*, sp. nov.

Figs. 31, 32.

Test of female flat, nearly circular, thin, waxy, greyish-coloured: the fringe is inconspicuous or absent in the latest stage, but normal at earlier periods. Diameter about $\frac{1}{7}$ inch. There are no rows of air-cells, or perforations, in the test.

Adult female filling the test and as usual shrivelling after gestation: colour brownish or grey. Antennæ (fig. 31) of six joints, the third being the longest and, as is commonly the case, often appearing like two. On the last joint a few long hairs. Foot normal: the upper digitules are fine hairs, the lower pair only a little broader. Anal ring and lobes normal.

In the second stage the usual wavy edge is conspicuous: the test is thin, glassy, with normal fringe. Antennæ and feet normal. The insect is somewhat thick, with yellowish colour.

Young insect normal.

Test of the male elongated, narrow, flat beneath, slightly convex above, white, glassy, thin and brittle, with a conspicuous fringe of which the segments are truncato-triangular (fig. 32). The test is divided into tessellations, the median row of which is quadrangular, with two series of pentagonal divisions between it and the fringe. Near the abdominal extremity a transverse narrow slit cuts the test in two, leaving a small segment at the extreme end apparently separate. Length of the test about $\frac{1}{14}$ inch. The adult male is yellowish-red in colour, about $\frac{1}{25}$ inch in length, exclusive of the wings. General form normal. Antennæ long, with ten joints, all long and equal, except the two first which as usual are very short: all the joints have several hairs. Legs normal, but the tibiæ are very long and slender and only a little thickened at the tip; tarsi somewhat thick; digitules fine hairs. Abdominal spike longer, I think, than usual, and very slightly curved. Four pairs of eyes.

On *Plagianthus*, *Cyathea*, and a few other plants sent to me from Hawke's Bay by the Rev. Mr. Colenso.

This insect resembles, to the naked eye, somewhat nearly *Ctenochiton perforatus*, mihi, but the female differs in the absence of the curious perforations in the test of that species and in the shorter and thicker antennæ with also more long hairs on the last joint. The test of the male is also different.

Subsection II.—LECANIEÆ.

Genus **Lecanium**, Illiger.

1. *Lecanium* sp., parasitized.

It is by no means uncommon, especially in the North Island, to find on many trees in the forests a number of circular brown spots on the leaves, varying from $\frac{1}{20}$ to $\frac{1}{10}$ inch in diameter, slightly convex and with a velvety appearance. On examination these spots are found to be chiefly fungoid: they cannot always be easily detached from the leaf, and often several of them are connected together by a thin sheet of fungoid growth so that a large patch comes off at once. On turning them over, very often nothing more is to be seen than from the upper side: but many specimens may be found showing in the centre of the under-surface a small oval object embedded in the brown mass. Closer examination shows this to be, in most cases, a Lecanid insect; but identification is very difficult, and it is almost impossible to make out the organs, even after prolonged maceration and boiling. It is impossible to render the insect transparent enough for complete study.

This is the effect of parasitism, and the insect in question is a *Lecanium* which has become covered with fungoid growth. I do not know exactly to what species to refer it. In general form it resembles *L. hesperidum*, but it is much smaller, averaging only $\frac{1}{30}$ inch in length. I do not quite see, also, why *L. hesperidum*, which is free from fungus in our gardens, should be so subject to it in the forests; indeed, almost exclusively so, for few other insects suffer in the same way. *Fiorinia asteliæ* is sometimes found in the same state, and I have specimens of an *Aleurodes* from Pelorus Sound also attacked by fungus; but this little *Lecanium* seems to be the chief victim.

Subsection III.—Lecanio-coccidæ.

The species forming this subsection are all European, and I have not seen any in New Zealand.

3rd Group.—HEMI-COCCIDÆ.

I have not seen a true *Kermes* in New Zealand, but have received from South Australia an insect of this genus which deserves full examination.

The genus *Asterolecanium*, which I have placed under this group in my foregoing list of genera, is to the naked eye similar to *Planchonia*, and it requires an examination of the abdominal region in all stages to detect the difference. But M. Signoret distinctly states that the adult *Asterolecanium* has the abdomen of the Lecanidæ.

4th Group.—COCCIDÆ.

Characterized by the absence in all stages of the deep abdominal cleft, and by the prolongation of the abdomen into lateral processes, more or less conspicuous, which I have called in these papers "anal tubercles." In some genera, as *Dactylopius*, these tubercles are scarcely noticeable, but may usually be made out on close examination (see Trans., vol. xi., pl. viii., figs. 19 *d* and 19 *g*). In others, as *Icerya*, there is so much secretion and hair on the abdomen of the adult that the tubercles can scarcely be detected. But in no case, I think, can any of the species be mistaken for Lecanidæ.

As for the mentum, it is usually tri-merous; but this character is variable, and also most difficult to make out.

Genus **Planchonia**, Signoret.

1. *Planchonia epacridis*, mihi.

(Trans., vol. xiv., p. 224.)

I think this species may stand. As remarked above, it outwardly resembles *Asterolecanium*.

Genus **Eriococcus**, Targioni.

Eriococcus araucariæ, mihi.

(Trans., vol. xi., p. 218.)

This appears to be certainly distinct. M. Signoret informs me that he has lately received some specimens from Spain. Mr. Comstock reports it also from the United States, but refers it to the next genus *Rhizococcus*, partly because it has, he says, seven-jointed antennæ. I am unable to agree with him: at least, after examination of many specimens I can only detect six, though certainly one of them sometimes appears double. In *Eriococcus hoheriæ*, mihi, there is no room for doubt. But this character of the antennæ is, as Mr. Comstock admits, most uncertain. It will be seen below that the two insects which I propose to place under *Rhizococcus* have less than seven joints in the antennæ.

Genus **Rhizococcus**, Signoret.

M. Signoret and Mr. Comstock agree in attributing to this genus the distinctions of—1st, seven-jointed antennæ; and 2nd, absence of cottony sac, at least until gestation. I am doubtful how far either of these may be really sufficient: but probably the second may be admitted: the first is of no value. I think, with Mr. Comstock himself (Ann. Report of the Dep. of Agric., 1880, p. 339, note), that it would be best to include all under *Eriococcus*.

1. *Rhizococcus celmisiæ*, sp. nov.

Figs. 33–35.

Female (fig. 33) deep red in colour, of oval outline, convex above and flattened below; length about $\frac{1}{11}$ inch. The segments of the body are not very distinct. The abdomen ends in two large and conspicuous anal tubercles, each of which bears one strong and fairly long terminal seta and three other spines (fig. 34). The anal ring has eight hairs. Antennæ (fig. 35) of six joints, sometimes looking like seven. Mentum doubtfully di-merous. The four digitules of the foot are long fine hairs. The tibia is a little shorter than the tarsus (a character exceptional in an adult insect, occurring only in this genus and *Acanthococcus*). The trochanter bears one long hair and two short ones. A few large conical spines (spinnerets) are scattered over the body, and a row of smaller ones, like hairs with tubercular bases, runs transversely on each segment: also some circular spinnerets. At the edge of the body, all round, is a row of the large conical spines, which are set in groups of three on the posterior segments, of four or five on the median segments, and almost continuous on the head. When the insect is alive these spines are often agglutinated with cottony secretion so as to give the appearance of a short fringe. The four spiracles are somewhat large and circular.

On *Celmisia*, sp., from the Southern Alps.

I have only one stage of this insect, the adult female before gestation, and cannot say precisely what sort of sac, if any, it forms. But this would be probably normal. The insect differs from the European *R. gnidii* in size, colour, and habitat, in the digitules of the foot, and in the grouping of the conical spines of the edge, which are only in pairs in *R. gnidii*.

2. *Rhizococcus fossor*, sp. nov.

Figs. 36–38.

Adult female (fig. 36) greenish yellow in colour, sometimes brown, almost circular in outline, flat beneath and slightly convex above: length about $\frac{1}{15}$ inch. In the last stage, after gestation it becomes dark brown. The cephalic part is smooth; the remainder segmented. The abdomen ends in two very small anal tubercles, which are nevertheless somewhat conspicuous on account of their brown colour. Between them there protudes a long thick pencil of white cotton, which is resolvable into six. Antennæ (fig. 37) short, with six joints, the last joint bearing several long hairs. Feet very small; the femur rather thick: the tibia is shorter than the tarsus by about one-third: the four digitules are long fine hairs. The anal tubercles have not terminal setæ; and I can only make out four hairs on the anal ring. A row of a few conical spines, set far apart, runs round the edge of the body, but I can see none elsewhere, nor any circular spinnerets. There is no sign of a sac in any stage.

In the second stage the insect is oval, flatter than the adult, and of a rich golden colour: length about $\frac{1}{40}$ inch. The segments of the body are somewhat more distinct than in the adult. The anal tubercles are proportionately larger, and bear terminal setæ. Antennæ longer than in the adult, with six joints. Feet also longer. All round the edge runs a row of conical spines, set more closely than in the adult; and from each of these springs a long curly tube of white cotton, making a kind of fringe to the body; each tube is a little dilated at the end, and then tapers to a narrow point (fig. 38). The base of each conical spine is a somewhat large tubercle.

The young insect has the general form of the young *Eriococcus hoheriæ*: colour yellow; length about $\frac{1}{60}$ inch. Antennæ as in adult, with six joints. The feet are somewhat large. Anal tubercles thick, bearing a terminal seta and one shorter hair. Along the edge of the body is the usual row of conical spines, set somewhat far apart, and four other longitudinal rows are seen on the surface. The mentum is large and, I think, di-merous.

This insect is viviparous. The females are often full of young larvæ, and, as these are born, they are sheltered in a cavity beneath the mother, as in some of the Lecanidæ. They do not remain there long, but soon begin their travels, and move rapidly.

The male insect is red in colour, about $\frac{1}{30}$ inch in length, undergoing its last transformation in a minute, white, cottony, oval sac. Antennæ of nine joints: the first two short and thick, the third very long and slender, the fourth, fifth, sixth, and seventh about half as long as the third, thicker and rounder, the eighth rather shorter, and the ninth very short and nearly globular. All the joints have hairs. Legs slender: the tarsus

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rather less than half as long as the tibia: the four digitules are fine hairs. The usual hairs and spine on the tibia, and two spines on the lower edge of the tarsus, not far from the claw. There are three pairs of eyes. The abdominal spike is short and thick, and exhibits a curved appendage similar to, but rather longer than, that of *Acanthococcus multispinus*, mihi (Trans., vol. xi., pl. viii., fig. 18*f*). This appendage is, indeed, common to the three genera *Eriococcus*, *Acanthococcus*, and *Rhizococcus*. At the base of the spike are two rather strong setæ, one on each side.

Rhizococcus fossor does not construct a cottony sac (for the female), but, instead, buries itself usually in a circular hole or pit, in the leaf it lives on. Many adult insects may be found simply resting on the leaf, accompanied by a number of young larvæ and females in the second stage. But in most cases they pass their last stage in a pit. The young insect is very active: the female of the second stage moves about sluggishly; in the last stage it is fixed and stationary. At first it appears simply to lie on the leaf (on the under-side), but in a short while, whether from some chemical action produced by it or by mechanically compressing the cells of the plant, a circular elevation or wall on the leaf is raised up round the insect. At the same time the portion of the leaf beneath the body is pressed downwards, and a corresponding elevation appears on the other side: this elevation assumes a brown tint. As the depression continues and the wall grows the insect sinks deeper in the leaf, becoming more and more buried, and the wall curls over it a little, so that in fact the orifice of the pit is somewhat smaller than the cavity below. The insect lies in the pit (which may average about $\frac{1}{18}$ inch in diameter at the opening, and is circular) with the head downward, and the anal tubercles and pencil of white cotton appearing over the wall, I presume to attract the male. Afterwards, as gestation proceeds, the whole body disappears in the pit, where the young larvæ are born. These cavities in the leaf look like small volcanic craters, and the corresponding brown elevation on the other side of the leaf is quite conspicuous.

Sometimes two insects may be found in the same pit, one lying over the other. I suppose the upper one simply took advantage of a ready-made domicile. The insects which are not in pits are generally darker in colour than the others.

On leaves of maire, *Santalum cunninghamii*, from the North Island, sent to me by C. P. Winkelmann, Esq., of Te Aute.

This is an interesting and peculiar insect, certainly differing from any that I know of in the genus. The curious mode adopted by it of burrowing into the leaf is, I think, unique. *Ctenochiton viridis*, mihi, produces a certain depression in the leaf it lives on, but by no means so complete a shelter for itself as does this little *Rhizococcus*.

Genus, **Dactylopius**, Signoret.

(Trans., vol. xi., p. 218.)

1. *Dactylopius alpinus*, sp. nov.

Figs. 39, 40.

Adult female dark purple in colour, the body thick and fat, inactive, enclosed in a mass of white closely felted cotton. When immersed in alcohol it produces a rich red tint. Length sometimes as much as $\frac{1}{7}$ inch. The internal substance is very oily. The body is normally segmented; anal tubercles inconspicuous. Anal ring large, with six hairs. Antennæ normal of the genus, with eight joints (fig. 39). The feet are normal; the two upper digitules are long fine hairs, the lower pair are somewhat broader. Mentum di-merous. All over the body there are a number of tubular projecting spinnerets, and many others circular; and on the three posterior segments are three rows of large conical spines, similar to those of *Rhizococcus*. Although the anal tubercles are not as prominent as in some of the *Dactylopii*, they are somewhat thick, with broad bases.

Young insect dark brown in colour, of generally normal form, about $\frac{1}{40}$ inch in length. Antennæ (fig. 40) of six joints. Feet normal. Anal tubercles thick and broad, and rather more prominent than in the adult. There are a few small spines on the body.

In the second stage the insect generally resembles the young larva, but is larger, and the body is covered with a great number of small circular spinnerets intermixed with others which have a bulbous base and fine hair-like tubes. Anal tubercles inconspicuous, bearing the usual spines. A few conical spines appear on the posterior segments. Antennæ of six joints.

I have not seen the male.

On a species of *Veronica*, sent me by Mr. J. D. Enys, from the upper valley of the Waimakariri, in the Southern Alps, near the glaciers.

The large conical spines, or spinnerets, on the posterior segments, distinguish this species, besides its size and very deep purple colour producing a rich tint in alcohol. The thick sac of white cotton in which it envelopes itself may probably be also an important character: in no stage, I think, is it like the ordinary "mealy bug," the type of *Dactylopius*.

2. *Dactylopius calceolariæ*, mihi.

(Trans., vol. xi., p. 218.)

Since first describing this insect I have received specimens from the forests of Stewart Island, in the extreme South of New Zealand, on a native grass, *Danthonia*, and on a leaf of *Phormium*. As Stewart Island is almost destitute of cultivation, and is certainly the last part of the colony where one would expect to find in the forests a new importation from other countries, I take it that *D. calceolariæ* is undoubtedly indigenous.

Some of the specimens on *Danthonia* were more than $\frac{1}{4}$ inch long, so that the insect is quite a large one.

3. *Dactylopius glaucus*, mihi.

(Trans., vol. xi., p. 219.)

I consider this also a good species, distinct from the last by its green colour and small size, which never exceeds $\frac{1}{12}$ inch.

I have obtained one mutilated specimen of a male. As far as I can make it out it offers no very distinctive character, except that the abdominal spike or sheath of the penis seems to be accompanied by a curved appendage as in *Acanthococcus multispinus*, mihi (Trans., vol. xi., pl. viii., fig. 18 *f*).

Genus **Pseudococcus**, Westwood.

A genus separated from *Dactylopius* by having nine joints in the antennæ of the adult female, and only two digitules on the foot.

Westwood's original genus is described as "having females not fixed and clothed with a woolly secretion" (Int. to Mod. Class of Insects, vol. ii., appendix, p. 119), characters which, in point of fact, would include the whole group *Coccidæ*. M. Signoret has confined its limits as above.

1. *Pseudococcus asteliæ*, sp. nov.

Figs. 41–44.

Adult female about $\frac{1}{10}$ inch long, yellowish-brown, covered with a not very abundant white cotton. General form resembling *Dactylopius*: the body segmented, anal tubercles inconspicuous, anal ring with six hairs. Antennæ (fig. 41) with nine joints, of which the third, fourth, and fifth are the longest; the second, sixth, and ninth a little shorter; the first, seventh, and eighth the shortest. The fourth, fifth, and sixth are the narrowest, the two ends of the antenna being thicker than the middle. The eighth joint is a little expanded at the tip; and the ninth is fusiform, with a shallow depression at the extremity. All the joints have a few long hairs, and on the eighth is one a good deal stronger than the others. The legs (fig. 42) have the tibia twice as long as the tarsus: the claw is slender, and has no tooth on the inner edge. There are only two digitules (the lower pair) which are long and fine. The trochanter bears one short bristle. The whole leg is slender and long. The eyes (fig. 43) are tubercular and smooth, showing after maceration in potash a small dark terminal spot. The body is covered with a number of spinnerets of two kinds, as shown in fig. 44; those with simple concentric circles are the largest, and are found all over the integument: the others are placed in groups at the edges of the segments and also in great numbers at the cephalic and abdominal extremities. Interspersed with these spinnerets are several hairs, mostly very short, but on the head are some pretty long. From the anal tubercles spring two strong setæ with tubercular bases, not very long. The mentum is di-merous and bears a few hairs on the tip. In the groups of spinnerets at the edges of the segments are found a few small conical spines. The four spiracles are small and simple.

I have not seen the male.

On a species of *Astelia* sent to me by the Rev. Mr. Colenso, from the forests of Hawke's Bay.

This insect appears to be most nearly allied to *Pseudococcus mespili*, Geoffroy, found in France on medlar and plane trees. The arrangement of the spinnerets in groups on the segments and in great numbers at the two extremities, the long hairs on the head and the length of the tibia, are similar in both. I find, however, in M. Signoret's description of the European insect no mention of the two kinds of spinnerets. The main differences between the two seem to be in the antennæ and the foot. In *P. mespili* the second joint of the antenna is the longest and the rest diminish gradually to the ninth: and the claw of the foot is strong and broad and shows a small tooth on the inner edge near the point. In *P. aceris*, another European insect, the mentum bears at its tip a large number of hairs. Both of these insects, too, are red in colour.

Genus **Icerya**, Signoret.

1. *Icerya purchasi*, mihi.

(Trans., vol. xi., p. 221.)

Through the kindness of M. Signoret I have had an opportunity of comparing this insect with *I. sacchari*, the Mauritian species, and I find that it is undoubtedly and markedly distinct. *I. sacchari* does not seem to form an ovisac with longitudinal grooves, nor does the body of the insect, although somewhat hairy, show the great tufts of black hairs and the curious projecting glassy tubes springing from large brown "coronetted" bases which are marked features of *I. purchasi*. The number of the circular spinneret orifices is also much smaller in the Mauritian insect.

Icerya purchasi has spread greatly in the last two years. It had just reached Napier at the date of my last paper; it has now established itself in that district, not only in gardens but in the native forests. In Auckland it is attacking all sorts of plants, from apple and rose trees to pines, cypresses, and gorse, and it is spreading over a large district. It has reached Nelson, and I have had many communications from that place complaining of its ravages. From the "Nelson Colonist" I learn that it is devouring wattles, cypresses, gorse, and many other plants. At the same time nobody seems to try to destroy it. With the example of California and the Cape of Good Hope before us we may be sure that ere long this pest will become a dreadful nuisance. I have tried to warn the people of

Nelson and Auckland, but no remedy has been attempted. The best authorities in America have come to the conclusion that the only cure is the destruction of infected plants. Some day the people of New Zealand will have to find this out also, but the longer it is delayed the worse the work will be.

Whether this pest will spread in our colder southern climate as it has in the warmer north remains to be seen. Our gardeners here are not in much dread of outdoor insects, they confine their attentions to those in greenhouses. They may be right, still the winter even in Canterbury is not severe enough to kill these insects, and I know that in the Christchurch public gardens many trees have had to be burnt simply on account of the ravages of Coccidæ. If *Icerya purchasi*, as seems likely, makes it way down here, I very much doubt whether gardeners will find it an easy matter to keep it in subjection.

Genus **Cælostoma,** mihi.

(Trans., vol. xii., p. 294.)

1. *Cælostoma zælandicum*, mihi.

(Trans., vol. xii., p. 294: vol. xiv., p. 226.)

The haltere of the male in this insect, which I had at first taken to resemble that of *Porphyrophora*, has, as I find, four terminal setæ, and generally resembles that described and figured below, under my next species.

2. *Cælostoma wairoense*, sp. nov.

Figs. 45–51.

Male insect so nearly resembling *C. zælandicum* in outward appearance that it may be very easily mistaken for it, having a red or purplish body about ⅛ inch long, bluish wings with strong red nervures, prominent eyes with numerous large facets, and antennæ of ten joints. The antennæ (fig. 45) are, however, more slender than in that species, and have fewer and finer hairs. The legs also have fewer hairs, especially on the tibia. The claw differs entirely, not only from *C. zælandicum*, but also from every other species known to me. Instead of having two, or four, or no digitules, it shows a great number of them, forming indeed a sort of brush round the claw (fig. 47). I have counted as many as twenty-four of these digitules, each of which springs from the claw itself, the tarsus not exhibiting any. All the digitules are knobbed. On the tarsus there are several strong spines on the inner edge. The sheath of the penis and the penis itself resemble those of *C. zælandicum*. The haltere (fig. 48) has an inflated sac-like body diminishing to a cylindrical tube, from the extremity of which spring four strong curved setæ of no great length; very frequently only three are seen. The abdomen has several segments, and each segment bears a number of short fine hairs springing from a minute tubercular base; the hairs are intermixed with numerous circular spots, as in *C. zælandicum*, but in that species these are simply two concentric circles, whereas in *C. wairoense* they exhibit (fig. 49) an outer circle with six smaller ones within it.

The male pupa is bright red, and is enclosed in a small cylindrical sac of white cotton slightly tinged with red. Apparently these sacs are found in great numbers. A mass of several hundreds together was sent me on one occasion, and, after about six weeks (in the depth of winter) two or three hundred males emerged.

Amongst this mass of male puparia were a few (perhaps half a dozen) objects which I took for females, at least before the hatching of the males. They certainly were not male pupæ, but I cannot exactly make out what they are. They were much shrivelled, but on maceration in potash regained their original form. Length about $\frac{1}{7}$ inch: the body elliptical, segmented, generally resembling *C. zœlandicum*; colour dark purple. Antennæ (fig. 50) of nine joints, all nearly equal in length, the first two somewhat broad, the rest narrowing to the fifth and then widening again to the last, which is almost globular. All the joints are short, and on each there is one ring of hairs with tubercular bases, forming a sort of crown. The eyes are small, tubercular and smooth, conical and a little projecting, with a small terminal spot. Legs (fig. 51) strong and thick. The trochanter bears one very long hair. Tibiæ somewhat dilated at the extremity, with a few spines on the inner edge. Tarsi thick, tapering towards the claw, which is normal in shape, and has two lower digitules, which are long, fine, knobbed hairs. Anal ring oval, without hairs. There is no sign of anal tubercles. The segments of the body bear a number of longish fine hairs with tubercular bases, interspersed with circular spinneret orifices. These last show two concentric circles and a central spot. The hairs and spinnerets are most numerous at the two extremities. There are twenty-four spiracles, *i.e.*, one at each side of each segment; the spiracles are simple, and the tracheæ small. There is not the least sign of a mouth, neither rostrum, mentum, or rostral setæ. I should have mentioned that the tibiæ are twice as long as the tarsi.

I have not seen any specimens which I can take to be adult females, nor any young larvæ. I presume that the adult female will have antennæ of eleven joints.

My specimens were sent to me by T. Cheeseman, Esq., of Auckland, who informs me that the insect is found in the District of Wairoa, attacking *Phormium* and *Leptospermum*.

There is no doubt that this is a distinct species. The antennæ and legs of the male differ from those of *C. zœlandicum*, but the claw of the foot is quite sufficient to distinguish it from that and all other Coccidæ. I have therefore no hesitation in considering it as new, even without seeing the adult female. As regards the stage last described, which is certainly not the male pupa, I have been in some doubt. The specimens were found amongst several hundred male puparia; but there were only five or six of them to be seen, though I made diligent search. A very similar form is found amongst male puparia of *C. zælandicum*—so similar indeed that, except in colour, the two are almost identical. In my paper of 1879 (Trans., vol. xii., p. 296), I described, or rather alluded to, this form as the second stage of the female *C. zælandicum.* I afterwards discovered the error and corrected it in vol. xiv. Unless this form be the second stage of the male insect I do not know what it can be; but if it is, then the male of *Cœlostoma* must pass through more transformations than any other Coccid. The normal stages are—1, the egg; 2, the young larva (identical, or nearly so, for male and female); 3, the pupa; 4, the perfect insect. Now, the form under consideration is certainly not the pupa, and equally certainly not the young larva just hatched; it is neither the egg nor the perfect male. Similarly (in *C. zælandicum*) it is not the larva, nor the adult, nor the second stage. It would seem therefore that the insects of this genus pass through a transformation more than other Coccids. There is one point to be noted. I have observed above that in this form the antennæ have nine joints, and the tibiæ are twice as long as the tarsi. The first character is conclusive against the insect being adult; the second character is one which, in most Coccids, is considered to indicate an advanced stage. M. Signoret (Ann. de la Soc. Entom. de France, 1874, p. 548, note) says: "In studying the Coccidæ it should be noted that almost always, when a specimen is found with the tibia shorter than the tarsus, it is a larva." The rule is not without exceptions, e.g. *Kermes*, *Acanthococcus*, etc. Still, it holds good generally, and in this case shows, I think, clearly that the form in question is by no means the first after the egg. I take it to be an intermediate state preceding the pupa of the male.

I am still puzzled by the absence of any sort of mouth. In the form just mentioned there is an orifice between the second pair of legs, as in the adult *C. zælandicum*, but nothing more.

DESCRIPTION OF PLATES I. AND II.

PLATE I.

Fig. 1. *Aspidiotus sophoræ*, abdomen of female .. .. × 90
2. *Fiorinia minima* „ .. .. × 100
3. „ „ diagram of female in puparium: *a.* 1st pellicle: *b.* 2nd pellicle: *c.* adult female: *d.* secretion
4. *Fiorinia grossulariæ*, abdomen of female .. .. × 50
5. „ *stricta*, abdomen of female .. .. × 100
6. „ „ diagram of female in puparium: *a.* 1st pellicle: *b.* 2nd pellicle: *c.* adult female: *d.* secretion

Fig. 7. *Fiorinia stricta*, antenna of male .. .. × 60
8. „ „ foot of male .. .. × 100
9. „ „ spike of male .. .. × 100
10. *Ctenochiton flavus*, dorsal view of test .. .. × 10
11. „ „ female .. .. × 10
12. „ „ female, 2nd stage .. .. × 10
13. „ „ spiracular spine and spinnerets .. .. .. × 200
14. „ „ antenna of female .. .. × 150
15. „ „ foot of female .. .. × 150
16. „ „ „ to show digitules .. .. × 300
17. „ „ anal ring of female .. .. × 100
18. „ „ test of male, dorsal view .. .. × 10
19. „ „ male .. .. × 30
20. „ „ antenna of male .. .. × 60
21. „ „ last joint of antenna of male .. .. × 250

Plate II.

Fig. 22. Diagram of abdomen of *Diaspidæ*.
23. „ „ *Lecanidæ*.
24. „ „ *Coccidæ* (*Eriococcus*).
25. „ „ *Coccidæ* (*Dactylopius*).
26. *Lecanochiton metrosideri*, antenna of male .. .. × 90
27. „ „ foot of male .. .. × 90
28. *Ctenochiton perforatus*, antenna of female .. .. × 70
29. „ *fuscus*, antenna of female .. .. × 90
30. „ „ foot of female (two digitules shown) .. .. .. × 90
31. „ *depressus*, antenna of female .. .. × 90
32. „ „ fringe of test of male .. .. × 20
33. *Rhizococcus celmisiæ*, adult female .. .. × 10
34. „ „ abdomen of female .. .. × 30
35. „ „ antenna of female .. .. × 90
36. „ *fossor*, adult female .. .. × 12
37. „ „ antenna of female .. .. × 90
38. „ „ spines and spinnerets, 2nd stage .. .. .. × 200
39. *Dactylopius alpinus*, antenna of female .. .. × 90
40. „ „ antenna of young insect .. .. × 90
41. *Pseudococcus asteliæ*, antenna of female .. .. × 90
42. „ „ foot of female .. .. × 90
43. „ „ eye of female .. .. × 200
44. „ „ spinnerets of female .. .. × 500
45. *Cœlostoma wairoense*, antenna of male .. .. × 40
46. „ „ foot of male .. .. × 40
47. „ „ claw and digitules of male .. .. × 180
48. „ „ haltere of male .. .. × 40
49. „ „ spots and hairs of male .. .. × 350
50. „ „ antenna, 2nd stage of male .. .. × 90
51. „ „ foot, 2nd stage of male .. .. × 90

Art. VI.—*On the Anatomy of* Sepioteuthis bilineata, *Quoy and Gaimard.*

By H. B. Kirk, M.A.

[*Read before the Wellington Philosophical Society, 31st October,* 1883.]

Plates III.–VIII.

(Note.—Owing to my having been unable, until within the last week or two, to obtain large and perfect specimens, I have not, as a rule, introduced other than relative measurements. The drawings, except those from the microscope, are natural size; and with the exception of pls. v., vi., vii., fig. 1, and viii., figs. 5–9, are made from the specimen figured at pl. iii. I regret that I have been unable to replace all the drawings by those of large specimens. The largest specimen I have seen measures 14 inches along the posterior surface of the mantle, this length not including any portion of the fins. To avoid confusion of terms, I have described the animal as though it were in a walking position, head downwards; but have adopted the practice, sanctioned by Professors Nicholson and Huxley, of showing the drawings in the reverse position. The terms *anterior* and *posterior* are applied to the so-called "dorsal" and "ventral" surfaces respectively.)

The distribution of *Sepioteuthis bilineata* is given by Professor Hutton (Manual of N.Z. Mollusca, 1880) as from Wellington to Auckland. In Wellington Harbour it is tolerably abundant during late spring and summer; but, with the exception of a few small ones in July, I have never seen a specimen during the winter months. Professor Hutton points out that there is nothing in Dr. Gray's description of *S. major* that does not apply to this species. The habitat of *S. major* is given as Cape of Good Hope (Catalogue of Mollusca in the British Museum); but Dr. Gray's description is very brief. Moreover, he gives *S. bilineata* in his catalogue.

External Characters.

The body is elongated and somewhat cylindrical in shape, but is flattened on the posterior surface, and still more so on the anterior surface. Its widest part is immediately above the base of the mantle, thence it narrows regularly to its extremity, where it is rounded. The edge of the mantle forms a complete collar round the "neck." On the anterior aspect of the animal the mantle-border is produced into a marked angle on the median line, this angle lodging the anterior extremity of the internal shell. From this point it recedes towards the posterior aspect, rising slightly on either side of the funnel, but immediately falling away in a well-defined curve at the base of the funnel. The two slight angles formed by the production of the posterior mantle-border mark the tips of the "articular" cartilages, adapted to fit into the "hinge" cartilages of the funnel.

Fins.—The fins are large and thick. They are attached to the sides of the body near its anterior aspect, and start from the mantle-border or close to it. They at once begin to expand, and their outline forms a curve widest at about its middle. They extend somewhat beyond the extremity of the body and coalesce. Their margin becomes thin, and often allows the coloured dorsal integument to shine through its substance like a purple band. Below the dermal layer is a thick muscular coat, whose fine but well-marked fibres extend from the inner to the outer margin of the fin. At the widest part of the fin they are parallel, but on either side they begin to radiate towards the outer margin, this radiation being most marked on the upper side. As the extremity of the body is approached they become less noticeable, and immediately opposite the extremity are not generally observable. On both aspects of the fin they are usually visible through the epidermis, and where they are most marked can be distinctly felt with the finger.

On the anterior aspect of the body the line of union of the fins is distinctly visible, although the fins are so apparently a continuation of the mantle that there is no marked depression.

Head.—The head is broader than long, its greatest width being at the projecting eyeballs. Behind these it contracts to a kind of "neck," similar to that noted by Professor Owen when speaking of *Sepia palmata* (Trans. Zool. Soc. of Lond., vol. xi., part 5). Below the eyes there is also a well-marked contraction at the base of the arms, though this contraction is not so striking as the upper one. The anterior surface of the head is flattened, and between the eyes is a depression which lodges the anterior production of the mantle-border when the neck is contracted. The posterior surface of the head is also flattened and has a marked depression which lodges the funnel. The eyes are on the sides of the head and are directed straight outwards. They present the character of the family in being covered with skin. When the tentacles are extended the sacs for their partial reception are easily discovered by pressure.

The ridge of integument (pl. iii. *b*) running behind the eye and parallel with its curve, and which Professor Owen in his description of *S. brevis* (Trans. Zool. Soc. of Lond., vol xi., part 5) regards as an external ear, is very well marked, amounting indeed to a groove covered by a fold of integument. This organ is, so far as I can discover, the same that is regarded by Professor Huxley Anatomy of Invertebrated Animals, 1877), and by Professor Macalister (Introduction to Animal Morphology, 1876), as olfactory in function. It is neither so large nor so striking as in *Loligo vulgaris*, figured in Professer Nicholson's Manual of Zoology, p. 428 of sixth edition.

Funnel (pls. iii., iv. *a*, and viii., fig. 16).—The funnel is large, flattened, somewhat conical in shape, longer than broad, and rounded at its apex. On each side of its base is a cartilaginous expansion, presenting a groove to lodge the articular ridges developed on the inner surface of the mantle. Its margins lie loosely upon the funnel. Between the surface of the head and the funnel are muscular bands; and these are so strongly developed on either side as to form a cup-shaped cavity at the base of the funnel between it and the head.

Inside the aperture of the funnel is a strongly-marked infundibular valve (pl. viii., fig. 15 *i*), so placed that, when depressed, it entirely closes the aperture. Its free portion forms a semi-circular curve; but the lower part is attached by the margins, so that, when the free portion closes the aperture, the opening of the funnel leads into a blind cavity.

Arms (pls. iii., viii., figs. 5–8).—The fourth pair of arms is the longest; next in length is the third; next the second; the first being the shortest and slightest. The arms of the fourth pair are 4-angular in section, and present a slight groove on the peripheral surface, the groove being caused mainly by the great production of the anterior peripheral margin, which is continued below to form the outer wall of the tentacular sac. Those of the third pair are 3-angular, the peripheral surface presenting a sharp angle. The second pair are 3-angular or irregularly 4-angular; and the first have the peripheral surface rounded, or approach 3-angular.

The fourth and third arms on each side are connected by a peripheral web, which forms the outer wall of the tentacular sac. This web is attached to the inner peripheral margin of the fourth arm, and to the centre of the peripheral surface of the third arm. It extends to near the tip of the fourth arm, but only a short distance along the third. A very small web connects the third and second arms; and the second and first have a small web attached at the base to the peripheral surface of each. It extends a very short distance along the second arm, and a still shorter along the first.

The arms all taper to their extremity. There is a well-marked brachial membrane extending along each side of the acetubular surface of the arms and forming a fold, at whose base the suckers are inserted.

The suckers are arranged in alternate pairs, and this arrangement is observable from the point near the base of the arms at which they first begin to near the tapering extremity, where they become minute tubercles. Each sucker (pl. viii., figs. 10, 11) is sub-spherical or shortly cylindrical in shape, and is borne on a pedicel attached, not to the centre of the base of the sucker, but a little to one side. The margin of the sucker has a horny ring with small teeth more strongly marked on the higher than on the lower side. From the base of each pedicel a raised band runs across the brachial membrane to its edge.

Tentacles.—The tentacles vary in length relatively to the body, but when thrown back and fully extended often reach beyond its extremity. They are oval in section, except at the clavate portion where they are 3-angular. The suckers are similar to those on the arms, but are arranged in alternating rows of four, are larger and have the horny ring more strongly marked. A membrane, similar to that on the arms, is developed on each side of the acetabular surface.

Each tentacle has a muscular band attached for a short distance near its base and widening into a web which connects it with the inner wall of the tentacular sac. The sac is not large enough to receive more than a short portion of the tentacle, and probably contraction is limited to the extent of the muscular band.

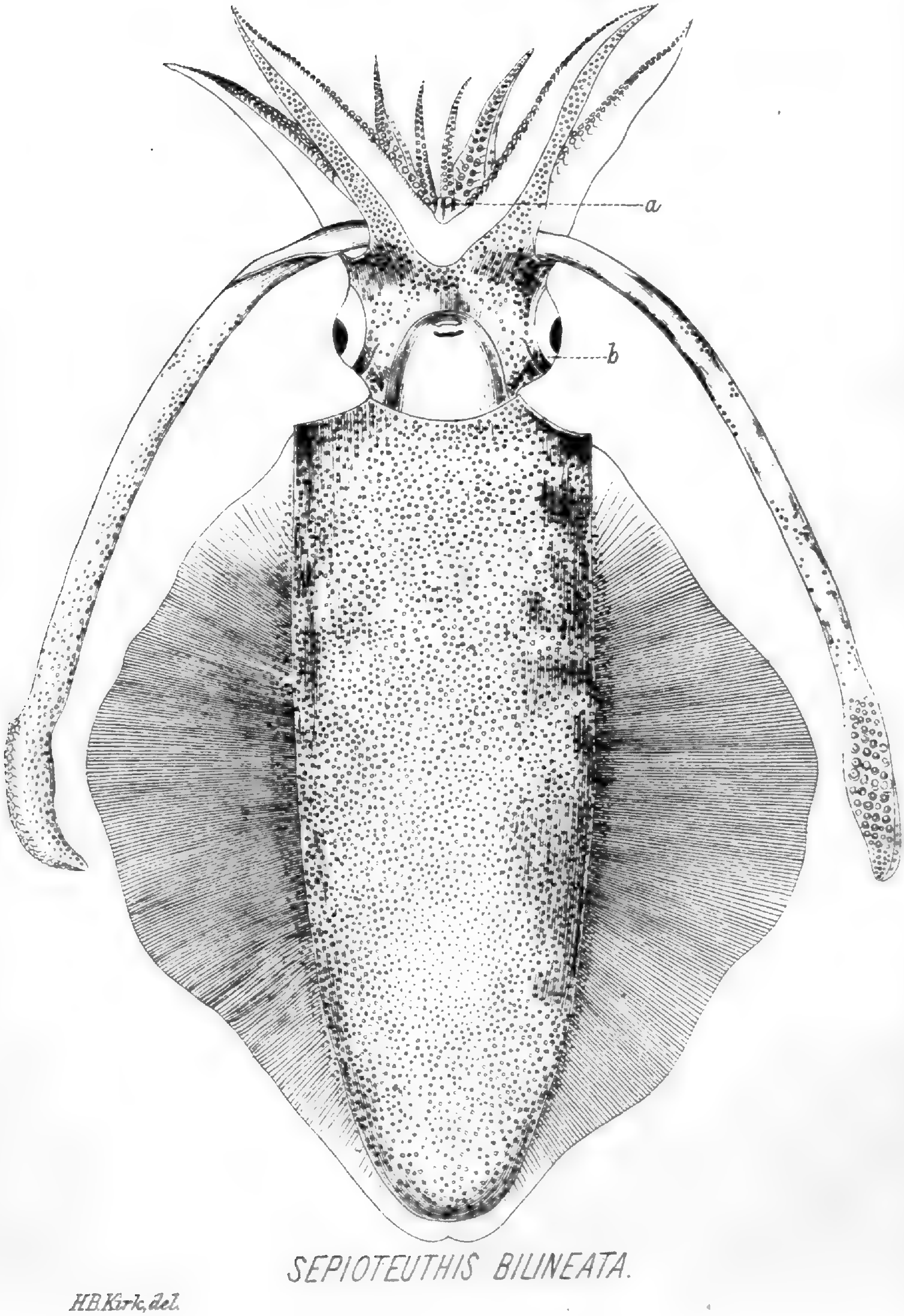
Oral Surface.—The outer lip or buccal membrane (pl. iii. *a*) is a simple membrane with seven marked angles, showing the points of attachment of brachial frœna. The structure here is very similar indeed to that described by Professor Owen as occurring in *Loligopsis ocellata* (Trans. Zool. Soc. of London, vol. xi., pt. v.). Of the frœna, the first springs from the small basal web between the arms of the first pair; on each side of this is one springing from between the second and third arms; next one springing from the base of the acetabular surface of each third arm; then a similar one from each fourth arm. The surface of the buccal membrane is smooth.

The inner lip (pl. vii., fig. 1 *a*.) is thick and muscular, and its border is marked by strong regular corrugations.

The whole surface of the head and body is richly spotted with chromatophores. They extend over the anterior surface of the fins, but only a short distance from the body on the posterior surface. They extend along the peripheral surface of the arms, and even along the surface of the first three brachial frœna. They occur sparingly on the acetabular surfaces of all the arms, and on the peripheral surface of the tentacles. There are none on the funnel.

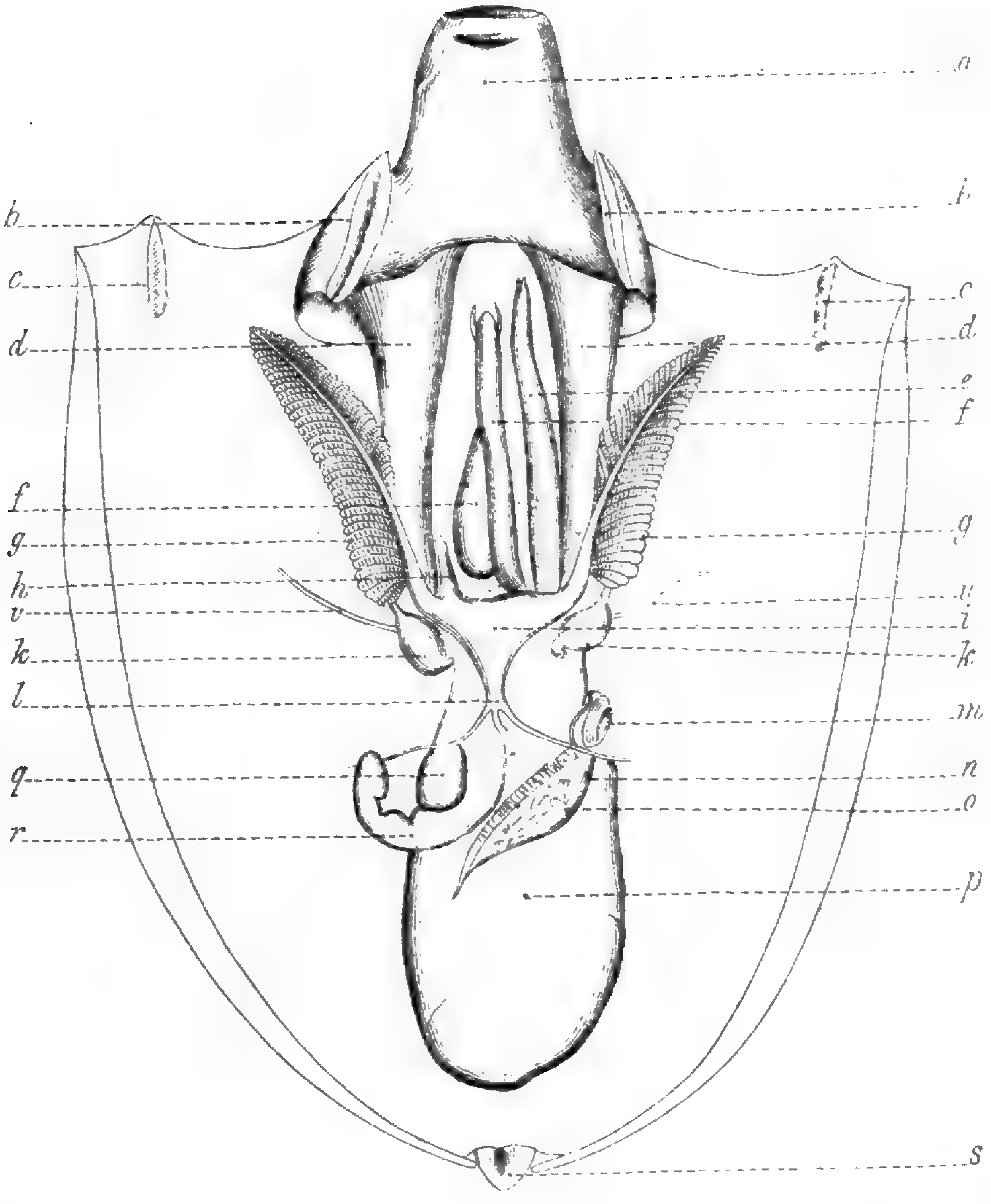
Microscopic Structure of the Integument.

The chromatophores, when examined under the microscope, show, as prevailing colours, black or very deep brown, chocolate-brown, cloudy-purple, full pink, and pale yellow. Each chromatophore appears to have around it a few loose muscular fibres; and at times I have fancied I have detected a loose transparent capsule, with muscular fibres in its walls. In



SEPIOTEUTHIS BILINEATA.

H. B. Kirk, del.



SEPIOTEUTHIS BILINEATA.

H.B.Kirk, del.

such cases the chromatophores are well-defined; but often the outline is very ill-defined in one direction. This may, however, be due to the coloured contents having flowed out, leaving a part of the capsule empty, its thin walls being often invisible from their transparency.

The chromatophores appear to be in two distinct layers, as at times one may be seen distinctly overlying another. Thus a deep brown chromatophore may be seen over a yellow one; pink may be seen over yellow; chocolate-brown over pink, and so on.

Above the layer or layers containing the chromatophores is a colourless cuticular layer; below it is a layer containing muscular fibres.

The whole integument is very loosely attached by fine muscular fibres to the substance of the animal; it is loose, but nowhere wrinkled, and is very elastic.

Cartilages.

The cartilages are—the cephalic cartilage, the neck cartilage, the hinge and articular cartilages, and the pinnal cartilages.

Cephalic cartilage (pl. viii., fig. 2).—The cephalic cartilage forms, when the animal is in a walking position, a roof for the eye-balls. An idea of its general shape may perhaps be best obtained by imagining a broadly cordate leaf with its apex and the base of the midrib infolded towards the centre. The posterior side shows a marked depression, and the outline is here strongly concave. From within the central point of the posterior margin rises a slight prominence, which gives off two small wing-like cartilaginous expansions which lie upon the eye-ball. The anterior outline is concave, as are to some extent the lateral margins. The cartilage is pierced at its centre by the aperture for the gullet and visceral nerve branches. This aperture has its margin strengthened by a cartilaginous ridge on either side, the two ridges receding slightly from the aperture, but becoming confluent on the posterior aspect and rising to form the prominence already noted. In the cup formed by the receding of these ridges lies the peri-œsophageal nerve ring. On either side of the ridge formed by their confluence are two perforations.

Neck cartilage (pl. viii., figs. 3, 4).—Lying on the neck is a cartilage of irregular diamond shape. Its sides are incurved, so as to give it a spoon-shape. Attached to it, and passing upwards, is a double muscular band attached at its opposite extremity to a tough membrane which covers the gladius. Thus the neck of the animal is strongly attached to the anterior part of the mantle. The anterior aspect of the cartilage has a raised central ridge, grooved throughout its length. This ridge corresponds with the channel of the gladius.

Hinge and articular cartilages (pl. iv., *b*, *c*).—The hinge cartilages are two developments, one on each side of the funnel. Part of the cartilage is free and expands slightly on the surface, having a longitudinal central groove. The portion that is imbedded in the substance of the funnel is triangular in section, the base being at the surface. This cartilage is long and narrow, and the ends of the surface-portion are rounded.

Corresponding with these hinge cartilages are two slightly raised cartilaginous ridges, one on each side of the inner posterior surface of the mantle. These cartilages are not so marked as those of *S. brevis*, Owen (Trans. Zool. Soc. of Lond., vol. xi., pt. v.). When the mantle is contracted they fit into the cartilaginous sockets on the funnel. They extend quite to the mantle-border, forming the angles that on the posterior surface give the appearance of shoulders. It is impossible to observe any definite outline in the imbedded portion; indeed it would seem that the ridges are rather hardened elevations of the mantle than true cartilages.

Pinnal cartilages.—A long cartilage, having a low thickened central ridge with thin dilatations on each side, extends the whole length of each fin. A section in the thickest part shows a low triangle, whose broad base lies against the body of the animal, and to whose sides the muscles of the fins are attached; but the outline is in most parts irregular.

A thin cartilaginous plate of oval outline lies at the base of the funnel.

Muscles.

On a dissection along the posterior surface being made, one of the most striking features are the *musculi retractores infundibuli* (pl. iv. *a*) extending from the base of the funnel to somewhat beyond the centre of the anterior surface of the mantle, where they are attached, one on each side of the gladius. In the groove between these elongated muscular masses lie the intestine and ink-sac, the penis and the œsophagus, with the mass of the liver.

The double muscular band already spoken of as being attached to the neck cartilage probably serves to change the position of the neck. The neck has also two well-marked muscular masses lying under the *musculi retractores infundibuli.*

Each arm shows a central mass of muscle-fibres channelled for blood-vessels and nerves. From this central mass radiating fibres are given off to a circular muscular coat lying beneath the surface of the arm.

Gladius (pl. viii., fig. 1).

The gladius is lanceolate in shape, and is transparent. The central rib is well marked, and has a deeply excavated channel. It extends beyond the dilated wings about one-sixth of the total length. The broadest part is at about three-fifths of the total distance from the apex, where the breadth is about one-tenth of the length. The gladius is lodged in the anterior aspect of the mantle; and the posterior wall of its chamber is formed by a tough transparent coat, whose consistency approaches that of cartilage where it covers the apex. The gladius extends the whole length of the mantle.

Circulatory and Respiratory Organs (pls. iv. and v.)

The systemic heart (pl. iv. *i*) lies about the centre of the perivisceral cavity. In shape it is nearly triangular, the base of the triangle lying towards the oral end of the body. The right side is the larger, owing to the great cephalic aorta being given off from this side. Lying at the base of the branchiæ are the large branchial hearts (pl. v., fig. 1*f*), globosely ovoid in shape, and with their axis forming an acute angle with that of the body. At its inner end each has a small fleshy appendage (pl. v., fig. 1*f*′), and each is encased in a chamber with transparent membranous walls (id., *k*).

As it approaches the heart the vena cava (id., *b*) divides, one branch going on each side of the intestine at its point of flexure and entering the branchial heart on its upper surface. Veins (pl. iv., *v*, *v*) are seen converging on the inner side of the mantle to enter the vena cava. These cross from the mantle by the peritoneal membrane which is thickened for the purpose. Similar veins run from the anterior aspect of the body, entering the vena cava with those from the sides of the mantle.

After passing from the branchial heart through the gills the blood enters the systemic heart at the two dilatations ("auricles") already noted as giving the triangular shape to the heart. The left auricle is the more strongly marked, the right being somewhat obscured by the great development at the point whence the cephalic aorta (pl. v., 1 *c*) is given off. Shortly from its commencement this aorta gives off branches to the liver. At its opposite end the heart contracts to give off the posterior aorta (id., *h*), which, shortly after its commencement, divides into three branches, these being borne along reflexions of the peritoneal membrane to the mantle.

The branchiæ (pl. iv., *g*, *g*; pl. v., fig. 1) are large and prominent, the tip extending to beyond the base of the funnel. About 70 non-ciliated lamellæ are given off on each side. The continuation of the branch of the vena cava, after passing through the branchial heart, forms the central axis of the gill on the anterior side; and it is attached throughout the whole length of the gill by a suspensory membrane (id., *a*) to the anterior mantle surface. On the posterior side, the branchial vein forms the central axis. Each lamella is bordered by two capillaries, one running from each of the axes of the gill and meeting at the apex of the lamella, and themselves borne on a fine suspensory membrane. Across the space between them stretch still smaller plume-like lamellæ (id., fig. 2), each with a small capillary. These sub-lamellæ look like repetitions of the entire gill; but, on microscopic examination, it is seen that they consist of a capillary with a very thin membrane thrown into transverse folds (fig. 3) on each side.

The renal organ (fig. 1 *g*) is well-developed on the branches of the vena cava. Two long lobes extend over the heart, which they almost hide; and each of these lobes has a well-marked opening, which communicates with its branch of the vena cava. Thus, if air be blown into one of the openings, it inflates its branch of the vena cava, and also the branchial heart into which that branch opens.

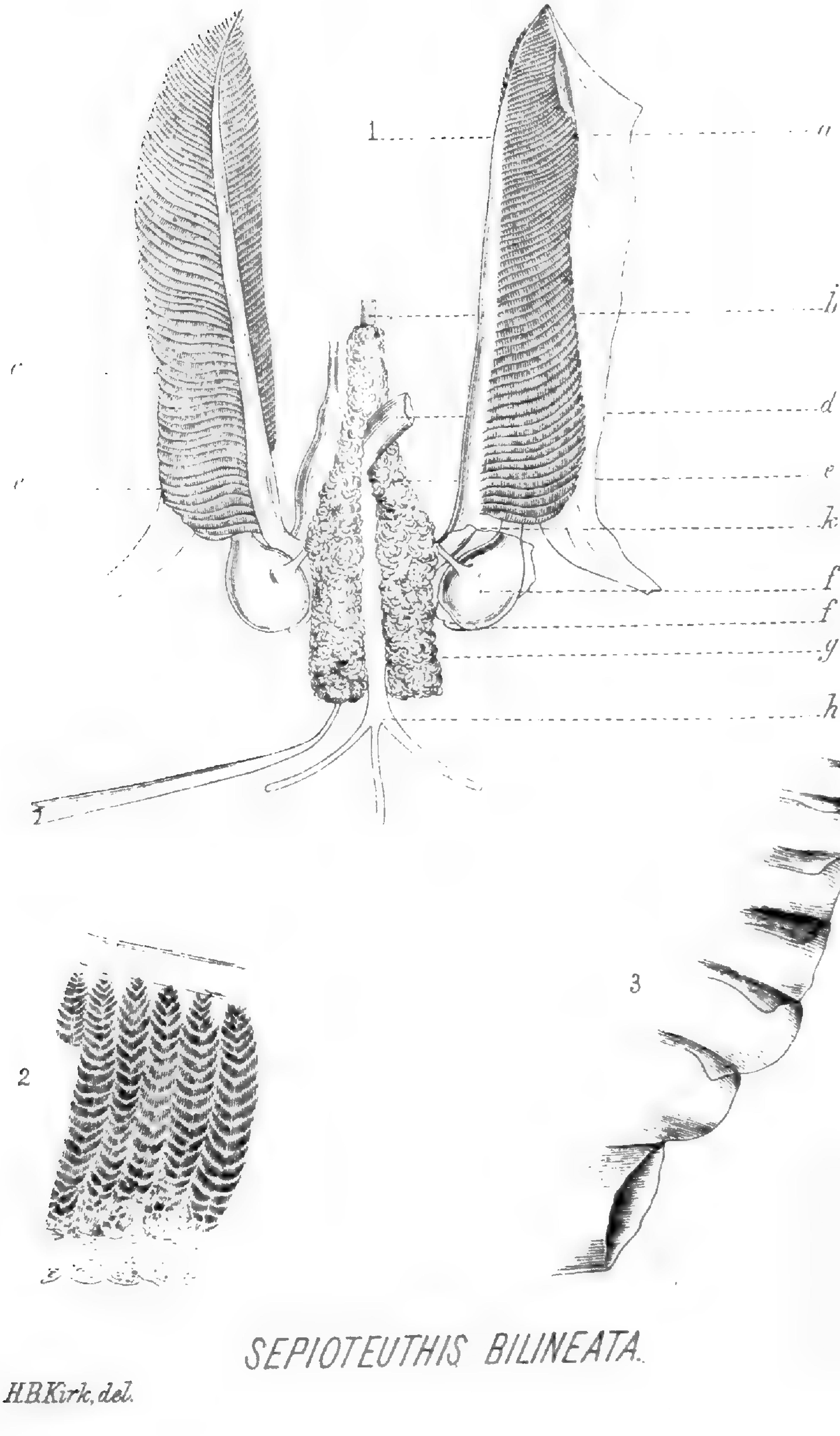
Reproductive Organs.

Male (pl. vi.).—The male organs consist of a testis, vas deferens, "prostate" gland, duct of the "prostate," receptacle of spermatophores and penis. The testis (fig. 1 *g*) lies at the ab-oral end of the body, is large, irregularly oval in outline, and flattened. Its lower outline is concave, its upper convex. It is encased in a thin membrane attached on its anterior surface and uniting it below with the inner anterior surface of the mantle.

The vas deferens communicates with the capsule of the testis towards the upper end. Its commencement seems rather to be lost in the membrane than to have a well-marked opening. It is short but slender, and does not present the convolutions noticed in all descriptions of the male organs of Cephalopods that I have seen.

The vas deferens opens into a long, cylindrical vesicula seminalis, which leads to the "prostate" gland. The walls of the vesicula present well-marked transverse plicæ. Except that it narrows at either end, it is of about the same thickness throughout. It contains spermatozoa, which appear, when examined with the ¼-in. objective, to be simple straight rods. Though the walls of the vesicula appear to be thick and white, they are in reality thin and transparent, the white colour being caused by the spermatozoa. The plicæ may possibly be due to only partial distention.

The "prostate" gland (fig. 1 *d*; fig. 2) is a delicate tube, presenting marked convolutions, and having the appearance, when viewed on the posterior aspect, of a spiral coil. At the point where the vesicula seminalis enters it is dilated (3); then there is a strong convolution; then a slightly expanding tubular portion (2), which leads to a sac-like portion (1). Near the point where the vesicula enters is a small cœcal dilatation (4); and a similar dilatation is produced from the saccular portion from which the duct springs.



SEPIOTEUTHIS BILINEATA.

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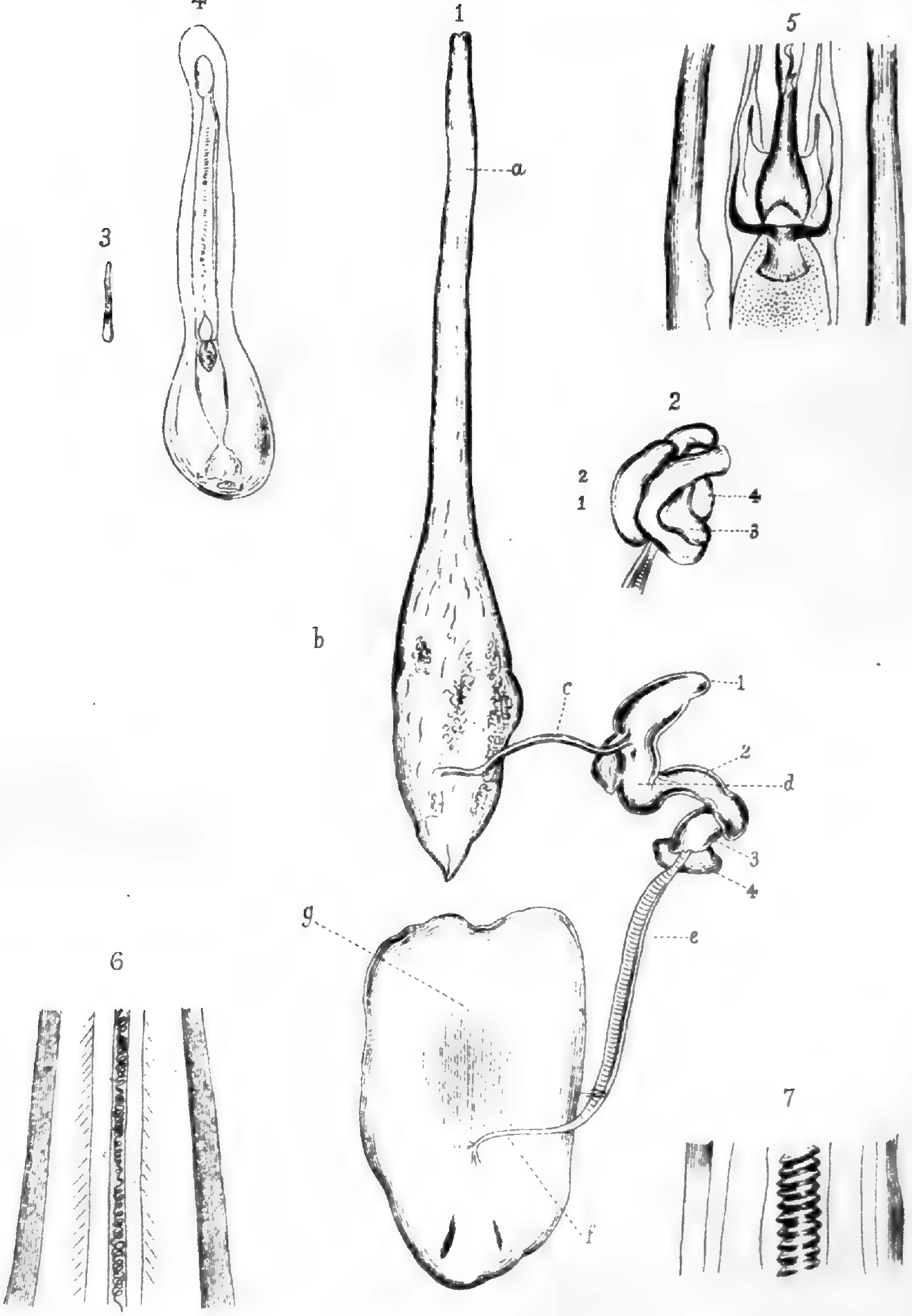

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From the saccular portion, near the opening of this dilatation, springs the duct of the "prostate" (*c*). The wall of the "prostate" contains a network of branching and interlacing fibres.

The "prostate" gland differs from that of *S. brevis*, Owen, where it is described as an "oblong, blind, glandular sac." *Loligopsis ocellata*, Owen, too, shows a blind sac with a single duct for ingress and egress. Indeed this character seems common, so far as I have been able to discover; but the species at present under notice differs widely in having the "prostate" a thickened tube or canal with ingress at one end and egress near the other.

The duct of the "prostate" (fig. 1 *c*) is slender, and has transparent walls. It leads to the receptacle of spermatophores, into which it opens near its upper end.

The receptacle of spermatophores (*b*) is a large sac with thin transparent walls, and is usually packed with spermatophores and loose spermatozoa. It opens by a wide mouth into the penis (*a*) of whose base it appears to be a simple dilatation.

The penis tapers gradually towards its opening, which has an uneven, almost fringed margin.

When *in sitû* the vesicula seminalis and the duct of the "prostate" lie parallel to each other along the receptacle of spermatophores, to whose walls and to each other they are held by a membranous connection. The whorls of the prostate are held together by similar connections, so closely as to require the exercise of the utmost care to sever them without injury to the organ. The vesicula, duct, and receptacle of spermatophores thus held together lie transversely to the axis of the testis.

Spermatophores (pl. vi., figs. 3–7).—A common length of the spermatophores is about 9 lines, but this is often exceeded. The shape varies somewhat, but the general outline is the same. One end is thickened, often club-shaped, or with a knob; from this end the spermatophore tapers, but as the opposite end is approached there is often a slight dilatation and the end is obtuse, never, so far as I have been able to observe, filamentous. The outer case is transparent and of tolerable consistency. The thick end is mainly occupied by a sac containing spermatozoa, which extends for varying distances, but seldom, if ever, half the length of the spermatophore. To this sac is attached a sponge-like body of definite though slightly varying shape, resembling the turned handle of an awl. This body fits into the spermatophoric tube like a piston. From it extends towards the thin end of the tube a flat spirally coiled thread enclosed in a transparent case. The thread may extend to the thin end of the spermatophore and be there attached, or it may extend nearly to the end and then be recurved, or it may not extend right to the end.

Professor Huxley (Anat. of Invertebrated Animals), on the authority of M. Milne-Edwards, describes the spring and the piston-like body as resembling the sponge of a gun with a spiral screw turned on the handle. I have carefully endeavoured to confirm this observation so far as the species under notice is concerned, but have not been able to do so. There seems to be always a spirally coiled thread encased in a transparent tube or sheath. The nearest approach to an axis bearing a screw is when the coils are thrown close together, as often happens. I have added a sketch (fig. 7) of a close portion of a coil, drawn from the $\frac{1}{4}$ in. objective with the camera lucida.

Female.—The only female specimen I have been able to obtain is a very small one (about 2 inch. in length) and much mutilated. The organs I have been able to observe are the long, narrow, nidamental glands, lying on the median line just above the gills, the oval flat and apparently stalked accessory glands immediately below them, and the ovary. The ovary in this specimen is very small and is somewhat pyramidal in shape, the apex lying at the upper end of the body. I am not sure that I have correctly observed the oviduct, but what I take to be the oviduct opens on the left side, having passed under the branchial heart.

(Note.—The fact that this specimen is the only female among ten that I have examined, and that the males were all fully ready for congress, would seem to show that sexual selection may have considerable scope among the members of this species.)

Alimentary System, (pl. vii.)

Mandibles (fig. 2).—Within the annular inner lip already noticed, are two vertical conchiolin jaws forming the beak, the posterior jaw overlapping the anterior one. The exposed parts are reddish-brown in colour, while the covered parts are transparent and colourless. Each jaw consists of an uncus, alæ and apophysis, the alæ being backward and lateral expansions of the uncus.

In the anterior or upper-jaw the uncus runs forward in a decurved line, terminating in a sharp point. The outer border of the alæ forms a continuous curve with this line, and runs backward to about half the length of the apophysis, from which it stands out prominently. The lower border of the alæ is a concave curve; and the front border, from the margin of the uncus, presents a waved outline. The apophysis extends downwards, its greatest length being at its outer margin. It is fully twice the size of uncus and alæ. Its inner border forms a convex curve, which extends round to the under-border, where it becomes concave.

In the posterior or under-jaw the uncus is not so large as that of the upper-jaw, is more obtuse, and is proportionately stouter. The alæ extend but a short distance backwards on the outer aspect, being here shortened by a concave border. At the sides they expand and become irregularly oblong in shape. They have a somewhat irregularly waved outline and extend forward beyond the uncus, so as to cover the inner portion of the alæ of the upper-jaw. The apophysis extends outwards and backwards with a slight curve, its shortest length being at the median line, where the margin is concave. Its greatest length is within, where the margin is convex. The apophysis slopes rapidly from the median line, leaving a well marked keel.

(Note.—In describing the jaws I have not adhered to the rule of speaking of the animal as though it were in a walking position, but have noticed them as they are detached and shown in the drawing.)

Taste-organ (fig. 3 *a*).—Within the jaws and on the posterior side of the mouth is the gustatory organ, showing a fairly well-marked division into two lobes. It is soft and uncurved, and under the microscope shows interlacing fibres.

Odontophore (fig. 3 *b*).—Next follows the broad radular band which works in and out of a socket in the centre of a raised papilla. It is armed with seven rows of silicious teeth. Its upper part is expanded, and has the margins recurved. The lower part has the margins incurved so as to form a cylinder, and it is probable that this part is but little used in mastication. The teeth on the upper part are stronger and stouter.

The central row of teeth consists of slightly curved, rather stout and obtuse spines, whose bases develope short obtuse prominences, one on each side, giving the denticles of this row a 3-fid appearance. The first lateral row consists of slightly curved spines, somewhat more acute than those of the median row. The spines have the base also developed as in the median row, but the inner basal spine is somewhat shorter than the outer. The next two rows consist of longer curved spines without basal spinules.

Faucial follicles (fig. 3 *d*). Next come the two "faucial follicles." They are attached along one side, starting at the tongue and continuing to the commencement of the œsophagus. They are very well developed. The free margin is straight, and when folded over they form a covered channel over the radular socket.

Salivary glands.—The mandibles, tongue, odontophore, and faucial follicles are contained in the buccal mass, which narrows into the œsophagus. Outside the buccal mass, at the commencement of the œsophagus, are two slightly-raised papillæ, the lingual salivary glands. Further along the œsophagus, and imbedded in the liver, are two salivary glands with well-marked ducts.

Œsophagus (fig. 1 *c*).—The buccal mass narrows into the œsophagus, which passes through the nerve-collar and peri-œsophageal cartilaginous ring, and is continued to the stomach without ingluvial dilatation. It dilates slightly as it enters the stomach.

Stomach (fig. 1 *m*).—The stomach is saccular and thick-walled. It shows two slight constrictions. The walls present on their inner surface strong longitudinal plicæ, which are prolonged into the intestine, and continue throughout its length.

Lying within the stomach is a loose tunic or sac with thick, though almost transparent, walls, showing longitudinal plicæ or corrugations. It has a wide orifice at one end, and at the other is thin or open. I have not been able to discover that it has any organic connection with the walls of the stomach, but as I have found it in all the specimens I have examined, I do not think its occurrence can be accidental.

The pyloric opening is at the lower end of the stomach and close to the cardiac opening. The commencement of the intestine is shown by a well-marked constriction. Neither cardiac nor pyloric opening is protected by a valve.

Pyloric cœcum (fig. 1 *n*).—Immediately following the constriction there is given off a long cœcal dilatation with thin but tough transparent walls. It expands at its attached end and tapers gradually to its opposite rounded extremity. When *in sitû* it forms a half curve round the stomach. As will be presently noticed, the hepatic ducts open into this cœcum. On the broadest part of its wall, at the attached end is a circular coat formed by a radiating mass, whose nature I have not discovered.

Intestine (fig. 1 *h*).—From the pyloric cœcum the intestine narrows gradually until the anus is reached. At somewhat less than half the distance between the cœcum and the anus it is folded over so as to form a distinct flexure. The anus has two stalked and leaf-like lateral valves.

Ink-sac (fig. 1 *h*).—The ink-sac is large and broad. Its highest and broadest part lies near the intestinal flexure, and from this part it narrows to its opening into the anus. Its coat is silvery and, in places, iridescent; and the dark sepia shows through the sac-walls. Throughout its length it is held closely to the intestine by a membrane.

Liver (fig. 1 *f*).—The liver is large, extending from immediately above the cephalic cartilage for about two-thirds of the length of the œsophagus. It is encased in a capsule showing under the miscroscope close fibres and yellow concretions. The liver itself is loose, and under the microscope shows clustered follicles and interlacing tubes with abundant yellow concretions. The bilobed condition is not observable.

The hepatic ducts are two, and open close together into the commencement of the pyloric cœcum. They have developed upon them the light-coloured spongy "pancreatic" glands, which show under the microscope a loose fibrous tissue interspersed with yellow concretions (fig. 4). The fibrillar tissue is more loose and the yellow concretions larger, but less numerous, than in the liver. There is everywhere a network of ramifying tubes.

The whole of the organs are enclosed in a peritoneal membrane, which sends three mesenteric reflexions to the mantle, one of the arterial branches from the posterior aorta running along the anterior border of each reflexion.

Nervous System.

The main masses of the nervous system are aggregated into a large circular band (pl. vii., fig. 1 *d*) surrounding the gullet and lying in the aperture of the cephalic cartilage. On the anterior side of the gullet lie the cerebral and superior buccal ganglia, almost confluent and on the posterior surface are the inferior buccal, pedal, and parieto-splanchnic ganglia. The cerebral ganglion sends off optic nerves which enlarge greatly, forming the optic ganglia (pl. vii., fig. 1 *e*). I have not been able to discover the auditory nerves. From the parieto-splanchnic ganglia two nerves run, one on each side, towards the anterior aspect of the animal, passing under the columellar muscle and each forming on the back of the pallial chamber and at the side of the gladius a large stellate ganglion (fig. 1 *g*), which sends branches over the mantle. For about half their course the nerves to these ganglia are imbedded in the liver.

On the intestine, at the point where the pyloric cœcum is given off is a well-marked ganglion (fig. 1 *l*), which appears to be connected with the main nervous centres by a nerve following the course of the intestine. This ganglion gives off radiating fibres on all sides.

Eyes.

The eyes are lateral, are large and prominent and are covered by a transparent layer of integument. The eyeball is invested by a silvery tapetum composed of loose cells in two layers, one or both of which contain numerous refracting corpuscles. In front this passes into the loose iris, but I have not been able to observe any cartilage of the iris. The tapetum is lightly attached and can be easily removed. Then comes a thin, transparent, apparently muscular membrane, covering a thin cartilaginous coat which becomes thickened slightly in front. The membrane is not continued beyond the thickened front edge of the cartilaginous coat. Within the opening is suspended a cartilaginous ring, to which is attached a fringed radiating membrane having the lens in its centre. This is the corpus ciliare. The lens is surrounded by a deep groove, so as to form practically two lenses, the outer one being the smaller, the inner the larger and more convex. It is in the groove of the lens that the fringe of the corpus ciliare is attached. Within the eye is the fluid vitreous humour. The eye is lined by a delicate layer of loose cells, underlaid by a pigment layer, and then the inner layer of the retina.

Behind the eyeball, and forming as it were a cushion at its base, is a peculiar development of nervous tissue, the "white body." It consists of rounded or irregular, apparently nucleated cells.

Auditory Organs.

In the substance of the cephalic cartilage are excavated two auditory chambers, one on either side of the ridge already referred to. Their walls give rise to several rounded protuberances, which are most numerous on the side nearest to the nervous ring. The two chambers approach each other on the posterior side, where the dividing wall becomes thin and transparent. Each contains a single large otolith, composed of carbonate of lime. The otoliths, (pl. viii., figs. 12–14) are somewhat flattened, and are similar in shape, though one is a little larger than the other. The main portion of the otolith has one of its margins markedly convex, while the other is roughened and uneven, with two fairly well-marked excavations. From this mass the otolith narrows to an end. All the surface, except the roughened part referred to, is white and smooth so far as can be seen with a pocket magnifier; but the microscope shows a rugose surface.

EXPLANATION OF PLATES III.-VIII.

PLATE III.—*Sepioteuthis bilineata.*

a, buccal membrane.
b, "oreille externelle."

PLATE IV.—*Dissection along posterior surface, showing position of organs.*

a, funnel.
b,b, hinge cartilages.
c,c, articular cartilages.
d,d, musculi retractores infundibuli.
e, penis.
f, intestine.
f′, ink-sac.
g,g, branchiæ.
h. descending aorta.
v,v, veins from the mantle.
k,k, branchial hearts with appendages.
l, ascending aorta with arterial branches.

Plate III.—*continued.*

m, prostate gland.
n, vesicula seminalis.
o, receptacle of spermatophores.
p, testis.
q, stomach.
r, pyloric cœcum.
s, end of the gladius, exposed by tearing the membranous covering.

Plate V.—*Circulatory and Respiratory Organs.*

Fig. 1. *a*, suspensory membrane of branchia.
b, vena cava.
c, descending aorta.
d, intestine, cut and turned aside to show branching of vena cava.
e,*e′*, left and right branches of vena cava, covered by renal organs.
f, branchial heart.
f′, appendage of branchial heart.
g, left lobe of renal organ. The opening is below; the tip of the blow-tube is inserted in the opening of the right lobe.
h, ascending aorta, with arterial branches.
k, cut edge of membrane encasing branchial heart.

Fig. 2. Portion of a single branchial lamella, drawn with the camera lucida from the 1 in. objective.

Fig. 3. Portion of the last, drawn with the camera lucida from the ¼ in. objective, and showing the way in which the transverse capillary membranes of the lamellæ are folded.

Plate VI.—*Male Organs.*

Fig. 1. Sketch of the male organs after the membranes holding the vesicula seminalis, duct of the prostate, and whorls of the prostate, have been severed.
a, penis.
b, receptacle of spermatophores.
c, duct of the prostate.
d, prostate gland.
e, vesicula seminalis.
f, vas deferens.
g, testis.

Fig. 2. The prostate gland as *in sitû.* The small figures, 1, 2, 3, 4, show the parts so numbered in fig. 1.

Fig. 3. A spermatophore, natural size.

Fig. 4. The same enlarged.

Fig. 5. A portion of the same, drawn with the camera lucida from the 1 in. objective.

Fig. 6. Another portion.

Fig. 7. A close portion of a spiral coil from near the thin end of a spermatophore, showing a solid appearance. From the ¼ in. objective with the camera lucida.

PLATE VII.—*Alimentary and Nervous Systems.*

Fig. 1. Sketch of Alimentary and main portions of Nervous System.

a, inner lip.
b, buccal mass.
c, œsophagus.
d, nerve collar.
e, optic ganglion.
f, liver.
g, ganglion stellatum.
h, intestine, ending in anus with lateral anal valves.
i, ink-sac.
k, pancreatic glands, along the course of the hepatic duct.
l, splanchnic ganglion.
m, stomach.
n, cœcum.

Fig. 2. Mandibles.

a, anterior or upper.
b, posterior or lower.

Fig. 3. Buccal mass cut open and mandibles removed. The point of the curved needle is inserted in the œsophagus.

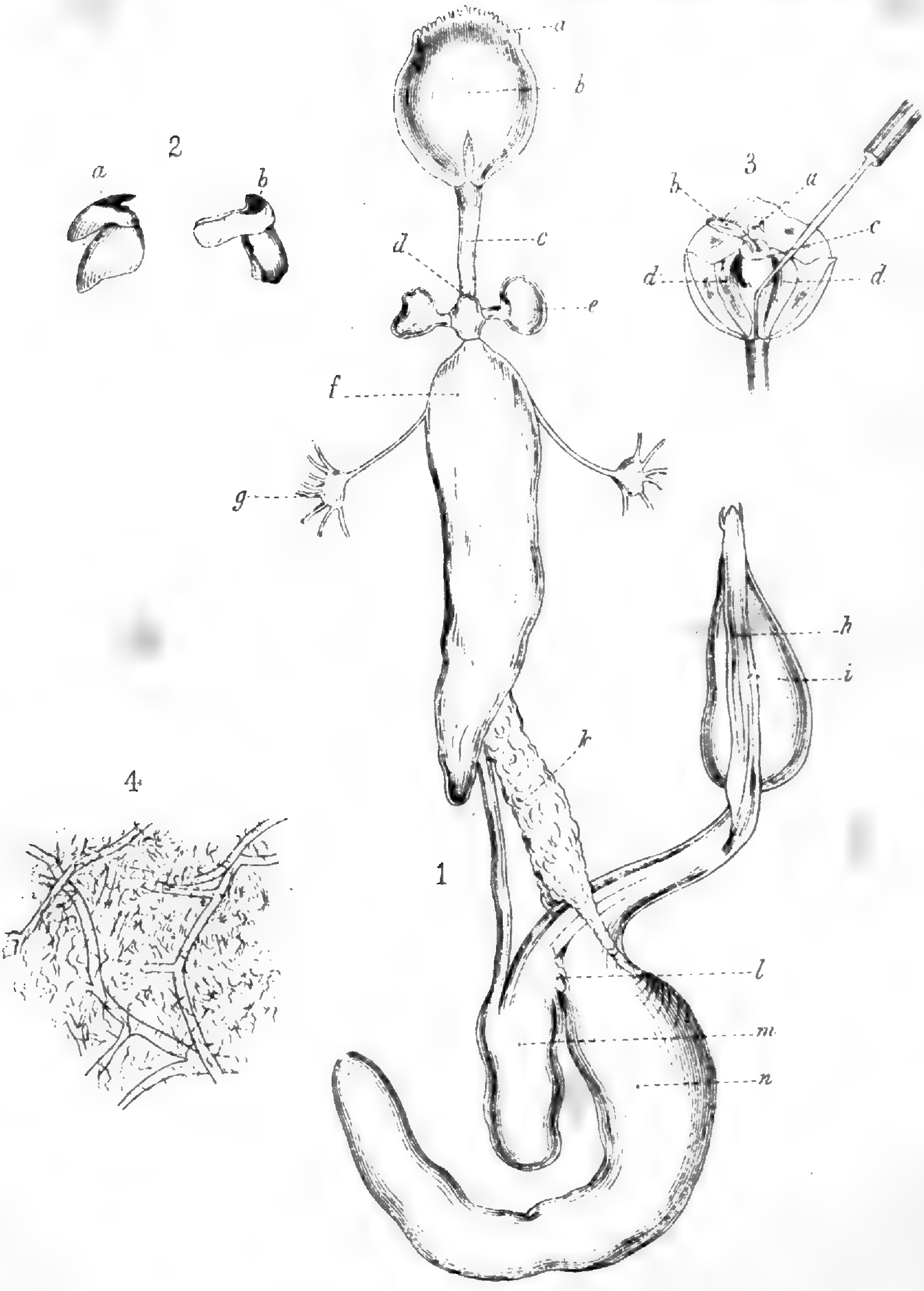
a, taste organ.
b, odontophore, turned aside.
c, socket of odontophore.
d,d, faucial follicles.

Fig. 4. Portion of pancreatic gland, drawn from the 1 in. objective with the camera lucida.

PLATE VIII.

Fig. 1. Gladius.
2. Cephalic cartilage.
3, 4. Neck cartilage, posterior and anterior aspects; showing attached muscular bands.
5-9. Sections through 1st, 2nd, 3rd, and 4th right arms and clavate portion of tentacle. The dark line shows the extent of the chromatophoric surface.
10. A single sucker.
11. Section of the same.
12. An otolith, natural size, on dark ground.
13, 14. View of both surfaces of an otolith, much enlarged.
15. The funnel cut open.

i, the infundibular valve.



SEPIOTEUTHIS BILINEATA.

H.B. Kirk. del.

SEPIOTEUTHIS BILINEATA.

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ART. VII.—*Notes on some New Zealand Land Shells, with Descriptions of new Species.* By Professor F. W. HUTTON.

[*Read before the Philosophical Institute of Canterbury, 7th June,* 1883.]

Plates IX.–XI.

I HAVE divided this paper into two portions, the first containing descriptions of the animals and dentition of species that have already been described, the second containing descriptions of new species. In the first part I have arranged the species according to the Manual of New Zealand Mollusca (1880), and under the same names as there given, although the dentition proves in many cases that this arrangement is quite wrong. I hope shortly to offer a paper containing a new and more natural grouping of all our Land Mollusca.

A. *Old Species.*

PATULA PILULA, Reeve (= *iota*, Pf.). Pl. ix, fig. K., and pl. xi., fig. M.

Jaw arcuate, with about 35 flat ribs, which indent the concave but not the convex margin.

Dentition, 27–1–27, varying from 25 to 29. Laterals from 13 to 15.

Central tooth small, narrower in front than behind, longer than broad, the reflexed portion constricted at the sides, covering about half the base, with a rather large acute point. First lateral like the central but larger; the other laterals with a deep notch on the outer side of the reflexed portion, the cutting point increasing in length outwards. Marginals broader than long, the inner with a cutting point and a denticle on each side of it; the outer serrated, one of the inner points longer than the others.

Hab. Auckland (T. F. Cheeseman).

PATULA DIMORPHA, Pfeiffer. Pl. ix., fig. V.

Jaw slender, slightly arcuated, with about 35 flat ribs which indent both surfaces.

Dentition, 35–1–35, with 18 laterals in a large specimen. In smaller specimens the number of teeth is sometimes as few as 22 with 10 laterals.

Central tooth with the base narrower in front, longer than broad; reflexed portion narrow, two-thirds the length of the base, with a minute lateral cusp on each side, the point moderate. Laterals with the inner side of the reflexed portion sinuated, outer side with a short, broad, emarginate process, the cutting points longer than on the central tooth. Marginals at first longer than broad, but near the exterior broader than long; the inner with a bidentate point; the outer also with a bidentate point, and one or two smaller ones outside it.

Hab. Auckland (T. F. Cheeseman).

PATULA CELINDE, Gray. Pl. ix., fig. O, and pl. xi., fig. U.

Jaw slightly arcuate, with flat ribs; very delicate.

Dentition, 18–1–18. Laterals about 5.

Central tooth rectangular, as broad as long; the reflexed portion tricuspid, extending over half the base, with a large, clavate, median cusp extending quite to the posterior margin, and with a rather large cutting point. Laterals like the central tooth. Inner marginals with an oblique reflexed portion carrying a long point at the end, the outer side indented and with a minute point. Outer marginals broader than long, with two points; at first the inner point is much the larger, but near the outer edge both points get equal.

Hab. Auckland (T. F. Cheeseman).

The shell has distant membranaceous plaits which are produced at the periphery into triangular processes.

PATULA COMA, Gray. Pl. ix., fig. C, and pl. xi., fig. K.

Animal small, mantle rather posterior, the tail not produced behind the shell; eye-peduncles large, clavate, approximated at their bases; the tentacles short. Yellowish-white, eye-peduncles and a stripe down each side of the head dark purple.

Jaw finely striated, arcuated, not tapering, with a slight median projection.

Dentition, 13–1–13; varying from 12 to 15. Laterals 4 or 5.

Central tooth with the base broader than, or as broad as, long; the reflexed portion slightly contracted near the attachment, and tricuspid; the median cusp with a long point reaching beyond the posterior margin of the base. Lateral teeth similar to the central, but with a longer base, and a shorter reflexed portion. Marginals with a tridentate cutting point, which is bidentate on the penultimate and absent on the minute outer tooth.

Hab. I have examined the radulas of seven individuals—five sent by Mr. Cheeseman from Auckland, and two by Mr. Helms from Greymouth. The living animal was sent by Mr. Helms.

In the shell the interstices between the ribs are finely striated with growth-lines.

PATULA LUCETTA, Hutton (=*coma*, Pfeiffer, not of Gray). Pl. xi., fig. A.

Animal like *P. coma*, but white; the peduncles purplish, and a band on each side of the head slightly speckled with purple.

Jaw smooth, membranous, slightly tapering to each end.

Dentition, 14–1–14. Laterals 6.

Central tooth rectangular, as long as broad; the reflexed portion less than half the base, tricuspid; the middle cusp with its point reaching to the posterior margin. Laterals about 6, the inner with the side-cusps equal, and the middle cusp with a large point projecting beyond the posterior margin; in the outer laterals the inner cusp becomes obsolete. Marginals broader than long, with three points; the last without points, and the penultimate with only two points.

Hab. Hawke's Bay (W. Colenso).

The shell in this species differs from that of *P. coma* in having the ribs nearer together and the spire more elevated.

PATULA BUCCINELLA, Reeve (= *gamma*, Pf.). Pl. ix., fig. D.

Jaw finely striated, with a slight median projection.

Dentition, 10–1–10. Laterals 3 or 4.

Central tooth rectangular, longer than broad; the reflexed portion less than half the length of the base, tricuspid, the middle cusp with a short cutting point. The first three laterals like the central tooth, but the reflexed portion longer and the cutting point reaching the posterior margin of the base. Marginals broad, the inner ones with a bidentate cutting point at the inner corner; the last tooth minute, without any cutting point.

Hab. I have examined the dentition of three individuals from Auckland, and found it alike in all.

The shell in this species is broadly umbilicated, but the umbilicus varies a good deal; the spire is flat and the interstices between the ribs finely striated with growth-lines.

PATULA ANGUICULUS, Reeve (= *theta*, Pf.)? Pl. ix., fig. E.

Animal like that of *coma*; darkish-grey, the foot white with a grey patch on the back behind the shell.

Jaw membranous, very delicate.

Dentition, 11–1–11. Laterals 5.

Central tooth rectangular, the base as broad as long; the reflexed portion tricuspid, the median cusp covering about two-thirds of the base and swollen at the end. The first two laterals are like the central tooth, but more elongated, and the median cusp reaching nearly to the posterior margin of the base: the outer laterals have a small cutting point on each of the side-cusps. Inner marginals with three points; outer marginals very broad and with 4 or 5 points.

Hab. Greymouth (R. Helms).

As I do not feel sure about the identification of this species I give a description of the shell.

Shell very broadly umbilicated, the spire almost flat: whorls 4½, with nearly straight ribs, about 30 or 35 in the tenth of an inch, the interstices finely reticulated: aperture sub-vertical, lunately sub-circular. Colour dark reddish-brown, banded with horny. Greatest diameter ·1; least ·07.

Patula ida, Gray (*ide*). Pl. ix., fig. u.

Animal with the body rather short and narrow; mantle sub-central, rather anterior, slightly reflected over the peristome of the shell; foot narrow, extending behind the shell, the tail truncated and furnished with a mucous gland: no locomotive disc. Eye-peduncles very long, cylindrical, approximated at their bases; tentacles long. Colour pale olive-brown spotted with dark brown; a longitudinal dark brown line runs round the side of the foot, below which it is edged with alternate, transverse, bars of brown and pale olive-brown.

Jaw, with about 30 flat ribs, each transversely striated.

Dentition, 22–1–22. Laterals about 8.

Central tooth rectangular, longer than broad; the reflexed portion tricuspid, extending over a third of the base, the median cusp long and straight, but not reaching the posterior margin, the cutting point rather large, projecting beyond the margin; the side-cusps constricted on the outer side. Laterals like the central, but rather oblique, the outer side-cusps being larger than the inner. Inner marginals with a single bidentate cutting point; outer marginals broader than long, with several cutting points.

Hab. Greymouth (R. Helms).

Patula corniculum, Reeve (= *eta*, Pf.). Pl. ix., fig. f.

Animal like *coma*, but the eye-peduncles smaller and not clavate. White, slightly speckled with grey above; peduncles purplish.

Jaw finely striated.

Dentition, 14–1–14. Laterals 4 or 5.

Central tooth rectangular, longer than broad; the reflexed portion about half the length of the base, tricuspid, the middle cusp long, extending to the posterior margin and armed with a small point. Laterals like the central tooth, but the middle cusp more clavate. Inner marginals with one, and outer with three acute points.

Hab. Eyreton, North Canterbury (C. Chilton).

In the shell the interstices between the ribs are finely reticulated.

Patula infecta, Reeve (= *zeta*, Pf.). Pl. ix., fig. h.

Animal like *coma*. White, eye-peduncles and a stripe on each side of the head greyish.

Jaw finely striated.

Dentition, 15–1–15. Laterals 3.

Central tooth rectangular, broader than long; the reflexed portion tricuspid; the side-cusps constricted on the outer side; middle cusp reaching to the posterior margin and the cutting point projecting beyond. First lateral like the central; the others smaller, bicuspid, the inner cusp small, the outer long, narrow, and with a small point. Marginals tridentate, the denticles nearly equal in size.

Hab. Greymouth (R. Helms).

The surface of the shell between the ribs is finely reticulated.

PATULA IGNIFLUA, Reeve (=*lambda*, Pf.). Pl. x., fig. H.

Animal with the mantle sub-central, slightly reflected over the peristome of the shell: tail pointed, with a caudal mucous gland, but no papilla; eye-peduncles approximated at their bases. White, with clusters of brown spots and an interrupted brown line round the sides, below which the margin of the foot is striped with brown and white transverse bands; a streak on each side of the head black; sole of the foot mottled with brown, arranged in irregular transverse bands, which slope backwards and form an obtuse angle in the centre.

Hab. Rangitira Bush, Temuka (C. Chilton).

For the jaw and dentition of this species see Trans. N.Z. Inst., xiv., p. 151.

PATULA TAPIRINA, Hutton. Pl. ix., fig. G.

Animal like *coma*; colour white; peduncles, tentacles, and a stripe down each side of the head purplish black.

Hab. Rangitira Bush, Temuka (C. Chilton).

For the jaw and dentition of this species see Trans., N.Z. Inst., xiv., p. 150 (*P. coma*).

PATULA PORTIA. Gray. Pl. ix., fig. T.

Jaw arched, not tapering, with about 34 flat ribs, or plates.

Dentition, 24–1–24. Laterals about 9.

Central tooth rather wedge-shaped, broader behind, longer than broad; the reflexed portion triangular, slightly constricted, not covering half the base, the point small; laterals rather oblique, broader than the central, the reflexed portion bicuspid with a long point on the inner cusp. They pass gradually into the marginals which are rather broader than long, with a long cutting point, and a small one on each side of it.

Hab. Auckland (Cheeseman).

PATULA VENULATA, Pfeiffer. Pl. xi., fig. Y.

Jaw arched, with about 10 flat ribs in the centre; the ends striated.

Dentition, 17–1–17. Laterals 6.

Central tooth rectangular, longer than broad; the reflexed portion tricuspid, the lateral cusps small and constricted on the outer side; central cusp reaching nearly three quarters of the length of the base, the cutting point large. Laterals like the central, but broader, and the lateral cusps with points, of which the inner is the larger. The cusps get smaller, and the inner cutting point gets larger until the inner marginals have two, nearly equal, points and a small outside point. The outer marginals have the two points coalesced into a single bidentate point; while the outer point gets larger. The 17th marginal has only two small points.

Hab. Greymouth (R. Helms).

Gerontia pantherina, Hutton. Pl. ix., fig. i., and pl. xi., fig. r.

Jaw slightly arcuated, smooth, striated.

Dentition, 24–1–24. Laterals 8 or 9.

Central tooth rectangular, rather broader than long; the reflexed portion tricuspid, extending over half the base, the median cusp reaching the posterior margin; all the cusps with moderate cutting points. Laterals tricuspid, the outer side-cusps larger than the inner; each with a point. Outer laterals, or inner marginals, bicuspid, the outer cusp smaller; inner margin of the inner cusp emarginate and with a cutting point; a large acute cutting point at the end. Outer marginals longer than broad, with a broad bidentate point; the last without any point.

Hab. Greymouth (R. Helms).

The shell in this species is like *macrocyclis*, but the teeth are very different.

Microphysa (?) pumila, Hutton. Pl. ix., fig. q.

Jaw, none seen.

Dentition, 13–1–13. Laterals (?).

Central tooth longer than broad; the reflexed portion tricuspid, the middle cusp longer and with a sharp point. Laterals bicuspid, the two cusps separated, each with a point; the inner cusp larger. Marginals apparently like the laterals, but they are too minute to be made out distinctly by me.

Hab. Christchurch (J. F. Armstrong).

Strobila leioda, Hutton. Pl. ix., fig. p.

Jaw, none seen.

Dentition, 12–1–12. Laterals 4.

Central tooth rectangular, as broad as long; the reflexed portion small, tricuspid; middle cusp not reaching the posterior margin. Laterals larger, longer than broad, tricuspid, the middle cusp elongated, clavate, reaching the posterior margin. Marginals broader than long, the three inner with three minute points, the five outer without points.

Hab. Greymouth (R. Helms).

Vitrina dimidiata, Pfeiffer. Pl. ix., fig. y, and pl. xi., fig. o.

Animal, in spirit, is very much larger than the shell; the mantle appears to be sub-central, or anterior, and is broadly expanded over the shell, leaving a central opening only, but not divided into lobes; there is no locomotive disc to the foot; the tail is pointed and without any appearance of a mucous gland.

Jaw slightly arched, strongly ribbed with about fifteen rounded ribs in the centre; striated towards the extremities.

Dentition, 26–1–26. Laterals about 10.

Central tooth rectangular, longer than broad; the reflexed portion tricuspid, short, but with a long middle cusp reaching nearly to the posterior margin, and with a short point. The first six laterals are like the central tooth, the seventh to ninth with the reflexed portion rather longer, and the inner side-cusps obsolete. Marginals broader than long, tridentate; the inner with the middle point longer than the others; the outer with the three points nearly equal.

Hab. Auckland (T. F. Cheeseman).

HELIX GREENWOODI, Gray. Pl. x., fig. P.

Jaw none.

Dentition, 10–0–10; varying from 9 to 11.

Transverse rows of teeth forming an acute angle. Teeth robust, all aculeate, smooth, increasing from the centre to the ninth, which is the largest; the tenth much smaller; the eleventh very minute or absent.

Hab. Auckland (Cheeseman).

RHYTIDA AUSTRALIS, Hutton. Pl. x., fig. S.

Jaw, none.

Dentition, 16–0–16.

Transverse rows of teeth forming an acute angle. Teeth slender, all aculeate, smooth, increasing from the centre to the fourteenth, which is the largest; fifteenth small; sixteenth still smaller, but present in both the individuals that I have examined.

Hab. Stewart Island (T. Kirk).

RHYTIDA CITRINA, Hutton. Pl. x., fig. R.

Jaw, none.

Dentition, 17–0–17.

Transverse rows of teeth forming an acute angle. Teeth slender, all aculeate, smooth, increasing in size from the centre to the fifteenth, which is the largest; sixteenth nearly as large as the fifteenth; seventeenth much smaller.

Hab. Greymouth (R. Helms).

RHYTIDA PATULA, Hutton. Pl. x., fig. Q.

Jaw, none.

Dentition, 18–0–18.

Transverse rows of teeth forming an acute angle. Teeth robust, all aculeate, increasing from the centre up to the seventeenth, which is the largest; eighteenth very small. All the teeth smooth, except the seventeenth, which has an angular ridge running down the outer side.

Hab. Greymouth (R. Helms).

In specimens from Balclutha the dentition is 14–0–14.

Phrixgnathus marginatus, Hutton. Pl. ix., fig. s.

Jaw arcuate, not tapering, papillate, with about 28 broad ribs.

Dentition, 35–1–35. Teeth very minute.

Central tooth unicuspid, longer than broad; the reflexed portion minute. Laterals bicuspid; the cusps rather remote, and the reflexed portion small. Marginals apparently the same as the laterals, but too minute to make out clearly.

Hab. Greymouth (R. Helms).

Helix regularis, Pfeiffer. Pl. xi., fig. d.

Jaw arcuate, not tapering, papillate, with about 23 broad rounded ribs.

Dentition, 27–1–27. Laterals 18 or 20.

Central tooth rectangular, the length nearly three times the breadth; the reflexed portion covering only a third of the base, hollowed on each side. Laterals oblique; the reflexed portion covering a third of the base, bicuspid, the cusps close together; the inner cusp the larger and carrying the larger cutting point, which is long and pointed. Marginals quadrangular, broader than long, with several very minute cutting points.

Hab. Greymouth (R. Helms).

The shell is covered with a thin epidermis which is often ciliated round the keel of the last whorl.

Helix pœcilosticta, Pfeiffer.

Jaw arched, not tapering, of 21 imbricating plates covered thickly with papillæ.

Dentition, 23–1–23. All the teeth longer than broad and the reflexed portion very short. Central tooth unicuspid; laterals and marginals rather oblique, bicuspid, with small points.

Helix conella, Pfeiffer.

Jaw not seen.

Dentition, 38–1–38. As in the last species.

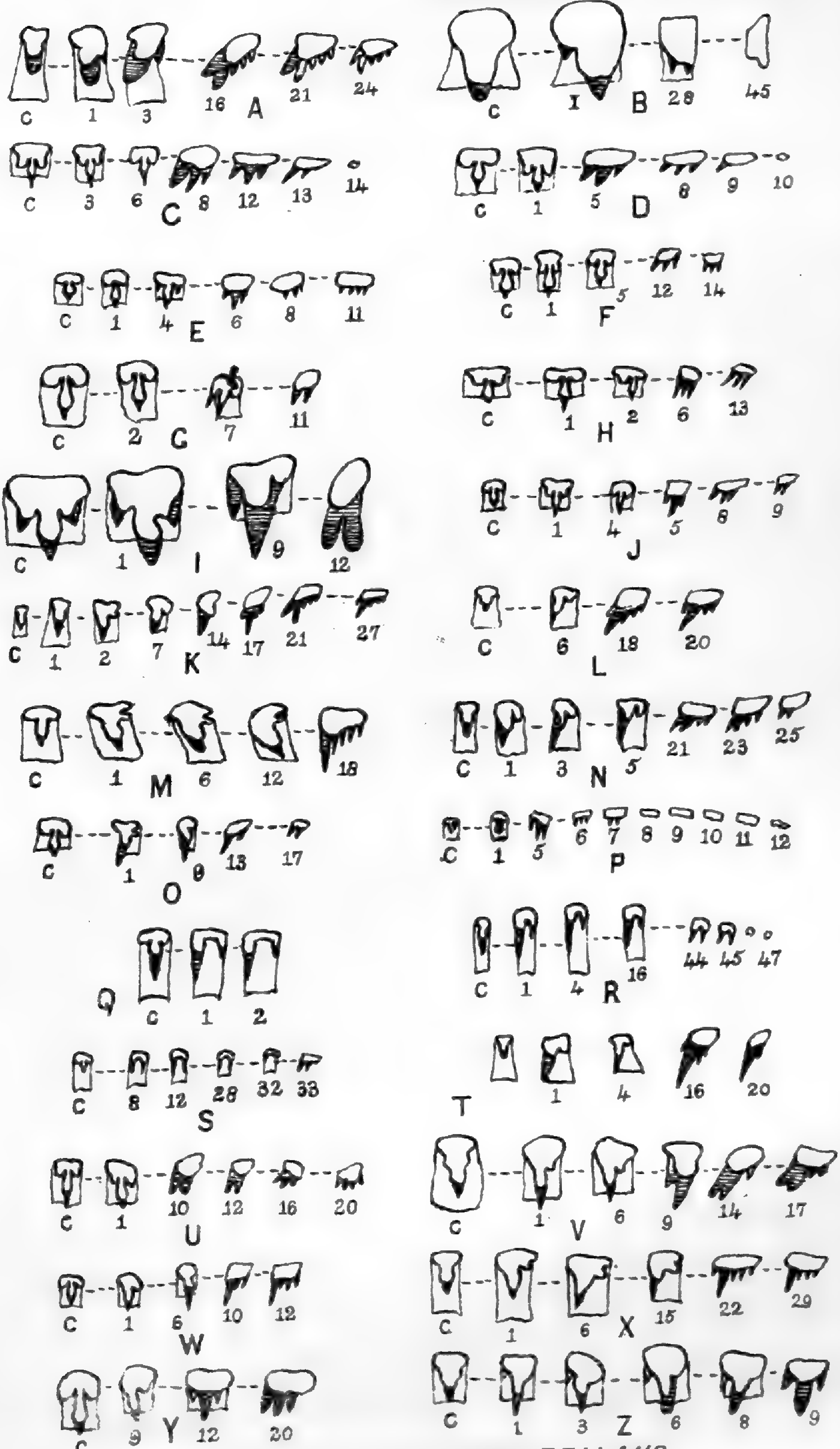
Helix stipulata, Reeve (= *alpha*, Pf.). Pl. xi., figs. b. and l.

Animal like *P. coma*; mantle subcentral, slightly reflected over the peristome; eye-peduncles long and cylindrical; tail short, pointed, and without any mucous gland. Colour pale brown, with a broad slate-blue band on each side of the head, including the peduncles.

Jaw slightly arched, not tapering, smooth, slightly longitudinally striated; the anterior edge concave with a jagged margin.

Dentition, 12–1–12. Laterals 3 or 4.

Central tooth rectangular, as broad as long; the reflexed portion tricuspid, the middle cusp reaching two-thirds of the length. Laterals tricuspid, the side-cusps constricted on their outer sides, the middle cusp



LAND MOLLUSCA OF NEW ZEALAND.

F.W. Hutton, del.

reaching the posterior margin, the cutting point projecting beyond it. Marginals broader than long; the inner with three cutting points; the three outer very broad, with two small points at the inner corner.

Hab. Rangitira Bush, Temuka (C. Chilton).

The shell is hairy, but the hairs rub off when the animal is dead.

HELIX ZEALANDIÆ, Gray. Pl. x., fig. E.

Jaw arcuate, flatly ribbed, the ribs indenting the concave margin.

Dentition, 35–1–35; varying from 27 to 40. Laterals about 9; varying from 8 to 10.

Central tooth rectangular, the length more than twice the breadth; the reflexed portion half the length of the base, slightly constricted and with a moderate point. The inner laterals like the central tooth, but broader and with the outer lobe more marked and notched, the notch getting gradually less outwards. Inner marginals with a long base and a short reflexed portion bearing a long oblique cutting point on the inner edge and a small cusp on the outer; outer marginals irregular, the breadth and length about equal, with a long oblique cutting point. The laterals pass gradually into the marginals, and the cutting point is longest in the middle of the marginals.

Hab. Auckland (T. F. Cheeseman).

HELIX ANTIPODA, Hombron and Jacquinot. Pl. x., fig. F.

Animal with the foot narrow, produced behind the shell; a caudal papilla and a mucous gland below it. Mantle subcentral, slightly reflected over the peristome of the shell. Colour pale grey, the anterior portion darker; peduncles and a line down each side of the head dark blue-black; mantle pale grey with dead white spots.

Jaw like that of *zealandiæ*.

Dentition, 35–1–35; varying from 31 to 36. Laterals about 12.

Central tooth rectangular, its length more than twice its breadth; the reflexed portion about half as long as the base, slightly constricted at about a third of its length, the point moderate. The first five or six laterals like the central tooth; the others oblique, with a large cutting point on the inner edge of the reflexed portion, and a small exterior cusp. Marginals with a small irregular base, and a long oblique cutting point, increasing in length to about the middle of the marginals and then decreasing.

Hab. Greymouth (R. Helms).

The shell varies very much in colour, sometimes being painted with alternating oblique narrow bands of yellowish white and rufous, sometimes almost entirely rufous, or pale brown.

THALASSIA (?) PROPINQUA, Hutton. Pl. x., fig. G, and pl. xi., fig. V.

Jaw arcuate, not tapering, with about 22 flat ribs, which slightly indent the concave margin.

Dentition, 31–1–31. Laterals 12.

Central tooth rectangular, the length more than twice the breadth; the reflexed portion triangular, slightly sinuated on the sides, about half the length of the base and with a moderate point. Inner laterals like the central tooth, but more deeply sinuated on the inner side; outer laterals bicuspid, the inner cusp larger and with a long point, the outer cusp with a small point. Inner marginals with a long acute point, and a small one inside it; outer marginals with the base as long as broad, and a single long point. The cutting points increase in size as far as the middle of the marginals and then decrease.

Hab. Southland (G. M. Thomson).

Helix kivi, Gray. Pl. ix., fig. a, and pl. xi., fig. i.

Jaw composed of about 50 separate overlapping plates, the length of which is four or five times the breadth, the inner edge of one plate lying in front of the outer edge of the one next it; all the plates transversely striated. Central plate with a length of three times its breadth, the lower margin emarginate.

Dentition, 28–1–28. Laterals about 15.

Central tooth rectangular, the length twice the breadth, the reflexed portion not reaching half-way and slightly constricted at the sides, with a broad cutting point. Laterals with the reflexed portion sinuated on the inner margin, and an additional small point on the outer side. Inner marginals with a broad blunt double cutting point, with several small acute ones outside it; outer marginals with 3 or 4 acute points.

Hab. Auckland (Cheeseman).

Helix granum, Pfeiffer. Pl. ix., fig. l.

Animal elongated, the foot narrow, projecting behind the shell; mantle subcentral, rather anterior, included; eye-peduncles long, rather clavate; tentacles moderate. Colour white, finely speckled with dark grey above, in front of the shell, and on the head, eye-peduncles, and tentacles; edges and sole of the foot often with white streaks.

Jaw like that of *P. pilula*.

Dentition, 27–1–27. Laterals about 14.

Central tooth wedge-shaped, broader behind; the reflexed portion short with a small cusp on each side. Laterals like the central tooth, but the reflexed portion oblique, inclined inwards. Marginals with a broad base and numerous points, of which one near the inner side is longer than the rest.

Hab. Eyreton, N. Canterbury (C. Chilton).

Paryphanta phlogophora, Pfeiffer. Pl. ix., fig. z, and pl. xi., fig. p.

Animal with the mantle subcentral, slightly reflected over the peristome of the shell, the margin entire; eye-peduncles moderate, thick, the tentacles short; tail depressed, rounded, with a mucous gland. Colour slate grey, the sole and sides of the foot orange.

Jaw arched, thick, tapering towards the ends, smooth, without ribs, the concave margin jagged.

Dentition, 21–1–21. Laterals 8.

Central tooth rectangular, longer than broad; the reflexed portion triangular, sinuated on each side, two-thirds the length of the base and with a large cutting point. First lateral like the central tooth but larger, the inner margin straighter and with a minute point; second to fourth laterals with the base nearly as broad as long, the reflexed portion deeply sinuated on the inner, less so on the outer side, a small point on the inner side: in the sixth to eighth laterals the inner side is less sinuated and the point becomes larger. Marginals broader than long, with three points of which the middle is the longest; in the outer marginals the two inner cutting points are equal and united.

Hab. Oxford, N. Canterbury (C. Chilton).

AMPHIDOXA CORNEA, Hutton. Pl. x., fig. A.

Jaw thin, slightly arcuate, smooth, faintly striated.

Dentition, 22–1–22. Laterals 8.

Teeth like those of *P. phlogophora* except the outer marginals in which the cutting points are more irregular and altogether absent in the last, which is minute.

Hab. Auckland (T. F. Cheeseman).

Animal dark slate grey, sole of the foot dirty yellowish; mantle mottled with grey. Mantle central, slightly reflected over the peristome; tail pointed, with a mucous slit.

Hab. Greymouth (R. Helms).

AMPHIDOXA COSTULATA, Hutton. Pl. x., fig. D.

Jaw, none seen.

Dentition, 14–1–14. Laterals 5 or 6.

Central tooth rectangular, almost as broad as long; the reflexed portion minute, tricuspid; the middle cusp reaching about half the length of the base. Laterals like the central tooth, but the middle cusp reaching the posterior margin. Marginals broader than long, tridentate; in the inner marginals the outer point is very small, and the two inner are united.

Hab. Auckland (T. F. Cheeseman).

PARYPHANTA CHIRON, Gray. Pl. x., fig. B.

Jaw, none seen.

Dentition, 17–1–17. Laterals 7.

Teeth like those of *P. phlogophora*.

Hab. Auckland (T. F. Cheeseman).

PARYPHANTA CREBRIFLAMMIS, Pfeiffer. Pl. xi., fig. G.

Jaw very delicate, membranaceous, smooth.

Dentition, 18–1–18. Laterals 7.

Central tooth rectangular, as broad as long; the reflexed portion tricuspid, the middle cusp reaching a half and the side-cusps a third of the length of the base. Inner laterals rather longer than broad, tricuspid, the reflexed portion constricted at the sides, the middle cusp reaching almost to the posterior margin, and with a small point: outer laterals with the inner side of the reflexed portion hollowed out; the outer side with a small constricted cusp, middle cusp with a large point. Inner marginals tridentate, the inner and middle points larger; outer marginals much broader than long, with a single dentate point, which gets smaller outwards and disappears altogether on the two last.

Hab. Greymouth (R. Helms).

Paryphanta jeffreysiana, Pfeiffer. Pl. xi., fig. f.

Jaw, none. *Dentition*, 9–0–9.

Transverse rows of teeth forming an obtuse angle. Teeth robust, all aculeate, smooth, the points rounded; increasing in size from the first to the fifth and then decreasing. The first about equal to the ninth; the third equal to the eighth.

Hab. Auckland (T. F. Cheeseman).

Paryphanta coresia, Gray. Pl. xi., fig. e.

Jaw, none. *Dentition*, 9–0–9.

Transverse rows of teeth forming an obtuse angle. Teeth rather robust, all aculeate, smooth, the points rounded; increasing in size from the first to the fourth and then decreasing. The third as large as the fifth.

Hab. Auckland (Cheeseman).

The teeth are more slender than in *jeffreysiana*.

Nanina mariæ, Gray. Pl. ix., fig. r.

Jaw arcuate, not tapering, papillate, with about 33 flat ribs.

Dentition, 47–1–47, without distinction between laterals and marginals.

Central tooth rectangular, the length three and a half times the breadth; the reflexed portion less than half the base, constricted at the sides and with a moderate point. Laterals larger than the central tooth; the reflexed portion minute, not more than a quarter of the base, bicuspid, the inner cusp with a long, the outer with a small point. Towards the margin the teeth get smaller and the points nearly equal. The two outer are minute and without points.

Hab. Auckland (T. F. Cheeseman).

Phacussa helmsi, Hutton. Pl. x., fig. i, and pl. xi., fig. w.

Jaw arcuate, not tapering, with 20 or 25 flat ribs which indent the concave margin.

Dentition, 28–1–28; varying from 26 to 30. Laterals 11 or 12.

Central tooth rather wedge-shaped, broader behind, the length nearly twice the breadth; the reflexed portion triangular, slightly sinuated at the sides, less than half the length of the base, with a moderate point. Laterals with the base rhomboidal; the inner with the reflexed portion half the length of the base, bicuspid, the inner cusp large with a moderate point, the outer cusp small without a point; outer laterals with the reflexed portion shorter and unicuspid, the point longer, reaching beyond the posterior margin of the base. Marginals aculeate, with a strong curved point, which is most developed in the centre of the marginals.

Hab. Greymouth (R. Helms).

This species differs from *Zonites* in having a ribbed jaw, in which respect it resembles *Zonites* (?) *lansingi*, Bland, from Oregon.

PHACUSSA FULMINATA, Hutton. Pl. x., fig. J.

Jaw like that of *P. helmsi.*

Dentition, 38–1–38. Laterals about 18.

Central tooth rectangular, the length nearly three times the breadth; the reflexed portion small, about a third of the length, constricted on the sides, the point small. Laterals bicuspid, the inner cusp much larger: inner laterals with the inner side emarginate, the cutting point small; outer laterals with the reflexed portion more oblique and its inner margin straight, the cutting point moderate. Marginals aculeate, with a long curved point.

Hab. Stewart Island (T. Kirk).

JANELLA BITENTACULATA, Quoy. Pl. x., fig. M.

Jaw delicate, smooth, broad, slightly arched, with a sub-quadrangular accessory plate proceeding backwards.

Dentition, 255–1–255.

Central tooth with a median cusp on the reflexed portion; the anterior margin simple or sinuated.

Hab. Christchurch (R. W. Fereday).

JANELLA MARMOREA, Hutton. Pl. x., fig. N, and pl. xi., fig. X.

Jaw like that of *J. bitentaculata.*

Dentition, 255–1–255.

Central tooth without a median cusp on the reflexed portion; the anterior margin emarginate.

Hab. Greymouth (R. Helms).

LEPTOPOMA PANNOSA, Hutton. Pl. x., fig. U.

Dentition, 3–1–3.

Central tooth longer than broad, constricted in the middle, rounded in front, and flat behind; anterior margin with five denticles, none on the basal part of the tooth. First lateral broad, with a very short stalk;

denticles four. Second lateral rhomboidal; the anterior margin with five denticles. Third lateral versatile, the base emarginate, the middle constricted, the outer posterior margin with three curved cusps.

Animal. Rostrum emarginate; tentacles short, slightly tapered, and rounded at the ends; the eyes on slight bulgings at their bases; foot short, not produced much beyond the operculum; tail rounded. Body and foot brown; tentacles and a band on each side of the head purple; rostrum broadly margined with white, and the tentacles minutely tipped with the same colour.

Hab. Greymouth (R. Helms).

Leptopoma calva, Hutton.

The operculum and dentition resemble that of *L. pannosa.*

Hab. Greymouth (R. Helms).

Realia turriculata, Pfeiffer. Pl. xi., fig. h.

Dentition, 3–1–3.

Central tooth longer than broad, narrower behind, deeply constricted in the middle, the recurved margin with five denticles. First lateral oval with a short, rather broad, stalk, and five denticles. Second lateral oval with a short narrow stalk and six denticles. Third lateral sub-rhomboidal, pointed behind and constricted on the outer margin, with four denticles.

Operculum oval, of about three rapidly increasing whorls, the last of which is rather strongly transversely striated; nucles nearer the centre than the margin.

Hab. Whangarei (Judge Gillies).

Realia hochstetteri, Pfeiffer.

The dentition and operculum are much the same as in the last species.

Hab. Auckland (Judge Gillies).

B. *New Species.*

Patula jessica, n. s.

Shell small, discoidal, widely umbilicated, ribbed; colour horny, largely radiately streaked and clouded with reddish brown, giving a general dark colour to the shell. Spire flat or slightly convex, apex often pushed in; whorls 4½ to 5½, very slowly increasing, rounded, with numerous rather close ribs, which are strongly sinuated on the upper surface, but straight and feebler below; ribs about 36 in the tenth of an inch, the interstices strongly striated with growth-lines, and more or less reticulated with spirals; suture impressed; umbilicus wide, perspective, showing all the whorls; aperture nearly vertical, rotundly lunar; peristome thin, flatly angled above, then regularly arched, the margins at right angles. Greatest diameter ·17; least ·15; length ·08 inch.

Hab. Bealey, Canterbury (Dr. v. Haast).

PATULA BIANCA, n. s.

Shell minute, discoidal, widely umbilicated, finely ribbed; colour horny brown banded with darker. Spire flat, or slightly convex; whorls 4, slowly increasing, rounded, delicately ribbed; ribs about 55 in the tenth of an inch, the interstices striated; suture impressed; umbilicus broad, gradated; aperture slightly oblique, rotundly lunar; peristome thin, regularly arched; greatest diameter ·1, least ·09 inch.

Hab. Greymouth (R. Helms).

This species is allied to *P. corniculum*, but it is more finely ribbed, and the colours are different.

PATULA TIMANDRA, n. s.

Shell small, discoidal, broadly umbilicated, distantly ribbed; colour brown, obscurely banded with paler. Spire flat, or slightly convex; periphery rounded; suture impressed; whorls 4–5, slowly increasing, rounded, delicately striated with growth-lines, and with distant ribs, which are sinuated on the upper surface near the periphery, and straight below; ribs about 18 in the tenth of an inch; umbilicus very broad, perspective, gradated; aperture slightly oblique, rotundly lunar; peristome simple, the margins approaching, forming more than three-fourths of a circle. Greatest diameter ·12, least ·10; height ·05 inch.

Hab. Auckland (Cheeseman).

PATULA SYLVIA, n. s.

Shell minute, discoidal, umbilicated, obliquely ribbed: colour very pale horny with faint thin radiating bands of chestnut on the upper surface. Spire flat or slightly convex; whorls 5½, very slowly increasing, rounded, with delicate rather distant ribs which are very oblique on the upper surface, but transverse to the whorls on the lower surface; ribs about 18 in the tenth of an inch, the interstices rather strongly striated with growth lines; suture impressed; umbilicus rather wide, gradated; aperture slightly oblique, rotundly lunar; peristome thin, regularly arched, the upper margin advancing. Greatest diameter ·12; least ·1; height ·06 inch.

Hab. Bealey (Dr. v. Haast); under logs in the beech forests.

FRUTICICOLA ADRIANA, n. s.

Shell small, discoidal, narrowly umbilicated, finely ribbed; colour pale horny with spots and angular streaks of chestnut. Spire flat; whorls 4½, slowly increasing, rounded, delicately ribbed; ribs about 50 in the tenth of an inch, the interstices reticulated; suture impressed; umbilicus narrow, but open; aperture slightly oblique, rotundly lunar; peristome thin, regularly arched, the columellar margin slightly reflected. Greatest diameter ·16; least ·14; height ·07 inch.

Hab. Near Christchurch (R. Brown).

ENDODONTA MARINA, n. s.

Shell conoidal, sub-perforated, striated; colour pale yellowish horn, sometimes faintly banded with chestnut, and tessellated with the same colour on the keel. Spire conoidal, rather obtuse; whorls 5½, slowly increasing, rather flattened, the last acutely keeled, delicately but rather irregularly striated; suture margined; umbilicus covered; aperture vertical, sub-rhomboidal; peristome thin; columella with a large acute plait; parietal plaits two, one on the penultimate whorl near the outer side, the other on the right lip above the keel. Greatest diameter ·13, least ·11, height ·1 inch.

Hab. Auckland (T. F. Cheeseman).

ENDODONTA NERISSA, n. s.

Shell conoidal, sub-perforated, striated; colour pale yellowish horny with indistinct bands of chestnut and spots of the same colour on the keel. Spire flatly conoidal, obtuse; whorls 5½, slowly increasing, rather flattened, the last acutely keeled, delicately and rather distantly striated; suture margined; umbilicus covered; aperture sub-vertical, sub-rhomboidal; peristome thin; columella with a large acute plait; parietal plaits six, two on the penultimate whorl, of which the outer is the larger, one on the right lip above the keel, and three blunt plaits on the basal lip. Greatest diameter ·11, least ·1, height ·07 inch.

Hab. Auckland (T. F. Cheeseman).

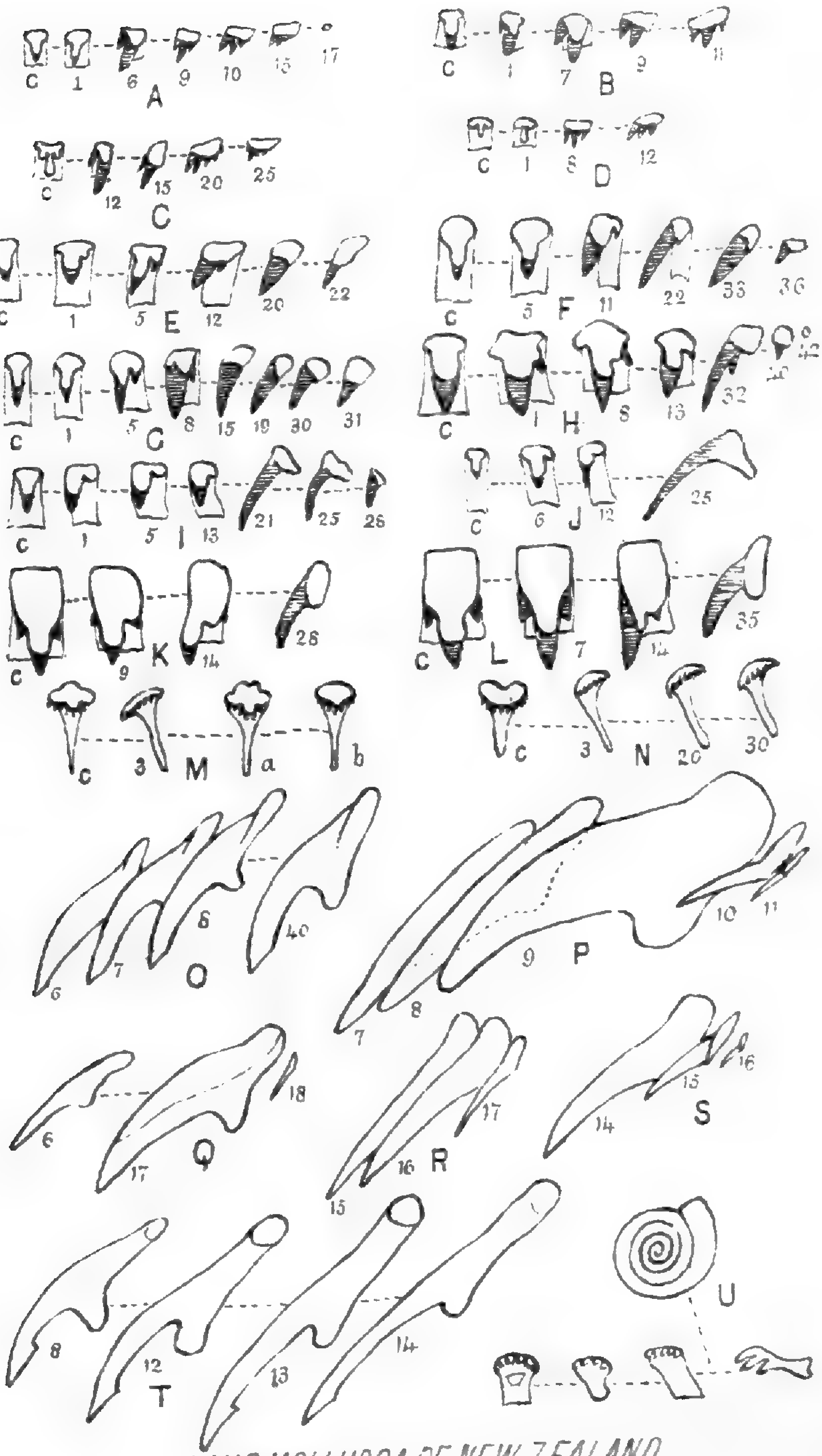
PHRIXGNATHUS CELIA, n. s. *H. fatua*, Hutton, Trans. N.Z. Inst., xiv., p. 153 (not of Pfeiffer).

Shell small, depressed, smooth, shining, umbilicated; colour horny with reddish-brown bands. Spire conoidal, depressed; whorls 5½, slowly increasing, the last obtusely carinated, faintly striated; the base delicately spirally striatulated; suture impressed; umbilicus narrow, but always well marked; aperture oblique, sub-rhomboidal; peristome thin, the columellar margin slightly reflected. Greatest diameter ·15, least ·12, height ·1 inch.

Animal with the mantle rather anterior, included; tail acute, without any mucous gland; peduncles long, slightly clavate, approximated at their bases. Colour greyish-brown, the anterior portion of the head darker; sometimes a dark transverse band under the shell.

Hab. Dunedin (F. W. H.).

This species differs from *H. fatua* in size and colour as well as in being thinner, less conical, and more finely striated. From *H. glabriuscula* it differs in having the whorls angled; and from *P. conella* in the umbilicus being much broader, and the spire more depressed.



LAND MOLLUSCA OF NEW ZEALAND.

F. W. Hutton, del.

PHRIXGNATHUS PHRYNIA, n. s.

Shell minute, conoidal, umbilicated, the epidermis plicated: colour pale horny, radiately streaked with rufous. Spire conoidal, acute; periphery obtusely angled; suture impressed; whorls 5, rounded, smooth, the epidermis rather distantly wrinkled; umbilicus narrow, open; aperture slightly oblique, rotundly lunar; peristome thin, the margins approximating; the columellar margin scarcely reflected. Greatest diameter ·1, least ·09; height ·09 inch.

Hab. Wanganui (T. W. Kirk).

Very near *P. celia*, but differs in the plaited epidermis.

PHRIXGNATHUS ARIEL, n. s.

Shell small, depressed, scarcely shining, finely ribbed, subperforate; colour pale yellowish horny. Spire conoidal, depressed, with 5 slowly increasing whorls, the last obscurely carinated; finely striately ribbed, the base delicately spirally striatulated; suture impressed; umbilicus covered; aperture oblique, lunate; peristome thin, the columellar margin reflected. Greatest diameter ·13, least ·12; height ·1.

Hab. Auckland (T. F. Cheeseman). A single specimen only.

Distinguished from the other species of the genus by being finely ribbed; and from *H. pœcilosticta* by the columella not being thickened, and the suture not margined. From *H. granum* it differs in colour, and in having the umbilicus covered.

Jaw as in *P. celia*. *Dentition*, 32–1–32. All the teeth longer than broad, and the reflexed portion very short. Central tooth unicuspid; laterals and marginals bicuspid, all with minute points.

PHRIXGNATHUS TITANIA, n. s.

Shell globosely conoidal, umbilicated, striated; pale horny irregularly banded with chestnut. Spire conoidal, rather obtuse; periphery obtusely carinated; suture margined; whorls 5–6, rounded, very finely striated; umbilicus broad, perspective; aperture very slightly oblique, subcircular; peristome thin, the margins closely converging; columellar margin not reflected. Greatest diameter ·14, least ·12; height ·10 inch.

Hab. Dunedin (F. W. H.).

Differs from *P. sciadium* in the higher spire and the obtuse keel.

PHRIXGNATHUS (?) HAASTII, n. s.

Shell minute, depressed, smooth, shining, umbilicated; colour horny, usually with irregular radiating bands of reddish brown and white. Spire conoidal, depressed; whorls 4½, slowly increasing, rounded, the last subcarinated, obscurely distantly striated; suture impressed; umbilicus moderate, pervious, showing the penultimate whorl; aperture subvertical, lunately subcircular; peristome thin, arched, the margins not approaching. Greatest diameter ·12, least ·1; height ·07 inch.

Hab. Mount Somers, Canterbury (Dr. von Haast), on limestone cliffs.

Distinguished by its smooth shining surface and brown and white bands. Its generic position must remain doubtful until the dentition is known.

PFEIFFERIA (?) CRESSIDA, n. s. Pl. ix., fig. x., and pl. xi., fig. N.

Shell turbinate, depressed, thin, translucent, striated, umbilicus covered; fulvous horny. Spire convex; whorls 5½, slowly increasing, rounded, shining, finely irregularly striated or plaited: suture impressed: umbilicus very narrow, covered by the peristome: aperture slightly oblique, lunately rotund; peristome thin, regularly arched, the columellar margin slightly thickened and reflected over the umbilicus. Greatest diameter ·48, least ·38; height ·33 inch.

Hab. Southland (G. M. Thomson).

Jaw arcuate, flatly ribbed, the ribs indenting both margins.

Dentition, 35–1–35; varying from 32 to 37. Laterals about 17.

Central tooth rectangular, twice as long as broad; the reflexed portion half the length of the base, slightly constricted on each side, and with a minute cutting point. Laterals with the reflexed portion bicuspid, the inner cusp carrying a cutting point which gets longer further from the centre; outer cusp notched in the middle. Marginals broader than long with several cutting points; on the inner marginals the two points at the inner corner are larger than the others; the outer marginals are irregular and the points disappear altogether.

In this species the shell is seen, under the microscope, to be finely obliquely reticulated, the crossing striæ having diagonal directions. I formerly mistook it for *H. guttula*, but in that species the shell is described as very smooth, with an inconsiderable, sub-marginated suture, and the last whorl as callous beneath, in all which points it differs from our species. It is doubtfully referred to the genus *Pfeifferia* as the animal is not known.

GERONTIA CORDELIA, n. s.

Shell sub-discoidal, widely umbilicated, striated; colour pale horny, marbled with reddish brown and covered by a shining yellow epidermis. Spire convex; whorls 4½, slowly increasing, rounded, with tolerably regular, rather crowded, and rather coarse striæ of old growth-lines; suture impressed; umbilicus broad, conical, showing all the whorls, but not gradated; aperture slightly oblique, sub-circular; peristome thin, right margin descending, columellar margin rapidly ascending but not vertical, the two margins not approaching. Greatest diameter ·32, least ·27; height ·18 inch.

Hab. Titirangi, Auckland (T. F. Cheeseman).

I place this species in *Gerontia* from the general appearance of the shell, but I do not know the animal nor the dentition. It differs from *G. pantherina* in being more convex, in the epidermis not being plaited, in being more coarsely striated, in the right margin descending, in the aperture being less oblique, and in its colours.

AMPHIDOXA PERDITA, n. s. Pl. xi., figs. C and Q.

Shell thin, shining, pellucid, depressed, umbilicated; colour pale olive horny. Spire convex; whorls 3½–4, rapidly increasing, rounded, finely irregularly striated; suture deeply impressed; umbilicus narrow, pervious; aperture oblique, lunately circular; peristome thin, the right margin joined closely to the next whorl. Greatest diameter ·23, least ·2; height ·18 inch.

This shell differs from *H. chiron* in being higher, the umbilicus narrower, and the right margin of the peristome not advancing. From *H. novaræ* it differs in being striated, in the suture being impressed and the spire convex. From *A. cornea* it differs in being umbilicated.

Animal with the mantle central, slightly reflected over the peristome of the shell; tail pointed, depressed, with a mucous gland. Colour dark slate-grey, the mantle marbled with black and white; sole of the foot dirty yellowish.

Jaw arcuated, narrow, not tapering, smooth, but with 30 or 40 delicate rounded ribs.

Dentition, 20–1–20. Laterals 6 or 7.

Central tooth rectangular, longer than broad; the reflexed portion covering two-thirds of the base; the sides concave, with a cutting point on each; the apical cutting point moderate. Laterals like the central; but the cutting points larger, and the outer margin of the reflexed portion more excavated. Marginals quadrangular, broader than long, the inner with three large cutting points; the outer with a single broad dentated cutting edge; the last without any cutting edge.

Hab. Greymouth (R. Helms).

AMPHIDOXA JACQUENETTA, n. s. Pl. x., fig. C.

Shell perforate, flattened, keeled; colour pale brown. Spire flat, or very slightly convex; whorls 2½, rapidly increasing, very slightly convex, the last acutely keeled and rounded on the lower surface; smooth, delicately striated with growth-lines, the surface very finely and irregularly diagonally reticulated, and crossed with faint distant spiral striæ; suture impressed; umbilicus very narrow; aperture (?). Greatest diameter ·2, least ·12; height ·06 inch.

Distinguished by its keeled whorls.

Animal unable to withdraw completely into its shell; the mantle rather broadly reflected over the margin; eye-peduncles short and stout, separated at their bases; orange-yellow, the upper sides thickly marbled with black; head between the peduncles bright orange; the peduncles and tentacles black.

Jaw nearly straight, thin, striated in the centre, and slightly folded towards the ends.

Dentition, 28–1–28. Laterals about 9.

Central tooth rectangular, rather longer than broad; the reflexed portion tricuspid, the lateral cusps hollowed on the outer side, median cusp clavate, reaching nearly or quite to the posterior margin of the base. The laterals are like the central tooth, but the cutting point on the median cusp gets larger as they recede from the centre; the outer laterals have a small point on the inner cusp, and the outer cusp vanishes. Inner marginals bicuspid, each with a cutting point, the inner of which is the smaller; the middle marginals have about 5 points, of which the two inner are much larger; in the outer marginals these two larger points diminish, and at last all disappear.

Hab. Greymouth (R. Helms).

Amphidoxa lavinia, n. s.

Shell sub-discoidal, umbilicated, ribbed; colour yellow horny, mottled with rufous on the upper side. Spire flat; periphery rounded; suture scarcely impressed; whorls 3½, rapidly increasing, rather flattened above, rounded below; upper surface not shining, evenly and closely ribbed; ribs about 18 in the tenth of an inch; lower surface smooth, shining, longitudinally striated, and irregularly spirally striatulated; umbilicus moderate, showing all the whorls; aperture oblique, rotundly lunar; peristome thin, the margins approaching; columellar margin not reflected. Greatest diameter ·5, least ·4; height ·25 inch.

Hab. Palmerston, Wellington (T. W. Kirk).

Charopa miranda, n. s. Pl. ix., fig. w, and pl. xi., fig. s.

Shell minute, depressed, imperforate, finely ribbed; colour pale horny tessellated with rufous. Spire flatly conoidal, obtuse; whorls 5–6, rounded, very slowly increasing; the first smooth, the second and third with rather distant, delicate ribs, which get closer and after the third whorl are very close and fine, about 50 in the tenth of an inch; umbilicus very narrow, covered; suture impressed; aperture subvertical, lunate; peristome simple, about three-fourths of a circle, the columellar margin slightly callous and reflected. Greatest diameter ·15, least ·14; height ·11 inch.

Animal. Mantle subcentral; tail truncated, with a mucous gland below a papilla; eye-peduncles thick, approximated at their bases. Anterior portion of the animal, including the eye-peduncles and tentacles, pale-purplish, the peduncles darker; a narrow white line down the back; foot and the rest of the body yellowish white.

Jaw rudimentary; flatly ribbed, the ribs indenting the concave margin.

Dentition 17–1–17. Laterals 8.

Central tooth rectangular, the base longer than broad; the reflexed portion tricuspid, the middle cusp covering three-fourths of the base. Laterals with the reflexed portion larger, reaching the posterior margin of the base, the inner side slightly indented, the outer with a well-marked cusp; median cusp with a long point. Marginals broader than long with four or five points, the inner of which is much longer than the others.

Hab. Greymouth (R. Helms).

Charopa planulata, n. s. Pl. ix., fig. j.

Shell small, depressed, sub-perforated, closely ribbed, rather shining: colour horny brown, sometimes clouded with rufous. Spire slightly elevated, flatly convex; whorls 4½–5, slowly increasing, rounded, ornamented with fine, slightly undulating, ribs, about 35 to 40 in the tenth of an inch, the interstices finely striated with growth-lines; last whorl rounded at the periphery, but slightly flattened below: suture impressed: umbilicus very narrow and generally covered over by the reflected columellar lip: aperture sub-vertical, transversely rotundly lunar; peristome thin; the right margin descending, then arched; columellar margin thickened, rapidly ascending and slightly reflected; basal margin rather flattened: interior slightly callous. Greatest diameter ·15, least ·12; height ·6 inch.

Jaw apparently absent.

Dentition, 11–1–11. Laterals 4. One specimen examined had only 9–1–9 teeth.

Central tooth small, rectangular, longer than broad, the reflexed portion short, tricuspid; the middle cusp not reaching much more than half the length of the base. Laterals with the reflexed portion tricuspid and longer than that of the central tooth, the middle cusps reaching almost to the posterior margin of the base; lateral cusps constricted on the outer side. Marginals tridentate, the outer ones bidentate.

Hab. Auckland (T. F. Cheeseman).

Charopa (?) cassandra, n. s.

Shell depressed, sub-perforate, closely ribbed: colour pale horny with longitudinal angulated bands of chestnut. Spire conoidal, depressed, obtuse; whorls 5½, gradually increasing, very finely ribbed; ribs about 20 in the tenth of an inch; periphery rounded: suture impressed; umbilicus very narrow, almost covered; aperture rather oblique, rotundly lunate; peristome acute, straight, the margins not approaching; columellar margin obliquely ascending, slightly reflected and thickened. Diameter ·5 inch.

Hab. Napier.

The generic position of this shell is very doubtful, it somewhat resembles *H. igniflua*, but differs in its very narrow umbilicus. The only specimens I have seen were old and rubbed.

Therasia tamora, n. s.

Shell small, conical, umbilicated, with membranous plaits: colour horny brown. Spire conical, rather acute; periphery sub-angled; suture impressed: whorls 5–6, rather flattened, finely striated and with irregular distant membranous ribs, easily rubbed off: umbilicus narrow, but open: aperture transversely oval; peristome thin, the margins converging.

Greatest diameter ·16, least ·14; height ·10 inch.

Hab. Auckland (T. F. Cheeseman).

Differs from *celinda* in the open umbilicus, and from *decidua* in being more conical and smaller. I place it with *celinda*, *decidua*, and *ophelia* into a separate genus called *Therasia*, having the dentition of *Charopa* with the shell of *Thalassia*.

Therasia thaisa, n. s. Pl. ix., fig. m., and pl. xi., fig. t.

Shell rather solid, depressed, umbilicated, striated; colour pale brown, usually irregularly banded and marked with reddish brown. Spire conoidal, obtuse; whorls 5–5½, slowly increasing, rather flattened, more or less obscurely angled, strongly but irregularly striated: suture impressed: umbilicus rather narrow, about one-seventh of the least diameter of the shell: aperture rather oblique, rotundly lunate; peristome thin, the columellar margin rapidly ascending and rather reflexed. Greatest diameter ·4, least ·35; height ·28 inch.

Animal elongated; the foot long and narrow, reaching beyond the shell, rounded behind, slightly truncated and with a mucous gland situated under a caudal papilla. Mantle sub-central, included; body roughish: peduncles long, cylindrical, approximated at their bases; tentacles moderate. Top of the head yellowish white, peduncles, tentacles, and a line down each side of the head dark grey; a broad longitudinal band of white, with a dark grey line in the centre, runs along each side, and below this band the foot is edged with alternate broad grey and narrow white transverse bands.

Jaw arcuate, with flattened ribs which indent the concave margin.

Dentition, 27–1–27; varying from 26 to 28. Laterals about 16.

Central tooth rectangular, longer than broad; the reflexed portion short, sharply constricted near the base and with a small cutting point. Laterals with the base oblique, the reflexed portion bicuspid, the inner cusp single, but constricted near the base and with a point, the outer cusp very oblique, notched at the end. Marginals broad, rounded at the ends, with numerous points, the inner one of which is much longer than the rest.

Hab. Waiau, Southland (G. M. Thomson).

This species is, I think, the same as *H. ophelia*, Reeve, but it is certainly not the *ophelia* of Pfeiffer. It is common in limestone districts in the South Island.

Therasia valeria, n. s. Pl. ix., fig. n. *H. hypopolia*, Hutton, Trans. N.Z. Inst., vol. xiv. (1881), p. 151, pl. iii., fig. b, not of Pfeiffer.

Shell globoso-conoidal, depressed, finely ribbed, subperforate; colour pale horny, irregularly marked with rufous. Spire conoidal, obtuse; periphery obtusely angled; suture scarcely impressed; whorls 4–5, rather flattened, irregularly finely ribbed both above and below, ribs about 20–25 in the tenth of an inch; umbilicus very narrow, covered; aperture oblique, angularly lunate; peristome simple, the margins not converging; columellar margin reflected. Greatest diameter ·25, least ·2; height ·15 inch.

Hab. Dunedin (F. W. H.).

Differs from *T. thaisa* in the narrow umbilicus, and from *T. ophelia* in being ribbed.

Trochomorpha (?) hermia, n. s.

Shell conical, depressed, imperforate, striated; colour horny brown, paler above than below, columella white. Spire conical depressed, obtuse; periphery acutely angled; suture slightly gradated or margined; whorls 5, flattened, closely obliquely rugosely plicated above; smooth and polished below; both surfaces with rather distant spiral striæ; base of the shell round the umbilical region slightly impressed; aperture very oblique, angularly lunate; peristome thin, the margins not approaching; the columella callous. Greatest diameter ·7, least ·6; height ·4 inch.

Hab. Manawatu (T. W. Kirk).

The generic position is doubtful.

Cyclotus charmian, n. s.

Shell rather thin, depressed, widely umbilicated, spirally striated; colour pale brown. Spire convex, obtuse; periphery with an undulating keel; suture impressed; whorls 4, rounded, with distant spiral raised striæ on the upper surface, not so well marked on the under surface; striæ about seven, principal striæ on the upper surface, with smaller ones between them; last whorl rounded at the mouth, keeled further back; umbilicus wide, not keeled, showing all the whorls; aperture oblique, circular, the interior callous; peristome simple, thin, straight, the two margins united by a thin callus. Greatest diameter ·4, least ·32; height ·22 inch.

Operculum orbicular, thin, of many slowly increasing whorls; nucleus central; horny, covered outside by a thin polished calcareous callus, thickened round the margin, and with a prominent centre.

Hab. Horokiwi, Wellington.

Leptopoma (?) pallida, n. s.

Shell conical, sub-perforated; pale brown. Spire acutely conical, the apex obtusely rounded; whorls 5½, rounded, the last rather flattened at the base, covered with a pale, thin, epidermis, which is rather closely longitudinally plaited. The first two whorls show delicate oblique growth lines; suture impressed; umbilicus very narrow, usually covered, not keeled; aperture slightly oblique, sub-circular; peristome thin, regularly arched, margins not meeting, columellar margin slightly reflexed. Operculum (?). Height ·2; diameter ·13 inch.

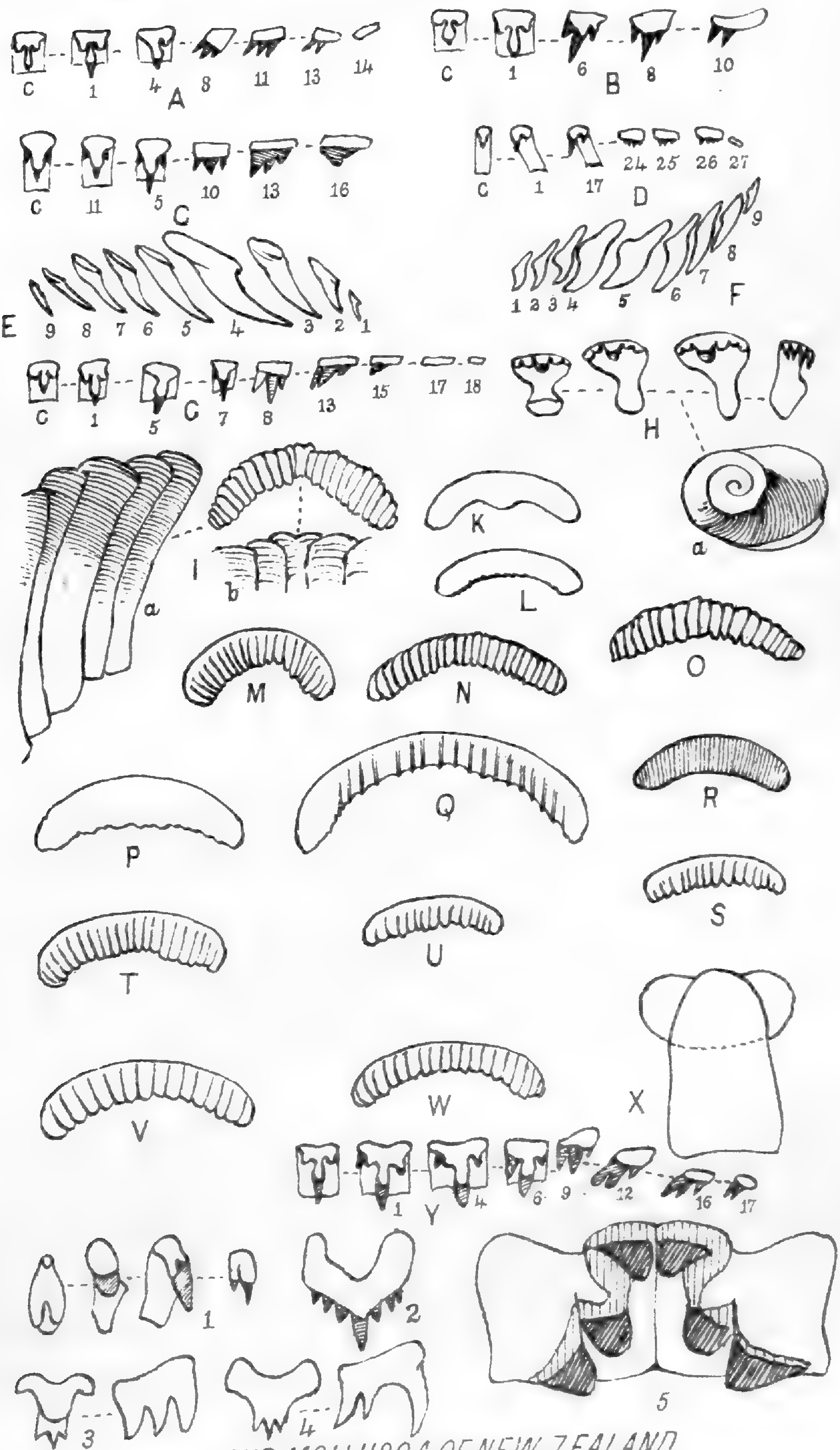
Hab. Auckland (T. F. Cheeseman).

In the absence of the operculum, the true generic position of this shell cannot be determined.

EXPLANATION OF PLATES IX.—XI.

Plate IX.

Fig. A. *Helix kivi.* Teeth × 470 times.
B. *Placostylus hongi.* Teeth × 160.
C. *Patula coma.* Teeth × 470.
D. „ *buccinella.* Teeth × 470.
E. „ *anguiculus.* Teeth × 750.
F. „ *corniculum.* Teeth × 470.
G. „ *tapirina.* Teeth × 470.
H. „ *infecta.* Teeth × 470.
I. *Gerontia pantherina.* Teeth × 470.
J. *Charopa planulata.* Teeth × 470.
K. *Patula pilula.* Teeth × 470.
L. *Helix granum.* Teeth × 470.
M. *Therasia thaisa.* Teeth × 470.
N. „ *valeria.* Teeth × 470.
O. *Patula celinda.* Teeth × 470.
P. *Strobila leioda.* Teeth × 470.
Q. *Microphysa pumila.* Teeth × 1,000.
R. *Nanina maria.* Teeth × 750.
S. *Phrixgnathus marginatus.* Teeth × 750.
T. *Patula portia.* Teeth × 470.
U. *Patula ida.* Teeth × 280.
V. *Patula dimorpha.* Teeth × 470.
W. *Charopa miranda.* Teeth × 470.
X. *Pfeifferia cressida.* Teeth × 470.
Y. *Vitrina dimidiata.* Teeth × 470.
Z. *Paryphanta phlogophora.* Teeth × 470.



LAND MOLLUSCA, OF NEW ZEALAND.

F.W. Hutton, del.

PLATE X.

Fig. A. *Amphidoxa cornea.* Teeth × 470 times.
B. *Paryphanta chiron.* Teeth × 470.
C. *Amphidoxa jacquenetta.* Teeth × 470.
D. „ *costulata.* Teeth × 470.
E. *Helix zealandiæ.* Teeth × 470.
F. „ *antipoda.* Teeth × 470.
G. *Thalassia propinqua.* Teeth × 470.
H. *Patula igniflua.* Teeth × 470.
I. *Phacussa helmsi.* Teeth × 470.
J. „ *fulminata.* Teeth × 470.
K. *Limax antipodarum.* Teeth × 280.
L. „ *emarginatus.* Teeth × 280.
M. *Janella bitentaculata.* Teeth × 470; *a* and *b*, varieties of central tooth.
N. „ *marmorea.* Teeth × 470.
O. *Paryphanta busbyi.* Teeth × 80.
P. *Helix greenwoodi.* Teeth × 80.
Q. *Rhytida patula.* Teeth × 33.
R. „ *citrina.* Teeth × 160.
S. „ *australis.* Teeth × 80.
T. *Testacella vagans.* Teeth × 80.
U. *Leptopoma pannosa.* Teeth × 470, and operculum.

PLATE X.

Fig. A. *Patula lucetta.* Teeth × 470 times.
B. *Helix stipulata.* Teeth × 470.
C. *Amphidoxa perdita.* Teeth × 470.
D. *Helix regularis.* Teeth × 740.
E. *Paryphanta coresia.* Teeth × 280.
F. „ *jeffreysiana.* Teeth × 280.
G. „ *crebriflammis.* Teeth × 470.
H. *Realia turriculata.* Teeth × 280; *a*, operculum.
I. *Helix kivi.* Jaw; *a*, lateral portion; *b*, central portion more highly magnified.
K. *Patula coma.* Jaw.
L. *Helix stipulata.* Jaw.
M. *Patula pilula.* Jaw.
N. *Pfeifferia cressida.* Jaw.
O. *Vitrina dimidiata.* Jaw.
P. *Paryphanta phlogophora.* Jaw.
Q. *Amphidoxa perdita.* Jaw.
R. *Gerontia pantherina.* Jaw.
S. *Charopa miranda.* Jaw.
T. *Therasia thaisa.* Jaw.
U. *Patula celinde.* Jaw.
V. *Thalassia propinqua.* Jaw.
W. *Phacussa helmsi.* Jaw.
X. *Janella marmorea.* Jaw.
Y. *Patula venulata.* Jaw.

Plate X.—*continued.*

Fig. 1. *Omphicardelus costellaris.* Teeth × 470.
2. *Æolis leptosoma.* Teeth × 160.
3. *Euthria striata.* Teeth × 280.
4. „ *flavescens.* Teeth × 280.
5. *Acmæa cingulata.* Teeth × 160.

Art. VIII.—*Revision of the* Land Mollusca *of New Zealand.*

By Captain F. W. Hutton.

[*Read before the Philosophical Institute of Canterbury, 2nd August,* 1883.]

In the following pages I have attempted to arrange the New Zealand Land Mollusca into something like natural groups. Of course any classification must at present be very imperfect as the animals of a large number of the species are as yet unknown, but I hope that the present will be found a useful contribution towards a monograph.

I have to tender my best thanks to several friends, especially Mr. R. Helms, Mr. T. F. Cheeseman, and Mr. Adams of the Thames, for sending me specimens either alive or in spirit. I have also to thank Dr. von Haast for allowing me to examine the collection in the Canterbury Museum; Professor T. J. Parker for allowing me to examine the collection in the Otago University Museum; Dr. Hector for having with great liberality lent me the whole of the collection in the Colonial Museum, at Wellington; and Mr. Justice Gillies for sending me from Auckland his private collection for examination. If it had not been for the assistance I have thus received I should have found it impossible to identify many of the described species; but the ample collections that have passed through my hands from nearly all parts of New Zealand, have enabled me to determine satisfactorily all but a very few, as well as to indicate fairly their distribution in the islands.

I have not thought it advisable to dismiss from our list any of the species ascribed to New Zealand. *H. reinga*, *H. taranaki,* and *H. rapida* are very probably New Zealand species, although no specimens exist in any of our collections. *Gerontia cordelia*, mihi, has, I think, been mistaken for *H. tiara*. *Hyalina corneo-fulva*, Pfeiffer, is certainly *H. cellaria*. I am not satisfied with my identification of *H. guttula*, Pfr., as the shell in the Wellington Museum exceeds the dimensions given by Pfeiffer, and it can hardly be called thin, but in other respects it corresponds well with the description, and with Reeve's figure. *Succinea tomentosa* is omitted because an examination of the animal proves it to be a fresh-water species belonging to *Amphipeplea*. *Patula varicosa* is the only shell I feel very doubtful about. Pfeiffer says that it was collected by Strange, in which case it probably belongs to

New Zealand, as I have identified nearly all the other of Strange's shells; but Reeve says that it was collected by Cuming, in which case the locality is pretty sure to be incorrect.

I have adopted Professor von Martens' suggestion, that all the specific names meaning of, or from, New Zealand should be spelt uniformly, and have taken *neozelanicus* as the most correct. I have also followed him in retaining Reeve's names for those species which Dr. Pfeiffer named after letters of the Greek alphabet, as these letters are usually employed for varieties, and not used for species.

I have retained the usual classification, although I think that the *Goniognatha* do not form a natural section, but that the genera should be distributed among the *Aulocognatha*. I incline to the opinion that *Phrixgnathus*, mihi, is near to *Punctum*, Morse, although the jaws are different; and I expect that *Carthæa*, mihi, is allied to *Charopa*, Albers, although I do not know the animal.

I am not aware that the dentition of *Endodonta*, *Charopa*, and *Amphidoxa* have been previously described. With regard to *Endodonta*, the only species whose radula I have examined, *E. pœcilosticta*, is not typical, and may be wrongly placed. *Charopa ida* I take to be typical of that genus; while *Amphidoxa* was made to include some species belonging to the *Aulocognatha*, and others belonging to the *Agnatha*; and I have chosen to associate it with the more numerous group belonging to the first section. I have seen no description of the dentition of *Thalassia*, and refer our species to it provisionally.

The present list comprises 116 species, of which 13 are unknown to me. There are also 7 species introduced from England. Of the native species, the dentition of 60 has been described by me either in the present volume, or in vol. xiv. of the Transactions of the N.Z. Institute; and the animals of 26 species are described either in this volume or in vol. xv. of the same journal.

As regards distribution, our knowledge is imperfect; but, so far as is at present known, about one half the species are confined to the North Island, one quarter to the South Island, and one quarter are common to both. Two of the three species from Stewart Island have been found nowhere else; and the single species from Campbell Island is also endemic: but the four species said to be found in the Auckland Islands are all natives of New Zealand; as also appear to be both the species recorded from the Chatham Islands. The Auckland Islands however possess a peculiar variety.

Outside the New Zealand Islands *Vitrina kermadecensis* is found in the Kermadec Islands. *Therasia ophelia* is found in Northern Australia, and *Paryphanta milligani* is Tasmanian. In neither of the two last cases however have shells from each locality been compared, and the dentition of all three is unknown. *Amphidoxa rapida*, said to come from New Zealand, occurs in North Australia (with a variety at the Solomon Islands); while *Rhagada rienga*, and *Streptaxis taranaki*, both doubtfully New Zealand, are closely allied to species from the same place. Our closest connection thus appears to be N. Australia, but there is a considerable generic affinity with the faunas of New Caledonia, Polynesia, and S. America.

Synopsis of the Families.

Sec. GONIOGNATHA.

Jaw of several transverse plates.

Sec. HOLOGNATHA.

Jaw of a single piece.

Sub-sec. AULOCOGNATHA.

Marginal teeth quadrate.

Fam. *Helicidæ.*

Animal heliciform (except *Otoconcha*), the tail without a mucous gland.

Fam. *Charopidæ.*

Animal heliciform, the tail with a mucous gland.

Sub-sec. OXYGNATHA.

Marginal teeth aculeate.

Fam. *Vitrinidæ.*

Animal heliciform, no caudal mucous gland.

Fam. *Limacidæ.*

Animal limaciform, no caudal mucous gland.

Fam. *Zonitidæ.*

Animal heliciform, a caudal mucous gland.

Sec. ELASMOGNATHA.

Jaw with a posterior accessory plate.

Sec. AGNATHA.

No jaw; teeth all aculeate.

Fam. *Streptaxidæ.*

Animal heliciform, no mucous gland.

Fam. *Testacellidæ.*

Animal limaciform, no mucous gland.

As Pulmonate Mollusca are now always classified principally by the structure of the animal and its dentition, it is not easy to make an analytical key leaving out these important points; but the following remarks may assist collectors in naming their shells.

1. Species with a few rapidly increasing whorls belong to *Otoconcha*, *Amphidoxa*, *Vitrina*, *Paryphanta*, *Elæa*, *Rhytida*, or *Daudebardia*.

2. Species with plaits inside the aperture belong to *Tornatellina*, *Strobila*, *Endodonta*, *Paxillus*, or *Diplommatina*.

3. Hairy species. *Charopa, Thera*, and *Thalassia portia*.

4. Ribbed species in *Pupa, Patula, Thera, Fruticicola, Strobila, Amphidoxa, Charopa, Psyra*, and *Phacussa*.

5. Smooth or striated species in *Microphysa, Endodonta, Phrixgnathus, Omphidoxa, Pyrrha, Gerontia, Therasia, Thalassia, Paryphanta*, and *Elæa*.

6. Surface malleated in *Rhytida*.

7. Trochiform species in *Thera, Endodonta, Phrixgnathus, Leptopoma, Omphalotropis*.

8. Shell turreted in *Realia, Pupa*.

9. Shell depressed but keeled in *Endodonta, Phrixgnathus, Amphidoxa, Therasia, Thalassia*.

10. Discoidal or very depressed species, with rounded periphery in *Patula, Microphysa, Fruticicola, Phrixgnathus, Amphidoxa, Gerontia, Charopa, Psyra, Phacussa, Paryphanta, Elæa*.

11. Species with very wide umbilicus in *Patula, Phrixgnathus, Gerontia, Amphidoxa, Charopa, Paryphanta, Elæa, Cyclotus*.

12. Species with narrow umbilicus in *Fruticicola, Stobila, Phrixgnathus, Amphidoxa, Therasia, Thalassia, Phacussa, Paryphanta, Rhytida*.

13. Imperforate or subperforate species in *Carthæa, Fruticicola, Endodonta, Phrixgnathus, Amphidoxa, Psyra, Therasia, Pyrrha, Phacussa, Vitrina, Trochomorpha, Paryphanta*.

14. Species with spiral sculpture in *Patula egesta, Charopa ida, Thalassia obnubila, Cyclotus, Cyclophorus*, and *Omphalotropis*.

15. Sinistral species in *Paxillus* and *Diplommatina*.

Sec. GONIOGNATHA.

Jaw in separate pieces, the median one often triangular: marginal teeth quadrate, usually broader than long, with several points.

Genus **Carthæa,** Hutton.

Animal heliciform. *Jaw* formed by many quadrate, overlapping plates, each higher than broad. *Shell* conoidly globose, the whorls slowly increasing; imperforate or narrowly perforate; aperture lunate; peristome straight, acute, the columellar margin rather reflexed.

C. KIWI, Gray (1843). *H. irradiata*, Gould (1846).

Closely striated, periphery rounded. White with irregular radiating purplish streaks. Diameter ·4. Dentition, 28–1–28.

The animal is unknown.

North Island.—Hokianga; Bay of Islands (Gould); Omaha (T. Kirk); Titirangi (Cheeseman); Napier; Wellington (T. W. Kirk).

Allied to *Helix radiaria* from the Solomon Islands.

Sec. HOLOGNATHA.

Jaw in one piece; teeth arranged in nearly straight transverse rows on the radula; central tooth quadrate.

Sub-sec. AULOCOGNATHA.

Marginal teeth quadrate, usually broader than long, and with several small points.

Fam. *Helicidæ.*

Animal heliciform, with an external shell; tail without any mucous gland.

Sub-fam. *Buliminæ.*

Shell ovoid, conoidal or turreted; the aperture longer than wide.

Genus **Placostylus**, Beck.

Shell large, imperforate, rugosely striate; the peristome thick and expanded, the margins united by a callus.

P. BOVINUS, Bruguière (1785) [not *B. auris-bovina*, Reeve, f. 185, which is *B. lessoni*, Petit, from New Caledonia]; *B. shongii*, Lesson (1830); *B. fibratus*, Gray in Dieffenbach's New Zealand, ii., p. 263 [not of Martyn].

Shell solid, oblong conical; fulvous brown, occasionally streaked with chestnut, the suture of the lower whorls with a white band; interior reddish or yellowish-white; peristome thickened; apical whorls finely undulately ribbed. Length 3·5 inches. Dentition, 55–1–55.

Var. *α*.—NEOZELANICUS, Pfeiffer (1861).

Shell ovately oblong; peristome thinner.

Var. *β*.—CANDIDUS, Crosse (1864).

Columella sub-vertical; peristome very thick, white.

North Island.—Cape Maria and North Cape (Dieffenbach, Gillies); Bay of Islands (Captain Cook, Lesson, Colenso, Gillies, etc.).

The animal has been described by Gould in the Zoology of the United States Exploring Expedition.

There has been some confusion in the name of this species. It appears that Captain Cook brought specimens of *Placostylus* from New Caledonia and New Zealand, and these were described by Bruguière as *B. bovinus*, from New Caledonia and New Holland. Martyn, about the same time, or a year before, had described the New Caledonian species as *B. fibratus*; and Ferussac, Lesson, Petit, and Crosse have all decided that our shell should be called *bovinus*.

P. ANTIPODARUM, Gray (1843).

Peristome thin. Shell pale fuscous variegated with dark lines, principally at the suture, where traces of a white band may also be often seen; apical whorls finely ribbed. Length 1 inch.

The animal and dentition are unknown.

North Island.—North Cape (Wellington Museum); Bream Head and Manawatu (Gillies); North Shore, Auckland (T. W. Kirk).

I am of opinion that this shell is the young of the last, although *P. bovinus* has never been found so far south. But, in deference to the opinion of Mr. Justice Gillies, I admit it as a distinct species until an examination of the animal settles the point.

Genus **Tornatellina,** Beck.

Shell minute, pellucid, columella truncated; a spiral ridge on the inner lip.

T. NEOZELANICA, Pfeiffer (1851).

Shell fulvous horny; variable in shape. Axis ·13 inch.

North Island.—Auckland (Greenwood, Kirk, Gillies).

The animal and dentition are unknown.

Sub-fam. *Pupinæ.*

Shell cylindrical or fusiform; aperture small.

Genus **Pupa,** Draparnaud.

Shell rimate, closely ribbed: whorls 9–12, not increasing; aperture sub-circular. Animal with tentacles as well as peduncles.

P. NEOZELANICA, Pfeiffer (1851).

Shell deep fuscous, with yellowish spots; apex rounded. Length ·18 inch.

North Island.—Napier (Meinertzhagen); Waimarama (Gillies); Horokiwi, Wellington.

Adams considers that this species is a *Vertigo*, belonging to the subgenus *Isthmia* of Gray. The animal and dentition are unknown.

Sub-fam. *Helicinæ.*

Shell globular, turbinate, trochiform, or discoidal.

Genus **Patula,** Held.

Shell depressed or discoidal, widely umbilicated, ribbed; whorls 4–6, slowly increasing; periphery rounded; aperture rotundly lunate; peristome simple, acute. Mantle included. Jaw striated or smooth.

A. Ribs on upper surface straight.

P. COMA, Gray (1843); *H. tau*, Pfeiffer (1861) [not *H. coma* of Pfeiffer, nor of Hutton, Trans. N.Z. Inst., xiv., p. 150].

Ribs distant, about 9 in the tenth of an inch. Pale brown, with bands of reddish brown. Diameter ·23 inch. Dentition, 13–1–13.

North Island.—Auckland (Sinclair, Greenwood, Cheeseman); Hawke's Bay; Wellington; Horokiwi, Wellington.

South Island.—Lake Guyon (F.W.H.); Greymouth (Helms); Bealey (Haast).

Allied to *P. consimilis*, Pease, from the Society Islands.

Its reported occurrence in Tasmania is incorrect.

P. LUCETTA, Hutton (1883); *H. coma*, Pfeiffer [not of Gray].

Ribs rather distant, about 15 in the tenth of an inch; spire convex; periphery obscurely angled. Pale brown, obscurely spotted. Diameter ·28 inch. Dentition, 14–1–14.

North Island.—Hawke's Bay (Colenso); Wellington (F.W.H.).

P. VARICOSA, Pfeiffer (1854).

Umbilicus moderate; spire slightly elevated, finely striated and "varicosely angled with distant ribs." Fuscous. Diameter ·14 inch.

New Zealand (Strange or Cuming).

I have not been able to make this species out.

P. BUCCINELLA, Reeve (1852); *P. gamma*, Pfeiffer (1851).

Ribs close, about 30 in the tenth of an inch; spire flat. Pale brown, banded or clouded with dark brown. Diameter ·14 inch. Dentition, 10–1–10.

North Island.—Auckland (Cheeseman, Gillies); Petane, near Napier.

South Island.—Dunedin (F.W.H.).

P. CORNICULUM, Reeve (1852); *H. eta*, Pfeiffer (1851); not *H. corniculum*, Hombron and Jacquinot (1854).

Ribs very close, about 40 in the tenth of an inch. White, silky. Diameter ·14 inch. Dentition, 14–1–14.

North Island.—Auckland (Cheeseman, Gillies); Petane, near Napier.

South Island.—Oxford and Christchurch (Chilton).

P. BIANCA, Hutton (1883).

Minute. Ribs very close, about 55 in the tenth of an inch. Horny brown, banded with darker. Diameter ·1 inch.

North Island.—Auckland (Cheeseman); Horokiwi, Wellington.

South Island.—Greymouth (Helms); Bealey (Haast).

P. ANGUICULA, Reeve (1852); *H. theta*, Pfeiffer.

Ribs close, about 33 in the tenth of an inch; aperture subcircular. Dark brownish with rufous streaks. Diameter ·10 inch. Dentition, 11–1–11.

North Island.—Auckland (Cheeseman).

South Island.—Greymouth (Helms); Oxford (Chilton).

Auckland Islands (H. Krone).

B. Ribs on upper surface sinuated.

P. TIMANDRA, Hutton (1883).

Ribs distant, about 13 in the tenth of an inch. Brown, obscurely banded with paler. Diameter ·12 inch.

North Island.—Auckland (Cheeseman, Gillies); Horokiwi, Wellington.

P. JESSICA, Hutton (1883).

Ribs close, about 35 in the tenth of an inch. Dark reddish brown, marked with horny. Diameter ·17 inch.

South Island.—Bealey (Haast).

C. Ribs on upper surface arcuated.

P. TAPIRINA, Hutton (1882); *P. coma*, Trans. N.Z. Inst., xiv., p. 150; not of Gray.

Ribs about 18 in the tenth of an inch. Horny brown, obscurely banded with reddish. Diameter ·19 inch. Dentition, 13–1–13. Spire usually convex, but sometimes concave.

North Island.—Auckland (Cheeseman, Gillies); Hawke's Bay (Meinertzhagen); Masterton and Wellington (T. W. Kirk).

South Island.—Greymouth (Helms); Temuka (Chilton); Dunedin and Queenstown (F.W.H.).

P. SYLVIA, Hutton (1883).

Ribs distant, about 18 in the tenth of an inch; pale horny with thin bands of chestnut on the upper suface. Diameter ·12 inch.

North Island.—Auckland (Gillies); Horokiwi, Wellington.

South Island.—Bealey (Haast).

Smaller, paler, and with narrower whorls than the last species.

P. INFECTA, Reeve (1852); *H. zeta*, Pfeiffer (1851).

Ribs about 23 in the tenth of an inch. Pale horny, banded and tessellated with rufous. Diameter ·14 inch. Dentition, 15–1–15.

North Island.—Petane, near Napier.

South Island.—Greymouth (Helms); Oxford (Chilton); Bealey (Haast).

P. BICONCAVA, Pfeiffer (1851).

Spire deeply concave; aperture higher than broad; ribs about 32 in the tenth of an inch. Diameter ·17 inch. Animal and dentition unknown.

North Island.—Thames, Auckland (Adams), a single specimen.

D. With spiral grooves.

P. EGESTA, Gray (1849).

Strongly spirally grooved, and with distant, irregular ribs. Reddish brown, sometimes mottled with yellowish. Diameter ·17 inch.

The animal and dentition are unknown.

North Island.—Auckland (Greenwood, Cheeseman, Gillies).

Genus **Thera**, Hutton.

Animal and jaw as in *Patula*. Shell conical, high, perforate, hairy; periphery angled.

T. STIPULATA, Reeve (1852); *H. alpha*, Pfeiffer (1851); *H. barbatula*, Reeve (1852); *H. beta*, Pfeiffer (1851).

Ribs distant, about 14 in the tenth of an inch, and striated between; apex obtuse; umbilicus moderate. Yellowish brown, often marked with darker. Diameter ·14; height ·16 inch. Dentition, 12–1–12.

North Island.—Petane, near Napier.

South Island.—Greymouth (Helms); Temuka (Chilton); Dunedin and Queenstown (F.W.H.).

Genus **Rhagada,** Albers.

Shell imperforate, or sub-perforate, globose, striated; whorls 4½–5½, the last slightly descending in front; aperture very oblique; peristome lipped within, somewhat expanded.

R. RIENGA, Gray (1843).

Shell perforated, the perforation covered. Whitish, with a chestnut band, and many orange-coloured lines. Diameter ·59 inch.

North Island.—North Cape (Dr. Dieffenbach ?).

I have not seen this species: it is closely related to *H. dringi* from N. Australia.

Genus **Fruticicola,** Held.

Animal like *Patula*. Jaw with broad flat ribs. Shell narrowly umbilicated, depressly globose; periphery rounded; whorls 5–7, rather convex, ribbed; aperture broadly lunate; peristome acute, its columellar margin reflected.

F. PILULA, Reeve (1852); *H. iota*, Pfeiffer (1851).

Spire convex; closely ribbed, ribs about 17 in the tenth of an inch; umbilicus open. Pale horny variegated with reddish-brown. Diameter ·29. Dentition, 27–1–27.

North Island.—Auckland (Cheeseman, Gillies); Napier (Meinertzhagen); Wanganui and Wellington (T. W. Kirk).

Var. GRANUM, Pfeiffer (1857).

Spire conoidal, the ribs finer and closer, and the umbilicus narrower.

South Island.—Eyreton, N. Canterbury (Chilton).

The shell is very like that of *Phacussa*; but it is greyer, slightly thicker, and with stouter ribbing.

F. CHORDATA, Pfeiffer (1861).

Spire conoidal, closely ribbed; umbilicus covered. Diameter ·15 inch.

New Zealand (Hochstetter).

I have not seen this species, unless it is the same as *F. granum*.

Genus **Microphysa,** Albers.

Animal as in *Patula*. Jaw with numerous broad flat ribs. Shell umbilicated, depressed, thin, delicately striate, scarcely shining; whorls 4–5, gradually increasing; aperture roundly lunate; peristome thin, simple.

M. CAPUT-SPINULÆ, Reeve (1852); *H. epsilon*, Pfeiffer (1851).

Pale horny; umbilicus rather narrow; whorls 3½, membranous ribs about 30 in the tenth of an inch. Diameter ·07 inch.

North Island.—Auckland (Cheeseman); Horokiwi, Wellington.

M. PUMILA, Hutton (1882).

Brownish horny; umbilicus moderate; whorls 4, membranous ribs about 25 in the tenth of an inch. Diameter ·07 inch. Dentition, 13–1–13.

South Island.—Christchurch (J. F. Armstrong); Eyreton, N. Canterbury (Chilton).

M. CAMPBELLICA, Filhol (1880).

Shell minutely perforated, sub-globose, depressed, uniformly horny; above with crisped ribs, below finely striated. Whorls 4½, rather convex, regularly increasing; suture deeply impressed; aperture rounded; peristome simple, acute, straight; columellar margin slightly reflected. Diameter ·12; height ·08 inch.

Campbell Island.—(Dr. H. Filhol).

I have not seen this species.

Genus **Strobila,** Morse.

Animal as in *Patula*. Jaw with flat ribs. Shell umbilicated, depressed, striated or ribbed; periphery rounded; whorls 5–6, very slowly increasing; aperture lunately rounded; interior with spiral laminæ on the parietal wall and on the base of the last whorl.

S. LEIODA, Hutton (1882).

Spire flat; ribs about 30 in the tenth of an inch; seven laminæ on the penultimate whorl, one on the columella, and ten on the parietal wall. Horny with pale rufous bands; umbilicus brown, narrow. Diameter ·08 inch. Dentition, 12–1–12.

South Island.—Greymouth (Helms).

Doubtfully included in *Strobila* as the jaw is not known.

Genus **Endodonta,** Albers.

Shell sub-perforate, conical or conoidal; the periphery angled; whorls narrow, the suture usually margined; aperture angularly lunate; inner lip and generally the columella and parietal wall with spiral laminæ; peristome straight acute. Jaw imbricately folded; or of many imbricating plates; papillate.

E. LEIMONIAS, Gray (1849).

Conical high; no columellar plait; three parietal plaits, one on the penultimate whorl, and two on the outer lip, one above the other below the keel. Pale horny. Diameter ·09; height ·1 inch.

North Island.—Auckland (Greenwood, Cheeseman).

E. PŒCILOSTICTA, Pfeiffer (1851).

Spire conical; acute, finely ribbed, ribs about 22 in the tenth of an inch; a columellar plait only. Pale yellowish horny, with obscure chestnut spots. Diameter ·17 inch. Dentition, 23–1–23.

North Island.—Auckland (Cheeseman, Gillies); Napier; Wellington.

E. marina, Hutton (1883).

Spire conoidal rather obtuse; striated; a columellar plait, and two parietal plaits, none on the basal margin. Pale yellow faintly marked with chestnut. Diameter ·13 inch.

North Island.—Remuera, near Auckland (Cheeseman).

E. nerissa, Hutton (1883).

Spire conoidal, obtuse, striated; a columellar plait and six parietal plaits, three of which are on the basal margin. Pale horny with indistinct bands of chestnut. Diameter ·11 inch.

North Island.—Remuera, near Auckland (Cheeseman).

Genus **Phrixgnathus**, Hutton.

Animal heliciform, the body elongated; mantle sub-central, slightly reflected over the peristome of the shell; no locomotive disc, nor mucous gland. Jaw imbricately folded, the surface covered with small papillæ. Shell trochiform, turbinate, or depressed, umbilicate or sub-perforate, smooth, rather shining, striated; aperture edentulous.

Perhaps this genus and the last should be placed in the *Goniognatha.* The transverse rows of teeth form an obtuse angle, salient posteriorly.

A. Subperforate.

P. maria, Gray (1843); *H. umbraculum*, Pfeiffer (1851).

Spire conoidal, obtuse; periphery sharply angled; suture margined. Pale horny, with numerous undulating bands of reddish brown on both surfaces. Diameter ·28 inch. Dentition, 47–1–47.

North Island.—Auckland (Sinclair, Greenwood, Cheeseman, Gillies); Wellington (T. W. Kirk).

Allied to *H. insculpta* (Pfr.), from Norfolk Island (Martens).

P. conella, Pfeiffer (1861).

Spire conoidal, slightly acute, smooth; periphery slightly angled; suture slightly margined. Pale horny, with reddish brown spots and bands on both surfaces. Diameter ·13 inch. Dentition, 38–1–38.

North Island.—Auckland (Cheeseman, Gillies); Kakepuku (Hochstetter); Horokiwi, Wellington.

P. ariel, Hutton (1883).

Spire conoidal, depressed; finely ribbed, ribs about 46 in the tenth of an inch; sub-carinate; suture impressed. Diameter ·13 inch. Dentition, 32–1–32.

North Island.—Auckland (Cheeseman); Wanganui (T. W. Kirk).

B. Narrowly umbilicated.

a. Spire conical.

P. marginatus, Hutton (1882).

Spire acute; periphery sharply angled; suture margined. Pale horny, with broad radiating reddish-brown bands on the upper surface only. Diameter ·17 inch. Dentition, 35–1–35.

South Island.—Greymouth (Helms).

P. REGULARIS, Pfeiffer (1854).

As high as broad; very finely striated; periphery acutely angled; suture impressed; umbilicus partly covered. Horny, covered with a thin epidermis, which is produced into ragged processes at the periphery. Diameter ·15 inch. Dentition, 27–1–27.

South Island.—Greymouth (Helms).

P. ERIGONE, Gray (1849); *H. heldiana*, Pfeiffer (1851).

As high as broad; apex obtuse; periphery obtusely angled; suture impressed. Pale horny, obscurely marked with reddish-brown. Diameter ·08 inch.

North Island.—Auckland (Greenwood, Cheeseman, Gillies).

b. Spire conoidal.

P. CELIA, Hutton (1883); *H. fatua*, Trans. N.Z. Inst., xiv., p. 153 [not of Pfeiffer].

Spire acute; periphery obtusely angled. Pale horny, with reddish-brown bands. Diameter ·15 inch. Dentition, 20–1–20.

North Island.—Wanganui and Wellington (T. W. Kirk); Horokiwi, Wellington.

South Island.—Dunedin and Milford Sound (F.W.H.); Greymouth (Helms); Temuka (Chilton).

P. PHRYNIA, Hutton (1883).

Spire acute; periphery obtusely angled. Pale horny, radiately streaked with rufous; covered by a thin epidermis which is rather distantly wrinkled. Diameter ·1 inch.

North Island.—Wanganui (T. W. Kirk).

P. FATUA, Pfeiffer (1857).

Spire rather acute; periphery sub-carinated; finely striated. Yellow horn colour. Diameter ·2 inch.

North Island.—Taupiri (Hochstetter); Auckland (Cheeseman).

P. GLABRIUSCULA, Pfeiffer (1851).

Semi-globose; periphery rounded; smooth. Pale yellow, angularly lined with rufous. Diameter ·14 inch.

New Zealand (Strange).

I have not seen this species.

C. Broadly umbilicated.

P. SCIADIUM, Pfeiffer (1875).

Spire conoidal, obtuse; suture margined; periphery acutely angled. Pale horny obscurely variegated with reddish-brown. Diameter ·45 inch.

North Island.—Auckland (Gillies); Seventy-mile Bush, Wellington (T. W. Kirk).

P. TITANIA, Hutton (1883).

Spire conoidal, rather obtuse; suture margined; periphery obtusely angled. Pale horny irregularly banded with chestnut. Diameter ·14 inch.

South Island.—Dunedin (F.W.H.).

P. HAASTI, Hutton (1883).

Spire conoidal, depressed; suture impressed; periphery sub-carinated. Horny with irregular bands of reddish-brown and white. Diameter ·12 inch.

South Island.—Mount Somers (Haast).

Genus **Amphidoxa**, Albers.

Shell depressed, thin, pellucid; periphery usually rounded; whorls 3 to 4, rapidly increasing; aperture very oblique. Mantle reflected over the peristome of the shell, with an even margin: tail depressed.

A. Smooth, polished.

A. COMPRESSIVOLUTA, Reeve (1852); *H. omega*, Pfeiffer (1851).

Imperforate, depressed. Horny, without markings. Diameter ·3 inch. Dentition, 35–1–35.

North Island.—Petane, near Napier; Wellington (F.W.H.).

South Island.—Greymouth (Helms).

A. CORNEA, Hutton (1882).

Smaller than the last, the whorls more convex. Diameter ·25 inch. Dentition, 22–1–22.

North Island.—Auckland (Cheeseman, Gillies).

A. ZEBRA, Guillon (1842); *H. phlogophora*, Pfeiffer (1849); *H. flammigera*, Pfeiffer (1852); *H. multilimbata*, Hombron and Jacquinot (1854).

Umbilicus very narrow or covered. Pale yellow horny with dark reddish brown undulating bands. Diameter ·25 inch. Dentition, 21–1–21.

North Island.—Wellington (T. W. Kirk).

South Island.—Greymouth (Helms); Oxford (Chilton); Banks Peninsula (R. Brown).

Auckland Islands (British Museum).

A. JACQUENETTA, Hutton (1883).

Umbilicus very narrow. Periphery sharply angled. Horny brown, without markings. Diameter ·2 inch. Dentition, 28–1–28.

South Island.—Greymouth (Helms).

A. PERDITA, Hutton (1883).

Umbilicus narrow; spire convex, smooth. Horny without markings. Diameter ·23 inch. Dentition, 20–1–20.

North Island.—Auckland (Cheeseman, Gillies); Wanganui and Wellington (T. W. Kirk).

South Island.—Greymouth (Helms).

A. CHIRON, Gray (1849).

Umbilicus moderate; spire convex, with distant membranous plaits. Horny without markings. Diameter ·24 inch. Dentition, 21–1–21.

North Island.—Auckland (Greenwood, Cheeseman); Wellington (T. W. Kirk).

A. RAPIDA, Pfeiffer (1853).

Umbilicus moderate; spire flat, sub-immersed; whorls spirally striatulated. Chestnut with luteous streaks and dots. Diameter ·3 inch.

New Zealand.—Locality doubtful. I have not seen this species; it is found in N. Australia, and a variety at the Solomon Islands.

A. CREBRIFLAMMIS, Pfeiffer (1851).

Umbilicus broad; spire convex, finely striated. Pale horny, with reddish undulating bands. Diameter ·28 inch. Dentition, 18–1–18.

South Island.—Greymouth (Helms).

B. Whorls ribbed.

Sub-genus **Calymna,** Hutton.

A. COSTULATA, Hutton (1882).

Umbilicus moderate; spire convex, closely ribbed; ribs about 45 in the tenth of an inch. Horny banded with reddish. Diameter ·14 inch. Dentition, 14–1–14.

North Island.—Auckland (Cheeseman).

A. LAVINIA, Hutton (1883).

Umbilicus broad; spire flat, closely ribbed, ribs about 18 in the tenth of an inch; lower surface smooth. Yellow horny, mottled with rufous on the upper side. Diameter ·5 inch.

North Island.—Palmerston North (T. W. Kirk).

Genus **Otoconcha,** Hutton.

Shell external, of very few rapidly increasing whorls, all of which are open underneath. Animal limaciform, much too large to withdraw into the shell; mantle rather anterior, covering the shell; no locomotive disc, nor mucous caudal gland. Jaw with distant ribs.

This genus appears to be allied to *Peltella* from Brazil and the West Indies.

O. DIMIDIATA, Pfeiffer (1851) *Vitrina.*

Shell pale horny, translucent, of two and a half whorls; striated. Diameter ·2 inch. Animal entirely black, or pale coloured on the foot. Dentition, 26–1–26.

North Island.—Auckland (Cheeseman); Thames (Adams); Hawke's Bay (Colenso); Wellington (T. W. Kirk).

Fam. *Charopidæ.*

Animal heliciform, with an external shell; tail with a mucous gland.

Genus **Gerontia**, Hutton.

Shell depressed, widely umbilicated, striated; periphery rounded; whorls about five, slowly increasing; aperture oblique. Mantle included. Jaw smooth, striated.

G. PANTHERINA, Hutton (1882).

Shell striated with membranous plaits. Horny brown. Diameter ·37 inch. Dentition, 24–1–24.

South Island.—Greymouth (Helms).

G. CORDELIA, Hutton (1883).

Shell striated but not plaited. Pale horny marbled with reddish brown. Diameter ·32 inch.

North Island.—Auckland (Cheeseman, Gillies). Apparently allied to *Helix tiara*, Mighels, from the Sandwich Islands.

Genus **Pyrrha**, Hutton.

Animal heliciform, mantle sub-central, reflected over the peristome with an even margin: tail truncate, with a large papilla and mucous gland. Jaw with flat ribs. Marginal teeth broad, with several points. Shell thin, translucent, of $4\frac{1}{2}$–$5\frac{1}{2}$ regularly increasing whorls, subperforate.

P. CRESSIDA, Hutton (1883).

Shell olive horny, striated; suture deep, spire convex. Dentition about 35–1–35.

North Island.—Wellington (T. W. Kirk).

South Island.—Preservation Inlet (F.W.H.); Haast River (Haast); Southland (G. M. Thomson); Greymouth (Helms).

Stewart Island (T. Kirk).

P. GUTTULA, Pfeiffer (1853).

Shell rather solid, subperforate, smooth, spire convex, suture inconsiderable, columella thickened. Pale yellowish horny. Diameter ·7 inch.

North Island.—Mountains near Masterton (T. W. Kirk).

The animal and dentition are unknown, consequently it is referred here with doubt.

Genus **Charopa**, Albers.

Shell umbilicated, depressed, ribbed, usually with hairs; periphery rounded. Jaw with flat ribs. Marginal teeth broad, usually with many points.

C. IDA, Gray (1849); *H. zic-zac*, Gould (1848) (?).

Spire flat; umbilicus perspective; whorls with distant hairy ribs, about 12 in the tenth of an inch, and distant slight spiral membranous ridges, especially on the lower surface. Diameter ·33 inch. Dentition, 22–1–22.

North Island.—Auckland (Greenwood, Cheeseman, Gillies); Napier; Wellington.

South Island.—Greymouth (Helms).

Apparently allied to *H. hystrix*, Mighels, from the Sandwich Islands. As the locality of *H. zic-zac* is uncertain, Gould first referring it to Australia and then to New Zealand, it will be better to omit it altogether.

Genus **Psyra**, Hutton.

Shell imperforate or narrowly umbilicated, ribbed, periphery rounded, not hairy. Jaw and teeth as in *Charopa.*

P. DIMORPHA, Pfeiffer (1851).

Spire nearly flat; umbilicus almost covered; columella callous; whorls with distant smooth ribs, about 9 in the tenth of an inch. Pale horny variegated with reddish-brown. Diameter ·38 inch. Dentition about 30–1–30.

North Island.—Auckland (Cheeseman, Gillies); Wellington (T. W. Kirk).

P. CASSANDRA, Hutton (1883).

Spire flatly conoidal; umbilicus very narrow; columella slightly thickened; whorls finely ribbed; ribs about 20 in the tenth of an inch. Pale horny with longitudinal angulated bands of chestnut. Diameter ·5 inch.

North Island.—Napier.

P. VENULATA, Pfeiffer (1857).

Spire slightly convex; imperforate, the columella callous; whorls closely ribbed, about 23 ribs to the tenth of an inch. Horny brown, sometimes variegated with reddish. Diameter ·22 inch. Dentition, 17–1–17.

South Island.—Western slopes of Mount Cook (Filhol); Greymouth (Helms).

P. TULLIA, Gray (1849).

Spire slightly convex; narrowly umbilicated, the umbilicus covered; whorls closely ribbed, ribs about 30 in the tenth of an inch. Horny, or horny-brown obscurely marked with reddish, sometimes tessellated below. Diameter ·14 inch.

North Island.—Auckland (Greenwood); Wellington.

South Island.—Greymouth (Helms).

P. ADRIANA, Hutton (1883).

Spire flat, closely ribbed; ribs about 40 in the tenth of an inch; umbilicus narrow but open. Pale horny with spots and angular streaks of chestnut. Diameter ·16 inch.

North Island.—Napier.

South Island.—Banks Peninsula (R. Brown).

P. PLANULATA, Hutton (1883).

Spire slightly elevated; narrowly umbilicated, the umbilicus covered; whorls closely ribbed; ribs about 40 in the tenth of an inch. Horny brown sometimes clouded with rufous. Diameter ·15 inch. Dentition, 11–1–11.

North Island.—Auckland (Cheeseman).

South Island.—Greymouth (Helms).

P. MIRANDA, Hutton (1883).

Spire convex; very finely ribbed, ribs about 50 in the tenth of an inch; imperforate or very narrowly umbilicated. Pale horny banded with chestnut on the upper surface and tessellated with the same colour below. Diameter ·16 inch. Dentition, 17–1–17.

South Island.—Greymouth (Helms).

Genus **Therasia**, Hutton.

Shell conoidal, depressed, periphery sub-carinated; sub-perforate or narrowly perforate; whorls smooth, striated, or with membranous plaits. Jaw with flat ribs. Marginal teeth broad, usually with several points.

A. Sub-perforate.

T. CELINDA, Gray (1849).

Whorls with distant membranous plaits, about 10 in the tenth of an inch. Pale brown. Diameter ·14 inch. Dentition, 18–1–18.

North Island.—Auckland (Greenwood, Cheeseman).

T. VALERIA, Hutton (1883).

Whorls strongly striated. Yellowish horny, obscurely marked with reddish. Diameter ·25 inch. Dentition, 26–1–26.

South Island.—Dunedin (F.W.H.).

T. OPHELIA, Pfeiffer (1854).

Umbilicus very narrow. Whorls delicately striated; periphery angulated. Horny with obscure reddish streaks. Diameter ·40 inch.

North Island.—Auckland (Cheeseman).

South Island.—Dunedin (F.W.H.).

B. Narrowly umbilicated.

T. TAMORA, Hutton (1883).

Conical; irregularly plaited. Brownish horny. Diameter ·17 inch.

North Island.—Auckland (Cheeseman).

T. THAISA, Hutton (1883).

Irregularly coarsely striated. Pale horny, variously streaked with brown. Diameter ·35 inch. Dentition, 27–1–27.

North Island.—Auckland (Gillies); Napier; Wellington (T. W. Kirk).

South Island.—Waipara (Haast, Chilton); Waitaki, Queenstown, Dunedin and Lake Guyon (F.W.H.); Waiau, Southland (G. M. Thomson).

T. DECIDUA, Pfeiffer (1857).

Delicately striated, and with fine membranous plaits; periphery sub-carinated. Yellowish horny, obscurely marked with reddish. Diameter ·3 inch.

North Island.—Auckland (Cheeseman); Wangaruru.

Genus **Thalassia**, Albers.

Shell conoidal, depressed; periphery rounded, or carinated; umbilicus narrow or moderate; whorls smooth, often with membranous plaits, especially in the young. Jaw with flat ribs. Marginal teeth longer than broad with one point very much longer than the others.

T. PORTIA, Gray (1849); *H. kappa*, Pfeiffer (1851); *H. collyrula*, Reeve (1852).

Periphery rounded; umbilicus moderate; whorls with distant membranous hairy ribs; ribs about 12 in the tenth of an inch. Pale brown, obscurely variegated with rufous. Diameter ·33 inch. Dentition, 24–1–24.

North Island.—Auckland (Sinclair, Greenwood, Gillies, Cheeseman).

When deprived of hairs this shell somewhat resembles *Patula lucetta*, but it may be distinguished by the narrower umbilicus, and more distant ribs.

T. OBNUBILA, Reeve (1852); *H. sigma* and *H. lambda*, Pfeiffer (1851); *H. igniflua*, Reeve (1852).

Periphery sub-carinated; umbilicus moderate; whorls finely striated and with distant spiral shallow grooves; sometimes with membranous plaits. Brownish horny, often banded with reddish brown. Diameter ·58 inch. Dentition, 36–1–36.

North Island.—Napier.

South Island.—Dunedin (F.W.H.); Oxford (Chilton).

T. PROPINQUA, Hutton (1882).

Periphery obtusely angled; umbilicus very narrow; whorls striated, smooth. Pale horny with narrow undulating bands of reddish brown. Diameter ·25 inch. Dentition, 31–1–31.

North Island.—Auckland (Gillies); Hawke's Bay (Colenso).

South Island.—Weka Pass (Chilton); Southland (G. M. Thomson).

T. NEOZELANICA, Gray (1843).

Periphery acutely angled; umbilicus narrow; whorls striated, smooth, or with membranous plaits in the young. Horny brown, with undulating bands and spots of reddish brown. Diameter ·42 inch. Dentition, 35–1–35.

North Island.—Auckland (Sinclair, Greenwood, Cheeseman, Gillies); Wellington (F.W.H.); Wanganui (T. W. Kirk); Napier (Colenso).

Chatham Islands.

Var. *a.*—ANTIPODA, Hombron and Jacquinot (1854). Pale horny banded on both surfaces with brownish chestnut.

South Island.—Greymouth (Helms).

Auckland Islands (H. and J., H. Krone).

Var. *β.*—AUCKLANDICA, Guillon (1842). Yellowish brown with red spots on the upper surface only.

Auckland Islands.

Allied to *H. excavata*, H. and J., from Tahiti. The Chatham Island specimens are too much rubbed to say to which variety they belong.

Sub-sec. OXYGNATHA.

Marginal teeth aculeate, the base longer than broad with a single long curved point.

Fam. *Vitrinidæ.*

Animal heliciform; the mantle more or less reflected over the shell; no caudal mucous gland.

Genus **Trochomorpha,** Albers.

Shell umbilicated or imperforate, conical; the apex obtuse; whorls 5–8, the last carinated.

T. HERMIA, Hutton (1883).

Imperforate; closely plicated above, polished below. Horny brown, paler above than below; columella callous, white. Diameter ·7 inch.

North Island.—Manawatu.

The animal and dentition are unknown, and the generic position is doubtful.

Genus **Vitrina,** Draparnaud.

Shell imperforate, thin, pellucid, shining, depressed; whorls 2–3, rapidly increasing. Jaw smooth with a median projection.

V. KERMADECENSIS, Pfeiffer.

Shell polished, slightly undulated with growth-lines; spire flat; whorls 3. Pale yellow olive. Diameter ·34 inch.

North Island.—Hobson's Glen, Auckland (T. W. Kirk).

Found also at the Kermadec Islands.

The animal and dentition are unknown and the generic position is doubtful.

Fam. *Limacidæ.*

Animal elongated; mantle small, shield-like, enclosing the shell. No caudal mucous gland.

Genus **Limax,** Linné.

Mantle anterior, the front edge free. Foot with a locomotive disc.

Sub-genus **Milax,** Gray.

Back keeled to the mantle.

L. ANTIPODUM, Pfeiffer (1855).

Greyish or brownish; mantle rounded behind. Length 1 inch. Dentition, 40–1–40.

North Island.—Wellington (F.W.H.).

South Island.—Dunedin and Banks Peninsula (F.W.H.).

L. EMARGINATUS, Hutton (1879).

Dark grey or olive; mantle emarginate behind. Length 1 inch. Dentition, 46–1–46.

South Island.—Dunedin (F.W.H.).

L. FULIGINOSUS, Gould (1846).

Sooty black, tentacles reddish at the tip. Length 2·5 inch.

North Island.—Bay of Islands (Dr. Pickering).

I have not seen this species.

Fam. *Zonitidæ.*

Animal heliciform. A caudal mucous gland.

Genus **Hyalina,** Ferussac.

Shell umbilicated, depressed or discoidal, shining and vitreous; whorls 5–6, gradually increasing. Jaw smooth or striated.

H. NOVARÆ, Pfeiffer (1861).

Spire flat: whorls 4, finely striated at the suture; suture scarcely impressed; umbilicus somewhat narrow. Pale yellowish horny. Diameter ·23 inch.

North Island.—Bay of Islands (Hochstetter).

I have not seen this species. According to Pfeiffer it is allied to *H. remota*, Benson, from St. Helena. Perhaps it is the young of *Zonites cellarius.*

Genus **Phacussa,** Hutton.

Shell depressed; periphery rounded; whorls 5–6, gradually increasing. Mantle included. Jaw with flat ribs.

P. HYPOPOLIA, Pfeiffer (1851).

Spire almost flat; closely ribbed; ribs about 23 in the tenth of an inch; narrowly umbilicated. Horny, silky, sometimes obscurely marked with brown. Diameter ·26 inch.

North Island.—Hawke's Bay (Colenso); Wellington (T. W. Kirk).

The dentition is unknown.

P. HELMSI, Hutton (1882).

Spire convex; rather distantly ribbed; ribs about 16 in the tenth of an inch; narrowly umbilicated. Horny brown. Diameter ·35 inch. Dentition, 28–1–28.

Var. *a.*—MACULATA. Shell spotted and banded with reddish.

South Island.—Greymouth (Helms).

P. FULMINATA, Hutton (1882).

Spire convex, finely striated; very narrowly umbilicated; columella sub-callous. Pale horny with reddish-brown undulating bands. Diameter ·34 inch. Dentition, 38–1–38.

Stewart Island (T. Kirk).

Sec. ELASMOGNATHA.

Jaw in a single piece, with a more or less quadrate projecting plate above.

Fam. *Janellidæ.*

Animal limaciform, without tentacles; mantle rudimentary or absent. Respiratory orifice near the median line on the back.

Genus **Janella**, Gray.

Mantle absent; shell rudimentary; a mucous pore in front of the respiratory opening. Back with a longitudinal groove giving off oblique branches on each side.

J. BITENTACULATA, Quoy and Gaimard (1832); *Athoracophorus bitentaculatus*, Gould (1852); *J. antipodarum*, Gray (1853).

Yellowish, marked with pale brown; tail depressed, acute. Dentition, 250–1–250.

Var. PAPILLATA, Hutton (1879).

Back with small papillæ.

North Island.—Wellington (F.W.H.).

South Island.—Tasman Bay (Quoy); Christchurch (Fereday); Greymouth (Helms); Dunedin (F.W.H.).

Auckland Islands (H. Krone).

Chatham Islands (H. Travers).

J. MARMOREA, Hutton (1879).

Blackish marbled with pale brown; tail rounded, obtuse. Dentition, 258–1–258.

South Island.—Dunedin (Bourne); Greymouth (Helms).

Sec. AGNATHA.

Jaw absent; all the teeth aculeate; the transverse rows forming an angle salient posteriorly.

Fam. *Streptaxidæ.*

Animal heliciform. Shell globose or depressed.

Genus **Streptaxis**, Gray.

Shell umbilicated, globosely depressed; the base polished; convex; striated above; the last whorl enlarged and descending; peristome expanded, reflected.

S. TARANAKI, Gray (1843).

Umbilicus moderate; peristome thin, expanded; whorls 5. Pale horny, shining and white within. Diameter ·64 inch.

North Island.—Taranaki (Dr. Dieffenbach ?); Possession Island, Torres Straits (Ince).

I have not seen this species; it is closely allied to *H. delessertiana*, from N. Australia.

Genus **Paryphanta,** Albers.

Shell large umbilicated or imperforate; depressed, of few whorls, the last rapidly increasing; covered with a thick shining epidermis involving the peristome.

P. BUSBYI, Gray (1841).

Blackish green; whorls 4½; umbilicus broad, perspective. Diameter 3 inches. Dentition, 50–0–50.

North Island.—Hokianga and Bay of Islands.

Allied to *H. atramentaria* from Victoria.

P. HOCHSTETTERI, Pfeiffer (1861).

Greenish fulvous with undulating chestnut lines; whorls 5½; umbilicus moderate, not pervious. Diameter 2·75 inches.

North Island.—Manawatu (Travers, Gillies).

South Island.—Collingwood (Hochstetter); Picton (Seymour).

P. GILLIESII, Smith (1880).

Dark chestnut with yellowish spiral lines; shell pliable; whorls 5–6, the last separated from the previous one for some distance from the aperture: umbilicated. Diameter 1·4 inch.

South Island.—Collingwood (Travers); Nelson (Gillies).

The animal and dentition are unknown.

P. MILLIGANI, Pfeiffer (1852).

Dark olive brown; imperforate; whorls 3, polished, uneven with growth lines. Diameter ·86 inch.

North Island.—Wellington (T. W. Kirk).

I have not been able to compare this shell with Tasmanian specimens so I retain the name given to it by Mr. Kirk. The animal and dentition are unknown.

Genus **Elæa,** Hutton.

Shell small; epidermis thin, not involving the peristome; umbilicus wide; whorls few, rapidly increasing.

E. CORESIA, Gray (1849).

Yellow horny without markings or with fuscous streaks; spire nearly flat; whorls 3, striated; umbilicus very broad, showing all the whorls. Diameter ·27 inch. Dentition, 9–0–9.

North Island.—Auckland (Greenwood, Cheeseman); Wellington (T. W. Kirk).

E. JEFFREYSIANA, Pfeiffer (1851).

Horny with chestnut streaks; spire flat; whorls 4; striated; umbilicus very broad, perspective. Diameter ·28 inch. Dentition, 9–0–9.

North Island.—Auckland (Cheeseman, Gillies).

The shell of this species closely resembles that of *Amphidoxa crebriflammis*, but the spire is flatter and the umbilicus wider.

Genus **Rhytida**, Albers.

Shell umbilicated, thin, wrinkled and malleated, of few rapidly increasing whorls; aperture oblique.

R. DUNNIÆ, Gray (1841).

Brown; umbilicus moderate; periphery sharply keeled. Diameter ·95 inch.

North Island.—Bay of Islands (Colenso); Auckland (Gillies).

R. GREENWOODI, Gray (1849).

Olive-brown; umbilicus moderate, often obtusely keeled; periphery rounded. Diameter ·92 inch. Dentition, 10–0–10.

North Island.—Auckland (Greenwood, Cheeseman); Hawke's Bay (Colenso).

R. PATULA, Hutton (1882). Horny brown; umbilicus rather narrow, not keeled; aperture very oblique. Diameter ·9 inch. Dentition, 14–0–14 to 18–0–18. Outer tooth but one with an angular ridge.

South Island.—Greymouth (Helms); Balclutha (F.W.H.).

R. CITRINA, Hutton (1882).

Yellowish olive, pellucid; umbilicus narrow. Diameter ·8 inch. Dentition, 17–0–17. Teeth smooth, the outer tooth much smaller.

South Island.—Greymouth (Helms); Buller River (Haast).

R. AUSTRALIS, Hutton (1882).

Olive brown; umbilicus narrow. Diameter ·44 inch. Dentition, 16–0–16. Teeth smooth, the two outer ones much smaller.

Stewart Island (T. Kirk).

Perhaps a variety of the last species.

R. URNULA, Pfeiffer (1854).

Greenish brown; umbilicus very narrow, covered. Diameter ·63 inch.

North Island.—Wellington (F.W.H., T. W. Kirk); Pohui.

Fam. *Testacellidæ.*

Animal limaciform, with a small shell on the posterior part of the back.

Genus **Daudebardia**, Hartmann.

Shell depressed, paucispiral. Teeth not barbed.

D. NEOZELANICA, Pfeiffer (1862).

Shell of 2½ whorls, fulvous brown, distinctly striated; columella thickly callous above. Diameter ·6 inch.

North Island.—Waikato (Hochstetter, F.W.H.); Wainuiomata (T. W. Kirk).

Genus **Testacella**, Cuvier.

Mantle divided into numerous lobes. Teeth barbed at the point. Shell auriform, sub-spiral.

T. VAGANS, Hutton (1882).

Slate grey above, passing into yellowish white on the sides. Dentition, 15–0–15.

North Island.—Waiuku (T. Kirk); Auckland (Cheeseman).

Sec. TÆNIOGLOSSA.

Animal with a rostrum, the respiratory chamber open in front; eyes at the base of the tentacles. Foot with an operculum. Dentition, 3–1–3.

Fam. *Cyclophoridæ.*

Operculum horny or calcareous, spiral, the nucleus central.

Sub-fam. *Cyclotinæ.*

Operculum of two laminæ, the inner horny, the outer calcareous.

Genus **Cyclotus**, Guilding.

Shell discoidal, or turbinately depressed, widely umbilicated; aperture entire, circular; peristome simple or double, straight, expanded, or reflexed.

C. CHARMIAN, Hutton (1883).

Shell with spiral raised striæ; periphery with an undulating keel; umbilicus wide, perspective. Diameter ·4 inch. Operculum circular, of many whorls, the calcareous lamina thickened round the margin, and with a raised centre.

North Island.—Horokiwi, Wellington.

Sub-fam. *Cyclophorinæ.*

Operculum horny.

Genus **Leptopoma**, Pfeiffer.

Shell globosely turbinate or conical, narrowly umbilicated; peristome simple, reflexed, the margins wide apart, sometimes united by a very thin callus. Operculum circular, horny membranous, narrowly whorled, flat.

L. PANNOSA, Hutton (1882).

Conical, brown, covered with a dark fuscous, ragged epidermis; peristome single. Diameter ·11 inch; height ·13 inch.

South Island.—Greymouth (R. Helms).

L. CALVA, Hutton (1882).

Conical, reddish-brown, smooth; peristome single. Diameter ·08; height ·13 inch.

South Island.—Greymouth (Helms).

L. PALLIDA, Hutton (1883).

Conical, pale brown, with a pale plicated epidermis; peristome single. Diameter ·13; height ·2 inch.

North Island.—Auckland (Cheeseman).

Genus **Cyclophorus**, Montford.

Shell globosely turbinated or depressed; umbilicated; aperture circular; peristome continuous. Operculum circular.

C. LIGNARIUS, Pfeiffer (1857).

Shell turbinated, rather thin, covered with an opaque epidermis; aperture ovately rotund; peristome double. Operculum unknown.

Axis ·16; breadth ·2 inch.

New Zealand.

I have not seen this species.

C. CYTORA, Gray (1849).

Minute, trochiform, spirally striated; periphery rounded; brown. Operculum horny, of a few rapidly-enlarging whorls (?).

Axis ·08; breadth ·1 inch.

North Island.—Auckland (Greenwood).

I have not seen this species.

Genus **Paxillus**, Adams.

Shell pupiform, spire acuminate; aperture semiovate, ascending on the body-whorl; umbilical region with a spiral ridge; inner lip with a spiral fold; peristome double.

P. PEREGRINA, Gould (1848).

Shell sinistral, solid, perforated; whorls 8, flattened. Rufous. Axis ·37 inch.

New Zealand (Gould).

I have not seen this species.

Genus **Diplommatina**, Benson.

Shell subovate, whorls convex, the last subascendent; inner lip with a spiral fold; aperture subcircular; peristome double.

D. CHORDATA, Pfeiffer (1855).

Shell sinistral, thin, distantly ribbed; diaphanous, white. Axis ·16 inch.

New Zealand (Strange).

I have not seen this species. A variety occurs at Lord Howe's Island.

Fam. *Cyclostomidæ.*

Operculum ovate, of a few more or less rapidly-enlarging whorls, the nucleus eccentric.

Genus **Omphalotropis**, Pfeiffer.

Shell sub-conical, imperforate or umbilicated; simple or keeled round the perforation; aperture oval; peristome simple, the margins disjoined.

O. VESTITA, Pfeiffer (1855).

Perforated, striated, and spirally ridged, covered with a fuscous epidermis; last whorl with an acute keel below the middle, and another round the umbilicus. Axis ·2; diameter ·12 inch.

New Zealand.

I have not seen this species.

Genus **Realia**, Gray.

Shell perforate or sub-perforate, turreted, rather smooth; aperture ovate; peristome continuous, double.

A. Suture impressed.

R. EGEA, Gray (1849).

Pale brown, variegated with yellowish, with a deep brown band round the axis; the umbilical region often keeled. Axis ·29; breadth ·13 inch.

North Island.—Auckland (Greenwood, Cheeseman); Wanganui (T. W. Kirk).

R. TURRICULATA, Pfeiffer (1854).

Blackish brown, variegated with chestnut or yellowish, sometimes a pale band near the base. Axis ·36; breadth ·14 inch.

North Island.—Papakura (Cheeseman); Whangarei (Gillies).

A more acute spire than the last species.

B. Suture margined.

R. CARINELLA, Pfeiffer (1861).

Pale brown, faintly marbled with darker. Axis ·27; diameter ·13 inch.

North Island.—Drury and Taupiri (Hochstetter); Auckland (Cheeseman).

R. HOCHSTETTERI, Pfeiffer (1861).

Fuscous. Axis ·36; diameter ·16 inch.

North Island.—Bay of Islands (Hochstetter); Auckland (Gillies).

The spire is more acute than in the last species.

Introduced Species.

HELIX ASPERSA, Müller.

Shell imperforate, subglobose, the surface finely wrinkled and indented; yellowish or greyish with variable bands of chestnut crossed by narrow undulating flamules of yellowish. Greatest diameter 1·25 inch. Dentition, 50–1–50.

Hab. Auckland; Nelson; Greymouth.

HELIX HORTENSIS, Müller.

Shell imperforate, subglobose, shining, smooth; olivaceous yellow, often variously ornamented with spiral bands or lines of rufous. Greatest diameter ·8 inch. Dentition, 32–1–32.

Hab. Auckland,

ARION FUSCUS, Müller; *A. incommodus*, Hutton.

Dark grey with a lateral stripe on the mantle and a longitudinal band on each side black; sole of foot yellow. Dentition, 32–1–32.

Hab. Dunedin.

ZONITES CELLARIUS, Müller; *Hyalina corneo-fulva*, Pfeiffer.

Shell sub-discoidal, pellucid, smooth, polished; light greenish horn; whorls 5; umbilicus moderate. Greatest diameter ·5 inch. Dentition, 14–1–14.

Hab. Bay of Islands; Auckland; Napier.

H. corneo-fulva is described as "sub-orbicular," but the dimensions given do not agree.

LIMAX MAXIMUS, Linné.

Light brown, usually with spots and stripes of black on the back and sides. Length sometimes 4 inches. Dentition, 76–1–76.

Hab. Dunedin.

LIMAX FLAVUS, Linné.

Yellowish or ashy brown with pale spots; head and eye-peduncles bluish, tentacles white; the tail keeled. Length sometimes 3 inches. Dentition, 60–1–60.

Hab. Dunedin; Greymouth.

LIMAX AGRESTIS, Linné, *L. molestus*, Hutton.

Whitish, greyish, black, or yellowish, sometimes spotted; eye-peduncles and tentacles darker; tail shortly keeled. Length about 1 inch. Dentition, 45–1–45.

Hab. Auckland, Wellington, Nelson, Greymouth, Christchurch, Dunedin, etc.

ART. IX.—*Notes on some* Marine Mollusca, *with Descriptions of new Species.* By Professor F. W. HUTTON.

[*Read before the Philosophical Institute of Canterbury*, 7th June, 1883.]

Plate XI., figs. 1–5.

OPHICARDELUS COSTELLARIS, Adams (*Tralia*). Pl. xi., fig. 1.

Dentition, $\frac{55-1-55}{100}$. Laterals, 31. Central tooth oval with a deep posterior indentation, or thinning; the reflexed portion very small. Laterals rather oblique, unicuspid, with a broad cutting point; in the outer laterals the cusp, or reflexed portion, becomes emarginate or notched at the end. Marginals rather longer than broad, divided into two portions, the inner of which is the larger, each with a small cutting point.

Hab. Auckland, Napier, and Wellington.

In adult specimens the shell is irregularly longitudinally ribbed, but in the young these ribs are absent, and it has then either been mistaken for *O. australis*, Q. and G., or has been considered distinct, and has been named *Laimodonta quoyi* by Adams (= *Auricula quoyi*, Sowerby, in Reeve's Conch. Icon., fig. 39). The animal has not yet been described.

Melampus commodus, Adams; *M. zealandicus*, Adams; *M. sulcatus*, Adams; and *M. adamsianus*, Pfeiffer, are not, I believe, found in New Zealand; the two latter come from Australia and New Caledonia. I do not know what *Melampus novæ-zealandiæ*, Reeve, is of the list of New Zealand shells obtained by the Novara Expedition.

LEUCONOPSIS OBSOLETA, Hutton (*Leuconia*).

Dentition, $\frac{55-1-55}{150}$. The teeth are so minute that I have been unable to make them out distinctly with a sixteenth objective.

This species is found under stones between tide-marks at Auckland. It is distinguished from all the European species by having only one plait on the inner lip; consequently it should, I think, be formed into a separate genus for which I propose the name *Leuconopsis*.

ÆOLIS LEPTOSOMA, n. s. Pl. xi., fig. 2.

Animal small, elongated, the tail rather short, pointed; minute eyes behind the tentacles. Tentacles four, subulate, the oral pair distant at their bases. Gills as long as the breadth of the animal, crowded, in about twelve transverse rows on each side of the back. Foot rather expanded, the margin thin, not crisped nor produced in front. Colour yellowish-white with some thin lines of reddish-yellow on the head and back; gills brownish-grey, tipped and slightly margined with white. Length ·4 inch.

Dentition, $\frac{0-1-0}{36}$. Each tooth strongly arched, with six or seven cutting points, the central being rather larger than the others.

Hab. Lyttelton Harbour, on Sertularians.

EUTHRIA STRIATA, Hutton. Pl. xi., fig. 3.

Dentition. Central tooth strongly curved, the ends bent backward; a single tricuspid cutting point in the centre. Laterals with three subequal and equidistant blunt points.

Hab. Lyttelton Harbour.

EUTHRIA FLAVESCENS, Hutton. Pl. xi., fig. 4.

E. lineata, var. D. Man. N.Z. Mollusca, p. 51.

Dentition. Central tooth deep, slightly hollowed behind, the ends broad and not bent backward; a single tricuspid cutting point in the centre. Laterals with three points, of which the outer is the largest, and divided by a considerable space from the middle point, which is the smallest.

Hab. Ocean Beach, Dunedin.

The dentition of this animal differs so much from that of *E. lineata*, and that of *E. littorinoides*, that I am obliged to make it into a distinct species.

Cerithidea tricarinata, n. s.

Shell turreted, strongly longitudinally plicate, and distinctly spirally grooved: colour brown, the interior with lighter spiral bands. Whorls 9, or 10, flattened, with eight strong, rounded, sub-nodulose, longitudinal ribs, which on the body-whorl cover only the posterior half, and below them are three, sub-equidistant, well-marked, spiral ridges, with occasionally others on the pillar: spire whorls and posterior half of the body-whorl with three or four spiral grooves. Aperture broadly ovate, with a well-marked posterior canal; anterior canal very short, the aperture deeply notched at the base. Length ·56; breadth ·2 inch.

Hab. Katikati, near Tauranga.

Distinguished from *C. bicarinata* by its bolder sculpture, fewer plications, and the three ridges at the base of the body-whorl.

Bittium exilis, Hutton.

Shell turreted, with faint longitudinal plicæ, and distinct spiral ribs: colour dark reddish-brown. Whorls 8, flattened, the suture impressed: spire-whorls with two to four spiral nodular ridges, but on the apical whorls the nodules are absent: body-whorl with two to four nodular ridges, in front of which are about six smooth spiral ridges, making about nine in all; between the ridges there is usually a raised spiral line: columella nearly straight: aperture oval, without any notch at the anterior end; canal very short, or obsolete. Length ·2; breadth ·07 inch.

Hab. Auckland Harbour.

I give an amended description of this species from specimens sent by Mr. Cheeseman.

Cingula limbata, n. s.

Shell elongately conical, smooth, polished but not iridescent. Whorls 5 or 6, flattened: aperture ovate, peristome continuous, not iridescent within. Colour ashy brown, usually with a posterior row of white spots at the suture; last whorl often with angulated brown and white markings. Operculum unknown. Length ·11; breadth ·06 inch.

Hab. Auckland (T. F. Cheeseman).

Crypta unguiformis, Lamarck.

Dentition. Central tooth as broad as long, the reflexed portion triangular, concave and slightly dentate on each side, the cutting point minute. First lateral broad, with about nine minute teeth. Second and third laterals similar, curved and slightly denticulate on the outer margin.

Hab. Dunedin.

Cyclostrema fluctuata, n. s.

Shell small, rather solid, spirally striated, not iridescent: colour yellowish white or pale brownish with irregular waved longitudinal bands of brown, which are rather indistinct. Spire depressed, obtuse; whorls 4, rounded, distinctly and closely spirally grooved, the umbilical region smooth; suture scarcely impressed: umbilicus narrow, deep. Aperture sub-rotund; peristome acute, not continuous, the lower lip thickened. Operculum rather thick, sub-calcareous, translucent, white, round, of about six slowly increasing whorls. Diameter ·11 inch.

Hab. Foveaux Straits.

Acmæa cingulata, n. s. Plate xi., fig. 5.

Shell moderately thick white oval, conical; apex about one-third of the length from the anterior end: about 30 to 50 low radiating ribs. Interior white, the margin light brownish pink banded with white. Length ·56; breadth ·45; height ·2 inch.

Dentition. Teeth very short and broad, the recurved portions three, arranged in an oblique line so that the anterior on each side are in juxtaposition, while the posterior are widely separated; all are short and blunt. Basal plates imbricating; the posterior margin nearly straight, the exterior margin slightly, and the anterior margin deeply sinuated: no accessory teeth.

Hab. Lyttelton and Dunedin.

The shell in this species much resembles that of *A. lacunosa*, Reeve (= *corticata*, mihi), but the ribs are finer and the margin differently coloured; the teeth however are very different. It may prove to be a variety of *A. rubiginosa*, the dentition of which is not yet known.

Kellia citrina, n. s.

Shell minute, ovato-rotund, smooth, finely concentrically grooved, subequilateral; pale yellowish. Right valve without any cardinal teeth, the anterior lateral swollen and hollowed in the middle; posterior lateral small. Left valve with a small anterior cardinal tooth; the laterals on each side thin. Length ·08; height ·07 inch.

Hab. Tamaki Heads, near Auckland (T. F. Cheeseman).

Kellia sanguinea, n. s.

Shell minute, ovato-rotund, smooth, finely concentrically grooved, subequilateral; yellowish-white, the umbones bright pink. Right valve with an anterior broad triangular cardinal tooth, with a projection on its anterior face; anterior lateral small; posterior laterals two. Left valve with two small cardinal teeth disjoined at the base; anterior lateral single, getting thicker below; posterior lateral single, bifid at the end. Length ·08; height ·07 inch.

Hab. Foveaux Strait.

Unio depauperatus, n. s.

Shell very thin, oblong, compressed; anterior end very short, rounded; the posterior slightly winged, and very obliquely truncated; dorsal margin gently ascending, slightly arched; ventral margin straight and sinuated in the middle; cardinal teeth minute, compressed, smooth, only one in the left valve; lateral teeth low and thin. Length 2·4; height 1·2; thickness ·55 inch.

Hab. Lake Takapuna, Auckland.

Perhaps an impoverished form of *U. zelebori*, but too distinct to be passed over. The type is in the Colonial Museum, Wellington.

Unio rugatus, n. s.

Shell oval, rather thin, anterior end compressed, rounded, finely striated; posterior subventricose very rudely concentrically corrugated; dorsal margin ascending, straight; ventral margin flatly rounded; cardinal teeth rugose, not striated. Length 2·05; height 1·35; thickness ·65 inch.

Hab. Lake Pearson; Upper Waimakariri (J. D. Enys).

EXPLANATION OF PLATE XI., Figs. 1–5.

Fig. 1. *Omphicardelus costellaris.* Teeth × 470.
2. *Æolis leptosoma.* Teeth × 160.
3. *Euthria striata.* Teeth × 280.
4. „ *flavescens.* Teeth × 280.
5. *Acmæa cingulata.* Teeth × 160.

Art X.—*Revision of the recent* Rhachiglossate Mollusca *of New Zealand.* By Captain F. W. Hutton.

[*Read before the Philosophical Institute of Canterbury, 6th September,* 1883.]

In the Catalogue of the Marine Mollusca,* and in the Manual of the Mollusca, † published by the Colonial Museum and Geological Survey Department, no attempt is made to trace out the synonymy of the species, and but very little to expunge those names which have no right to appear in our fauna. These things were not attempted, partly for want of books of

* "Catalogue of the Marine Mollusca of New Zealand, with Diagnoses of the Species." By Frederick Wollaston Hutton, F.G.S., C.M.Z.S., Assistant-Geologist (Wellington, 1873).

† "Manual of the New Zealand Mollusca. A Systematic and Descriptive Catalogue of the Marine and Land Shells, and of the Soft Mollusks and Polyzoa of New Zealand and the adjacent Seas." By F. W. Hutton, F.G.S., C.M.Z.S, Professor of Biology, Canterbury College, New Zealand University. Late Curator of the Otago Museum (Wellington, 1880).

reference, and partly because it was thought desirable that the original descriptions should be reproduced in a form that was easily attainable throughout the colony. The present paper is an attempt, for a portion of the Mollusca, to clear the list of the names of species not found in New Zealand, and to settle, to some extent, the true nomenclature of those that remain.

The number of shells erroneously put down to New Zealand is surprising. Thus the present list contains 45 true New Zealand species, while 37 have been rejected as spurious. Mr. Tenison-Woods is inclined to think that this is in large part owing to the late Mr. L. Reeve regarding Van Diemen's Land as a part of New Zealand. This is probably true, but I suspect that most of the mistakes must be attributed to the carelessness of Mr. Cuming, who appears to have attached localities to his shells pretty well at random.

The classification followed is that of Professor Theodore Gill, of Washington, which I regard as, on the whole, the most natural yet proposed. Many conchologists object to it as founded too much on lingual dentition, which they say is inconvenient; is not found in the whole of the Mollusca; fails to separate even the phytophagous from the zoophagous animals; is as yet known only in a comparatively few species; and cannot be applied to fossils. But the odontophore is the most complicated organ possessed by the Gastropoda, and therefore is, of all others, best adapted for tracing out genealogies; for it is impossible to believe that two similar complicated dentitions could have arisen independently. On the other hand the shell is simple in structure; and very similar shells have certainly arisen independently in several cases. The objection that an examination of the dentition is "inconvenient" is of no value; conchologists must learn to use the microscope like other naturalists. To object to the Gastropoda being classified by the odontophore because it is absent in a few genera is ridiculous. That it fails to separate the phytophagous and zoophagous species is only partly true; but, so far as it goes, shows that such a division has but little value. That the dentition is as yet only known in comparatively few species is because conchologists will not take the trouble to examine it, and merely proves how much yet remains to be done in the classification of the Mollusca. The last objection, that the test cannot be applied to fossil species, is hardly worth answering. It is as if palæontologists were to insist upon botanists classifying plants by their leaves because flowers were rarely found fossil. To object to an attempt to find a true classification of living Mollusca because, if found, it might upset our ideas of the value of shells in palæontology is, I suppose, one of the weakest arguments ever uttered by naturalists.

As there is great difference among conchologists in the spelling of the specific name intended to represent that the species comes from New Zealand, I shall spell it uniformly *neozelanicus*, as I have already done in my Revision of the Land Shells, believing that this is the most correct and the shortest form.

Order RHACHIGLOSSATA.

Dentition, 1–1–1, or 0–1–0.

Sub-order Hamiglossa.

Dentition, 1–1–1; the lateral teeth versatile, with an elongated base of attachment, and only one cusp.

Fam. *Muricidæ.*

Animal with the mantle enclosed, and the foot simple; eyes on the sides of the tentacles. Shell fusiform or ovate, not porcellanous; columella smooth.*

Sub-fam. *Muricinæ.*

Shell with the spire usually longer than the aperture; the canal long or moderate; the whorls crossed by varices; the columella rounded; no posterior canal. Operculum ovate, with the nucleus subapical.

Genus **Murex**, Linné.

Whorls with three or more varices; the canal partly closed.

Sub-genus **Phyllonotus**, Swainson.

Varices numerous; canal rather short, wide, curved.

Murex neozelanicus, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 529, pl. 36, f. 5–7 (1832); Gray, Figures of Molluscous Animals, i., pl. 7, f. 3; Tryon, Manual of Conchology, ii., p. 108, pl. 29, f. 268.

Hab. Cook Straits.

Varices with five or six slightly curved spines on each whorl, the posterior much longer than the others.

The operculum is figured by Quoy, the dentition is unknown.

Murex octogonus, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 531, pl. 36, f. 8–9 (1832); Gray, Figs. Moll. Anim., i., pl. 7, f. 4; Tryon,

* The following species are omitted as not really inhabiting New Zealand:—

Murex ramosus, Linn. Inhabits the Indo-Pacific Province.
Typhis cleryi, Sowb. Inhabits New South Wales.
Trophon coronatum, Adams. Inhabits Japan.
Fusus vulpicolor, Sowb. Inhabits Falkland Islands.
Fusus incisus, Gould. Inhabits California.
Adamsia typica, Dunker. Inhabits Australia.
Purpura patens, Homb. and Jacq. Inhabits St. Paul's Island.
Purpura tesselliata, Lesson. Not again recognized.
Ricinula iodostoma, Lesson. Inhabits Tahiti.
Ricinula ricinus, Linn. Inhabits Indo-Pacific Province.

Man. Conch., ii., p. 110, pl. 30, f. 134 [not *M. octogonus*, Sowb., Pro. Zool. Soc., 1859, p. 428]; *M. dipsacus*, Broderip, Pro. Zool. Soc., 1832, p. 194; *M. peruvianus*, Sowb., Pro. Zool. Soc., 1840, Conch. Icon., f. 103.

Hab. Bay of Islands; Hauraki Gulf; Cook Straits. Found also in Japan and Peru.

Varices eight or nine, each with seven to thirteen strongly recurved spines, which however are sometimes obsolete.

The operculum and dentition are figured in the Trans. N.Z. Inst., vol. xv., pl. xiii., f. c.

Sub-genus **Pteronotus**, Swainson.

Varices three, fin-shaped; canal moderate, somewhat recurved.

MUREX ANGASI, Crosse (Typhis), Jour. de Conch., xi., p. 86, pl. 1, f. *r.* (1863); Tryon, Man. Conch., ii., p. 88, pl. 40, f. 522 [not ib., p. 109]. *M. eos*, Hutton, Cat. Marine Moll. of N.Z., p. 8 (1873).

Hab. Dead specimens only have been found at the Bay of Islands and Wellington (T. W. Kirk). It is not uncommon in Australia and Tasmania.

The colour is yellowish pink.

Genus **Trophon**, Montfort.

Shell white; whorls with numerous lamelliform varices; canal open, usually bent to the left.

A. Shell thin, canal produced.

TROPHON AMBIGUUS, Philippi, Abbild., Fusus, pl. 1, f. 2 (1844); Tryon, Man. Conch., ii., pl. 33, f. 365; Homb. and Jacq., Voy. Pôle Sud, Zool., v., p. 109, pl. 25, f. 13, 14. *Fusus cretaceus*, Reeve, Conch. Icon., f. 48 (1847). *Murex candida*, H. and A. Adams, Pro. Zool. Soc., 1863, p. 430. *Fusus varius* et *lyratus*, Cat. Marine Moll. of N.Z. (1873), [not of Lamarck].

Hab. Cook Straits to Foveaux Straits.

Whorls angled, and with numerous, unequal, spiral ribs; varices about 12 or 14, often produced at the angles, distant, sometimes obsolete on the body-whorl.

A very variable species. The operculum and dentition are unknown.

B. Shell thick; canal short.

TROPHON STANGERI, Gray (Fusus) in Dieffenbach's New Zealand, ii., p. 230 (1843). *Purpura rugosa*, Quoy and Gaimard, Voy. Astrolabe, Zool., ii., p. 569, pl. 38, f. 19–21 (1833) [not of Lamarck]; Gray, Figs. Moll. Anim., ii., pl. 96, f. 7; Tryon, Man. Conch., ii., pl. 51, f. 112 and 122; *Purpura quoyi*, Reeve, Conch. Icon., f, 71 (1846) [not *P quoyi*, Gray, Figs. Moll. Anim., iv., pl. 70]. *M. spiratus*, Adams, P.Z.S., 1863, p. 429; Kuster, Conch. Cab., t. 73, f. 8; Tryon, Man. Conch., ii., pl. 33, f. 354. *Purpura retiaria*, Hutton, Jour. de Conch., 1878, p. 20.

Hab. Auckland.

Whorls angled, with six or seven distant spiral ribs; varices very numerous and close; occasionally larger ones at regular intervals (*retiaria*).

A smaller and thicker shell than the last. The dentition and operculum are figured in the Trans. N.Z. Institute, xv., pl. xiii., f. Q. The operculum is also figured by Quoy.

TROPHON CHEESEMANI, Hutton, New Zealand Journal of Science, 1882, p. 69; Trans. N.Z. Institute, vol. xv., p. 131 (*Purpura*).

Hab. Port Waikato.

Whorls rounded, with five narrow spiral grooves, crossed by growth lines; right lip strongly toothed inside; columella rounded.

As the operculum and dentition of this species are unknown, it is doubtful whether it should be placed here or in *Polytropa*.

Genus **Kalydon,** Hutton (1883).

Shell purplish or yellowish brown, shortly fusiform, longitudinally ribbed or undulated, and spirally striated. Operculum ovate, with the nucleus subapical. Dentition as in *Trophon*.

Differs from *Trophon* in wanting varices and from *Urosalpinx* in the operculum.

KALYDON DUODECIMUS, Gray (Fusus) in Dieffenbach's New Zealand, ii., p. 230 (1843). *Fusus corticatus*, Hutton, Cat. Marine Moll. of N.Z., p. 9 (1873).

Hab. Auckland to Banks Peninsula.

Shell with about twelve broad, rounded, rather close, longitudinal ribs; crossed on the body-whorl by about twelve narrow spiral ribs, of which the anterior six are distant, the posterior five or six crowded. Canal moderate, nearly straight.

The operculum and dentition are figured in Trans. N.Z. Institute, xv., pl. xiii., f. D. (*paivæ*).

This species appears to be allied to *Fusus plumbeus*, Gould, from Tierra del Fuego. *Trophon paivæ*, Crosse, belongs to the genus, but has only eight or nine narrow longitudinal ribs, and the spiral ribs are closer.

Dr. Gray's description is a compound of this species and *Pisania vittata*.

KALYDON PLEBEIUS, Hutton, Cat. Marine Moll. of N.Z., p. 9 (1873).

Hab. Auckland to Stewart Island.

Shell with numerous narrow longitudinal ribs (sharp in the young) crossed by ten to fifteen strong spiral ribs, giving rise to a latticed or subnodulose appearance; canal short, sharply bent.

Dr. von Martens refers this to *Fusus corrugatus*, Reeve, but our shell is much smaller and differently marked, if Reeve's figure is correct.

The operculum and dentition are not known.

KALYDON INFERUS, Hutton, Cat. Marine Moll. of N.Z., p. 9 (1873).

Hab. Stewart Island and Chatham Islands.

Perhaps a variety of the last species, but broader, the longitudinal ribs more irregular or obsolete, and the aperture strongly angled and shorter than the spire. The dentition and operculum are unknown.

In the Manual of the Mollusca of New Zealand, 1880, there is a mistake in the description of this species, all the words after "bent to the left," including the dimensions, should be omitted, as they have got in from the description of *Siphonalia dilatata.* The real dimensions are, length 1·1 inch; breadth ·7 inch.

Sub-fam. *Purpurinæ.*

Shell with the spire usually short; the canal short or reduced to a notch; the columella more or less flattened. Operculum with the nucleus lateral or sub-lateral.

Genus **Purpura**, Bruguière.

Spire short; aperture patulous with an oblique notch at the anterior end, and a less distinct posterior canal. Operculum semi-cordate with the nucleus lateral.

PURPURA SUCCINCTA, Martyn, Univ. Conch., pl. 45 (Buccinum) (1784); Reeve, Conch. Icon., Purpura, f. 23; Tryon, Man. Conch., ii., p. 51, f. 118.

Hab. Auckland to Nelson. Found also in New South Wales.

Deeply grooved, the ribs and grooves smooth, without any smaller raised ridges.

The operculum and dentition are not known.

PURPURA TEXTILIOSA, Lamarck, Anim. sans Vert. (1820); Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 552, pl. 37, f. 1–3; Gray, Figs. Moll. Anim., i., pl. 14, f. 6; Reeve, Conch. Icon., f. 66; Tryon, Man. Conch., ii., pl. 51, f. 119 and 125.

Hab. Auckland to Cook Straits. Found also in S. Australia (?).

Ribs and grooves with smaller ridges; or if uniform in size, they are shallow and close. The dentition and operculum are figured in the Trans. N.Z. Inst., vol. xv., pl. 13, f. P. The operculum has also been figured by Quoy.

Genus **Polytropa**, Swainson.

Shell with the spire acuminate; the aperture narrowed anteriorly; the canal small and oblique; no posterior canal. Operculum oval, with the nucleus sub-lateral.

POLYTROPA STRIATA, Martyn (Buccinum), Univ. Conch., pl. 7 (1784) [not *Purpura striata*, Q. and G.]; *P. rugosa*, Lamarck, Anim. sans Vert. (1820) [not *P. rugosa*, Q. and G.]; *P. rupestris*, Valenciennes, Voy. Pôle Sud, Zool.

v., p. 89, pl. 22, f. 23 (1854); Gray, Figs. Moll. Anim., iii., pl. 266, f. 4 (named wrong); Tryon, Man. Conch., ii., pl. 51, f. 107; *P. squamata*, Hutton, Jour. de Conch., 1878, p. 9 (jaw).

Hab. Cook Straits to Stewart Island, Chatham Islands, Auckland Islands. Found also in Tasmania, New South Wales, and Kerguelen's Land.

White, with eight or nine narrow spiral grooves, which are crossed by thin varices. In the young the varices cross the ribs as well as the grooves.

The operculum and dentition are figured in the Trans. N.Z. Inst., xv., pl. xiii., f. R.

POLYTROPA SCOBINA, Quoy and Gaimard, Voy. Astrolabe, Zool. iii., p. 567, pl. 38, f. 12, 13 (1835); Tryon, Man. Conch., ii., pl. 51, f. 123 [not *Purpura scobina*, Reeve.]

Hab. Bay of Islands to Auckland and Port Waikato.

Distinguished by having three prominent scabrous ribs on the body whorl.

The dentition and operculum are figured in the Trans. N.Z. Institute, xv., pl. xiii., f. S.

POLYTROPA ALBOMARGINATA, Deshayes, in Guerin's Mag. de Zool., 1841, pl. 44; Tryon, Man. Conch., ii., pl. 51, f. 121. *P. scobina*, Reeve, Conch. Icon., f. 72 (1846) [not of Q. and G.]. *P. tristis*, Dunker, Verhandl. Zool-bot. Verein zu Wien, 1866, p. 910; and Reise der Novara, Moll., p. 6, pl. 1, f. 4 (1868). *P. biconica*, Hutton, Jour. de Conch., 1878, p. 20.

Hab. Abundant throughout the South Island, and extending as far north as Auckland.

This is a very variable species, and at Auckland passes into the last. Usually it is rough, but at Lyttelton it is sometimes quite smooth, even polished, and of a yellowish-white colour, with ten or twelve low, spiral, dark purple ribs.

The dentition and operculum are figured in the Trans. N.Z. Institute, xv., pl. xiii., f. T.

Sub-Genus **Lepsia**, Hutton.

Aperture ovate, rounded posteriorly, canal nearly obsolete, not recurved; columella excavated. Operculum as in the typical species of *Polytropa*.

POLYTROPA HAUSTRUM, Martyn (Buccinum), Univ. Conch., pl. 9 (1784); Quoy and Gaimard, Voy. Astrolabe, Zool. iii., p. 554, pl. 37, f. 4–5; Gray, Figs. Moll. Anim., i., pl. 13, f. 2 and 6; Reeve, Conch. Icon., f. 6; Tryon, Man. Conch., ii., p. 160, pl. 43, f. 25.

Hab. Throughout New Zealand and at the Chatham Islands.

Usually the interior is white, with a purple band round the mouth; but a variety occurs at Dunedin, in which the whole of the interior is yellow.

The dentition and operculum are figured in the Trans. N.Z. Institute, xv., pl. 13, f. o. Quoy has also figured the operculum, and Troschel the dentition, in Das Gebiss der Schnecken, ii., taf. xiii., f. 20.

Fam. *Olividæ.*

Animal with a voluminous foot, the lobes usually reflected over the sides of the shell; eyes none, or on the sides of the tentacles. Operculum small or absent. Shell porcellanous, without epidermis; columella, suture, and spire more or less callous; aperture obliquely notched below; outer lip simple.*

Sub-fam. *Ancillinæ.*

Eyes none. Shell polished, the columella grooved and twisted in front. Operculum small, ovate.

Genus **Ancillaria**, Lamarck.

Shell oblong or sub-cylindrical, thick; columella with a few anterior oblique plaits.

ANCILLARIA AUSTRALIS, Sowerby, Sp. Conch., 1830, pl. 7, f. 44–46; *A. australis* and *A. albisulcata*, Quoy and Gaimard, Voy. Astrolabe, Zool. iii., p. 19, 20, pl. 49, f. 5–17 (1834); Gray, Figs. Moll. Anim., i., pl. 19, f. 1, 2, 3, and 5 [not *A. albisulcata*, Sowb.]. *A. pyramidalis*, Reeve, Conch. Icon., f. 11 (1864); *A. australis*, Tryon, Man. Conch., v., p. 94, pl. 38, f. 28, 29.

Hab. Auckland to Cook Straits; Chalky Inlet.

The dentition is figured in the Trans. N.Z, Institute, xv., pl. xiii., f. v.

Fam. *Columbellidæ.*

Animal with the foot produced anteriorly; the eyes near the outer bases of the tentacles. Shell small, ovate or oblong, anteriorly notched or produced into a short open canal; inner lip tubercled, outer lip incurved in the middle and usually thickened. Central tooth a simple plate, the laterals notched at the outer end.†

Genus **Columbella**, Lamarck.

Shell with the inner lip usually excavated in the middle and crenulated or denticulated in front; outer lip inflected and crenulated in the middle.

Sub-genus **Mitrella**, Risso.

Shell mitriform, smooth, spire elevated; columella smooth or with a few anterior rugosities; outer lip smooth or crenulated within.

COLUMELLA CHOAVA, Reeve, Conch. Iconica, f. 239 (1858); Tryon, Man. Conch., v., p. 137, pl. 51, f. 51. *Pyrene flexuosa*, Hutton, Jour. de Conch., 1878, p. 23.

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* The following species are omitted as not really inhabiting New Zealand:—

Oliva duclosi, Reeve. Inhabits Australia and Polynesia.

Oliva erythrostroma, Lam. Inhabits Indo-Pacific Province.

Ancillaria novæ-zealandiæ, Sowb. Inhabits China and Australia.

† The following species is omitted as not really inhabiting New Zealand:—

Columbella zebra, Gray. Inhabits Japan and Polynesia.

Hab. Auckland to Banks Peninsula.

Small, olive brown with obscure chestnut-brown markings; sometimes altogether dark brown. There is no operculum. The animal and dentition are figured in Trans. N.Z. Inst., xiv., pl. vii., f. O and P.

Sub-order RHACHIGLOSSA.

Dentition, 0–1–0.

Fam. *Marginellidæ.*

Animal with the side-lobes of the mantle expanded over the shell; tentacles approximated; foot large, truncate in front, produced behind. Operculum usually absent. Shell polished, the spire short or immersed; columella plaited; outer lip with a thickened margin.*

Genus **Marginella,** Lamarck.

Spire short or concealed; outer lip with a thick marginal varix, its inner margin smooth or crenulated. Teeth with several cusps.

MARGINELLA MUSCARIA, Lamarck, Anim. sans Vert. (1820); Tryon, Man. Conch., v., pl. 6, f. 8; *Erato lactea*, Hutton, Man. N.Z. Moll., p. 63.

Hab. Auckland and Cook Straits. Found also in S. Australia and Tasmania.

White or tinted with yellowish.

The dentition is not known.

Sub-genus **Volvaria,** Lamarck.

Shell subcylindrical, outer lip not thickened.

MARGINELLA INFANS, Reeve, Conch. Icon., f. 150 (1865); *M. albescens*, Hutton, Cat. Marine Moll. of N.Z., p. 19 (1873); *Erato pellucida*, Tenison-Woods, Pro. Roy. Soc. Tasmania, 1878, p. 34.

Hab. Foveaux Straits, Chatham Islands. Found also in Tasmania, and at Singapore.

Translucent, white, occasionally with indications of two yellow spiral bands; columella with four plaits.

The dentition is unknown.

Our specimens are much smaller than the type and usually white.

Fam. *Volutidæ.*

Animal with the mantle largely developed, covering the sides of the shell; tentacles far apart, united by a broad veil over the head. Shell not porcellanous; columella with distinct plaits, the anterior of which are larger. Operculum usually absent.†

* The following species is omitted as not really inhabiting New Zealand:—
Marginella vittata, Hutton (= *M. de burghiæ*, Adams). Inhabits Australia.

† The following species are omitted as not really inhabiting New Zealand:—
Voluta kirki, Hutton (=*flavicans*). Inhabits N. Australia.
Voluta kaupii, Dunker. Habitat unknown.

Genus **Voluta**, Linné.

Shell ovate, the aperture narrow. Operculum none. Teeth tricuspid.

Sub-genus **Alcithoe**, H. and A. Adams.

Shell thick, the spire elongated, with a papilliform apex; outer lip expanded and more or less reflexed.

VOLUTA PACIFICA, Solander, Cat. Portland Museum, No. 4039 (1783); Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 625, pl. 44, f. 6; Gray, Figs. Moll. Anim., i. pl. 27, f. 3; Sowerby, Thes. Conch., i., pl. 48, f. 26; Tryon, Man. Conch., iv., pl. 28, f. 97; Homb. and Jacq., Voy. au Pôle Sud, Zool. v., p. 72, pl. 19, f. 7; Gray, l. c., iii., pl. 263, f. 1. *Buccinum arabicum*, Martyn, Univ. Conch., pl. 52 (1784).

Hab. Throughout the N. Island; Cook Straits; Banks Peninsula; Foveaux Straits.

Fulvous, with dark brown anastomosing markings, forming three or four spiral bands. Whorls with a row of tubercles; columella with four to six plaits.

Var. ELONGATA, Swainson.

Fulvous, and without tubercles.

The dentition is figured in Trans. N.Z. Institute, vol xv., pl. xiii., f. u.

VOLUTA GRACILIS, Swainson, Exotic Conchology, pl. 42 (1821); Griffith in Cuvier's Animal Kingdom, vol. xii., pl. 40, f. 4; Sowerby, Thes. Conch., i., pl. 55, f. 117; Tryon, Man. Conch., iv., pl. 28, f. 99. *Voluta fusus*, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 627, pl. 44, f. 7–8 (1833); Tryon, l.c. iv., pl. 28, f. 98.

Hab. Auckland.

Fulvous with anastomosing flexuous markings which do not form bands. The nodules elongated: columella with four plaits.

Smaller and narrower than the last species. The dentition is not known.

Sub-genus **Cymbiola**, Swainson.

Shell thin, the spire elongated, with a papilliform apex; outer lip sharp, occasionally slightly expanded.

VOLUTA LUTEA, Watson, Jour. Lin. Soc., Zool. xvi, p. 331 (1882); N.Z. Journal of Science, i., p. 441.

Hab. 200 miles west of Cape Campbell in 275 fathoms.

Pale buff with a high blunt spire, largish mouth, slightly reflexed outer lip, and four plaits on the columella.

I have not seen this species, which was obtained by the Challenger Expedition. The dentition is unknown.

Sub-order ODONTOGLOSSA.

Dentition, 1—1—1; the laterals not versatile, broad, many-cuspid (*Turricula* is said to differ from this.)

Fam. *Mitridæ.*

Shell fusiform, thick, the spire well developed; columella obliquely plaited, the posterior plaits larger. Operculum small or absent.*

Genus **Turricula,** Klein.

Shell longitudinally plicately ribbed; spire acuminate; aperture narrow; columella with numerous plaits.

The lateral teeth are said by Dr. Gray to be versatile, with a single cusp, in which case the genus should be referred to the *Olividæ.*

Sub-genus **Pusia,** Swainson.

Shell small, ovate; spire usually short, convex, with an obtuse apex; outer lip sometimes thickened.

TURRICULA RUBIGINOSA, Hutton, Cat. Marine Moll. of N.Z., p. 20 (1873), [not *Mitra rubiginosa*, Reeve].

Hab. Auckland to Stewart Island; Chatham Islands.

Smooth, longitudinal plications sometimes obsolete on the body-whorl. Purplish brown, with a dark purple spiral band in the centre of the body whorl; columella orange red.

Allied to *T. rubra*, Swainson, from the Paumotu Islands, but, I think, quite distinct.

The dark band is sometimes absent, and the shell may be brown or purple, but the columella is always red. Dead rubbed shells are often rosy or purplish.

Specimens from Auckland may be a distinct species as they appear to be spirally grooved; but I have only seen dead and discoloured shells.

The operculum and dentition are unknown.

Fam. *Fasciolaridæ.*

Shell more or less fusiform, without varices; outer lip not thickened. Eyes usually at the outer bases of the tentacles. Operculum always present.†

Sub-fam. *Fusinæ.*

Columella not plicate nor tortuose.

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* Species omitted as not really inhabiting New Zealand.

Mitra aurantia, Gmelin. Inhabits the Indo-Pacific Province.
Mitra abbreviata, Sowerby. Habitat unknown.
Mitra chrysalis, Reeve. Inhabits Polynesia.
Mitra obscura, Hutton. Inhabits Polynesia (?).
Turricula rubra, Swainson. Inhabits Paumotu Islands.
Cylindra nucea, Gronovius. Inhabits Polynesia.

† The following species are omitted as not really inhabiting New Zealand:—

Fasciolaria trapezium, Linné. Inhabits Indian Ocean.
Peristernia zealandica, Adams. Inhabits Indian Ocean.
Peristernia decorata, Adams. Inhabits Andaman Islands,

Genus **Fusus**, Klein.

Shell with a long and straight canal. Operculum with the nucleus apical.

FUSUS SPIRALIS, Adams, Proc. Zool. Soc., 1855, p. 221 [not of Tryon, Man. Conch., iii., pl. 85, f. 593]; *F. pensum*, Hutton, Cat. Marine Moll. of N.Z., p. 8 (1873).

Hab. Cook Straits, rare.

Whorls sub-carinated, spirally grooved; the keel sub-nodulose; suture very deep.

The operculum and dentition are unknown.

Adams' description answers very well to our shell, which is not uncommon as a fossil at Wanganui, but apparently very rare living. Tryon's figure, however, does not at all agree with our shell, and if he has drawn the type, *F. spiralis* must be struck off our list.

FUSUS AUSTRALIS, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 495, pl. 34, f. 9–14 (1833); Gray, Figs. Moll. Anim., i., pl. 9, f. 3; Tryon, Man. Conch., iii., pl. 34, f. 113. *Fusus caudatus*, Q. and G., l.c., ii., p. 503, pl. 34, f. 20, 21; Tryon, l.c., iii., pl. 34, f. 119.

Hab. North Island and Nelson.

Found also in Australia, Japan, and the Red Sea.

Whorls rounded, with spiral ribs and striæ, and longitudinal plications.

The operculum and teeth are figured by Quoy, but the latter are not in sufficient detail.

This species somewhat resembles *Siphonalia mandarinus*, but is distinguished by its longer and straighter canal.

Genus **Taron**, Hutton (1882).

Shell fusiform; canal short, slightly retroverted; columella smooth; aperture oval, the outer lip simple: no posterior canal, operculum oval, the nucleus sub-central. Dentition as in *Leucozonia*.

TARON DUBIUS, Hutton, Jour. de Conchyliologie, 1878, p. 13 (Trophon) [not *Leucozonia dubia*, Petit].

Hab. Auckland.

The body-whorl with twelve spiral ridges and usually nine or ten obsolete longitudinal ribs at the posterior end; aperture more than half the length of the shell.

The operculum and dentition are figured in the Trans. N.Z. Inst., xv., pl. xiii., f. E.

This species seems near *Fusus coreanicus*, Smith (P.Z.S., 1879, pl. 20, f. 36), from Japan, but differs from it in its shorter canal and longer aperture, as well as in its colours, and in the spiral ribs not being alternately smaller.

Sub-order Duplohamata.

Dentition, 1–1–1; the laterals versatile, with two or more cusps on a long base.

Fam. *Buccinidæ.*

Animal with a recurved siphon; shell ovate or fusiform; canal moderate, short, or reduced to a notch; columella smooth. Operculum ovate with the nucleus apical or lateral.

Sub-fam. *Neptuniinæ.*

Foot simple; eyes on the sides of the tentacles. Shell with the canal moderate and twisted.*

Genus **Siphonalia**, Adams.

Animal with a long siphon. Lateral teeth with three cusps, the central with four. Shell fusiform; canal moderate or rather short, last whorl ventricose. Operculum ovate, the nucleus apical.

Siphonalia mandarina, Duclos, Mag. Zool., viii. (1831); Reeve, Conch. Icon., Fusus, f. 8; Tryon, Man. Conch., iii., p. 138, pl. 57, f. 385. *Fusus zealandicus*, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 500, pl. 34, f. 4–5 (1833). *Fusus reevianus*, Sowb., Thes. Conch., 1880; Tryon, Man. Conch., iii., pl. 86, f. 600 [not of Petit].

Hab. Auckland to Cook Straits. Found also in S. Africa.

Whorls rounded, spirally grooved, each groove with one or two raised lines. Body-whorl with or without longitudinal ribs.

The dentition and operculum are unknown.

Siphonalia dilatata, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 498, pl. 34, f. 15, 16 (1833); Gray, Figs. Moll. Anim., i., pl. 9, f. 5; Reeve, Conch. Icon., Fusus, f. 49; Tryon, Man. Conch., iii., p. 135, pl. 54, f. 356–358. *Fusus adustus*, Philippi (1844); Tryon, l.c., iii., pl. 54, f. 359.

Hab. Auckland to Cook Straits. Found also in Tasmania, Australia, and Japan.

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* The following species are omitted as not really inhabiting New Zealand:—

Buccinum triton, Lesson. Inhabits Peru.
Buccinum zealandicum, Reeve. Not recognized.
Buccinum glandiforme, Reeve. Not recognized.
Buccinum gradatum, Deshayes. Not recognized.
Buccinum porcata, Gmelin. Inhabits Cape of Good Hope.
Buccinum lactea, Reeve. Inhabits Australia.
Buccinum quoyi, Kiener. Habitat unknown.
Nassa subspinosa, Lamarck. Inhabits Polynesia.
Nassa rutilans, Reeve. Inhabits N. Australia.
Nassa novæ-zealandiæ, Reeve. Inhabits Philippines.
Nassa nigella, Reeve. Habitat unknown.
Nassa corticata, Adams. Inhabits Australia.
Nassa sculpta, Marrat. Inhabits Polynesia.

Whorls angled and spirally striated, with seven or eight longitudinal ribs in front of the angle, and tuberculated on the angle.

The dentition and operculum are figured in the Trans. N.Z. Institute, xv., pl. xiii., f. F. The operculum is also figured by Quoy, and the dentition by Troschel, but he makes it different; probably he has mistaken the species.

SIPHONALIA NODOSA, Martyn, Univ. Conch., Buccinum, pl. 5 (1784); Tryon, Man. Conch., iii., pl. 56, f. 377. *Fusus raphanus*, Lamarck, Anim. sans Vert. (1820); Reeve, Conch. Icon., f. 61. *Buccinum raphanus*, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 428, pl. 31, f. 5, 6; Tryon, Man. Conch., iii., pl. 56, f. 376, 377.

Hab. Auckland to Cook Straits.

Whorls angled, with a row of fifteen or sixteen nodules on the angle, and often another row in front; canal short.

The dentition and operculum are figured in the Trans. N.Z. Institute, xv., pl. xiii., f. G.

Sub-fam. *Pisaniinæ.*

Shell heavy; canal short and wide; the outer lip thickened. Animal with the foot simple and eyes on the sides of the tentacles.

Genus **Pisania,** Bivona.

Animal with the siphon short. Lateral teeth with three cusps; central with three. Shell oblong or fusiform, smooth, or spirally striated. Operculum ovate, the nucleus apical.

PISANIA LINEATA, Martyn, Univ. Conch., Buccinum, pl. 48 (1784); Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 501, pl. 34, f. 6–8; Gray, Figs. Moll. Anim., i., pl. 5, f. 5; Tryon, Man. Conch., iii., pl. 72, f. 229, 230; Reeve, Conch. Icon., Fusus, f. 31 [not *Buccinum lineatum*, Gml., nor *Cantharus lineatus*, Menke].

Hab. Auckland to Banks Peninsula. Auckland Islands.

White, with distant narrow purple spiral bands. Whorls 8, of which 3 to 5 only are plicate. Lateral teeth with three nearly equal cusps. The dentition is figured in the Trans. N.Z. Institute, xv., pl. xiii., f. H. The operculum is also figured by Quoy.

Var. PERTINAX, Martens, Sitzb. Berlin, 23 (1878).

Hab. Auckland, Banks Peninsula, and the Auckland Islands.

Longitudinal ribs extending over the fifth and sixth whorls.

The dentition is not known.

Var. TRAVERSI, Hutton, Cat. Marine Moll. of N.Z., p. 9 (1873). *Euthria lineata* var. B., Man. N.Z. Mollusca.

Hab. Cook Straits, Stewart Island, Chatham Islands.

Longitudinal ribs extending over all the whorls.

Perhaps this is a distinct species. It is something like *Buccinum spadiceum*, Reeve, from Japan. The operculum and dentition are not known.

Pisania striata, Hutton, Trans. N.Z. Institute, vii. (1875), p. 458, pl. 21 (Cominella).

Hab. Lyttelton.

Shell, pale yellow-brown, the surface spirally striated. Lateral teeth with three nearly equal cusps.

The dentition is figured on pl. xi., fig. 3, of this volume.

Pisania flavescens, Hutton (1883); *Euthria lineata* var. d., Man. of N.Z. Mollusca.

Hab. Dunedin.

Shell spirally striated; colourless or orange with darker spiral bands; interior more or less banded with yellow. Lateral teeth with the middle cusp smaller than the others.

The dentition is figured on pl. xi., fig. 4, of this volume.

Pisania vittata, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 504, pl. 34, f. 18, 19 (1833); Gray, Figs. Moll. Anim., i., pl. 5, f. 4 (*B. fasciata*); Tryon, Man. Conch., iii., pl. 72, f. 235; [not *Buccinum vittatum*, Linn]. *Buccinum trilineatum*, Reeve, Conch. Icon., f. 98 (1846); *Fusus bicinctus*, Hutton, Cat. Marine Moll. of N.Z., p. 10 (1873); Tryon, Man. Conch., iii., pl. 72, f. 234.

Hab. Bay of Islands to Auckland; Banks Peninsula. Chatham Islands and Auckland Islands.

Shell spirally striated; greyish or yellowish; the interior with two or three purple or brownish bands, which sometimes extend through to the exterior. Lateral teeth with the two inside cusps equal and smaller than the outside one.

The operculum and dentition are figured in the Trans. N.Z. Inst., xv., pl. xiii., f. i.

Pisania littorinoides, Reeve, Conch. Icon., Buccinum, f. 94 (1846); Tryon, Man. Conch., iii., pl. 72, f. 231; *Euthria lineata* var. c., Man. N.Z. Mollusca.

Hab. Lyttelton and Dunedin. Chatham Islands.

Shell spirally striated; purple with darker spiral lines. Lateral teeth with the two inside cusps equal and smaller than the outside cusp.

The dentition is figured in the Trans. N.Z. Institute, xiv., pl. vi., f. d (*E. lineata*), and by Troschel, pl. 7, f. 12.

Pisania martensiana, Hutton, Jour. de Conch., 1878, p. 16.

Hab. Wellington (T. W. Kirk).

Shell spirally striated; brown. Much narrower than the last species.

The operculum and dentition are not known. These last five species of *Pisania* are closely allied.

PISANIA ANTARCTICA, Reeve, Conch. Icon., Buccinum, f. 30 (1845); Tryon, Man. Conch., iii., pl. 72, f. 228 [not *Buccinum antarcticum*, Philippi, 1868]. *Buccinum campbelli*, Filhol, Comptes Rendus, xci. (1880), p. 1094.

Hab. Banks Peninsula. Auckland Islands and Campbell Island. Found also at the Falkland Islands.

Interior purplish brown; columella and outer lip white.

The operculum and dentition are unknown. This species is perhaps the same as *Fusus rufa*, Homb. and Jacq. Reeve's figure is very bad.

Sub-fam. *Buccininæ.*

Foot simple; eyes variously placed. Shell ovate, the lip thin; aperture with a short oblique notch.

Genus **Cominella**, Gray.

Animal with a long siphon and eyes on the sides of the tentacles. Lateral teeth with two cusps; central with three. Operculum ovate, with the nucleus apical. Shell with a groove at the suture, and a posterior canal.

COMINELLA MACULATA, Martyn, Univ. Conch., Buccinum, pl. 49 (1784); Reeve, Conch. Icon., Buccinum, f. 16; Tryon, Man. Conch., iii., pl. 81, f. 421. *Buccinum turgidum*, Gmelin (after Solander). *B. testudineum*, Quoy and Gaimard, Voy. Astrolabe, Zool., pl. 30, f. 12; Tryon, l.c., iii., pl. 81, f. 422. *Buccinum melo*, Lesson, Ann. des Sci. Nat., 1840.

Hab. Auckland. Chatham Islands, Auckland Islands.

Shell turgid; yellowish gray with spiral rows of brown spots; columella yellow.

The operculum and dentition are figured in the Trans. N.Z. Inst., xv., pl. xiii., f. L. The operculum is also figured by Adams in the Gen. of Moll.; and the dentition by Troschel, ii., taf. viii., f. 3.

COMINELLA MACULOSA, Martyn, Univ. Conch., Buccinum, pl. 8 (1784); Tryon, Man. Conch., iii., pl. 81, f. 423 [not *P. maculosa*, Lamarck]. *Buccinum testudinea*, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., pl. 30, f. 8 to 11; Gray, Figs. Moll. Anim., i., pl. 14, f. 1 and 3 [not of Chemnitz].

Hab. Bay of Islands to Banks Peninsula.

Ash-grey with twelve or thirteen spiral or interrupted dark bands; columella brownish purple. Much narrower than the last species.

The operculum is figured by Quoy; the dentition in the Trans. N.Z. Inst., xv., pl. xiii., f. M.; and by Hogg in the Trans. Roy. Micro. Soc., 1868 (species doubtful).

COMINELLA TESTUDINEA, Chemnitz, Conch. Cab., *Buccinum*, x., f. 1454 (1788); Reeve, Conch. Icon., f. 66; Tryon, Man. Conch., iii., pl. 80, f. 414. *B. cataracta*, Chemnitz, l.c., x., f. 1455; Tryon, l.c., iii., pl. 80, f. 415.

Hab. Auckland. Chatham Islands.

Ash-grey with irregular dark markings; columella orange-yellow at the anterior end.

The operculum is similar to that of the last species. The dentition is figured in the Trans. N.Z. Institute, xv., pl. xiii., f. N.

COMINELLA VIRGATA, Adams, Genera of Moll., pl. 16, f. 6*a* (1858). *Buccinum quoyi*, Reeve, Conch. Icon., f. 36 (lineolatum) (1846); Tryon, Man. Conch., iii., pl. 80, f. 417 [not of Kiener]. *Buccinum lineolatum*, Quoy and Gaimard, Voy. Astrolabe, Zool. ii., p. 419, pl. 30, f. 14–16 [not of Lamarck]; Gray, Figs. Moll. Anim., i., pl. 5, f. 1; Tryon, Man. Conch., iii., pl. 81, f. 425. *B. lævigatum*, Hutton, Cat. N.Z. Moll., p. 14 (1873).

Hab. Bay of Islands to Auckland.

Ash-grey with five to eight distant narrow black spiral lines, which are never interrupted; anterior end of the columella bright orange.

The operculum is figured by Quoy, and the dentition in the Trans. N.Z. Institute, xv., pl. 13, f. K.

COMINELLA NASSOIDES, Reeve, Conch. Icon., Buccinum, f. 12 (1845); Tryon, Man. Conch., iii., pl. 81, f. 442 [not *Nassaria nassoides*, Gray]. *B. zealandicum*, Cat. Marine Moll. of N.Z., p. 14 (1873), [not of Reeve]. *C. nodicincta*, Martens, Sitzb. Berlin, 23, (1878); Tryon, l.c., iii., pl. 81, f. 443.

Hab. Foveaux Straits. Chatham Islands; Auckland Islands.

Shell nodulose at the suture; spirally ridged. Yellow-brown, the grooves orange brown; interior pale yellow. The operculum and dentition are unknown. A very variable species.

COMINELLA VENERIS, Filhol, Comptes Rendus, xci. (1880), p. 1094 (Buccinum).

Hab. Campbell Island.

Epidermis greyish; columella and margin of the mouth the same colour. Longitudinal ribs beginning at the apex, and becoming more and more marked; transverse ribs on the last and penultimate whorls. Length 1·6, breadth ·6 inch.

I have not seen this species.

COMINELLA HUTTONI, Kobelt, Cat. d. Gattung, Cominella, p. 233 (1878). *Buccinum costatum*, Quoy and Gaimard, Voy. Astrolabe, Zool. iii., pl. 30, f. 19, 20 [not of Lamarck]; Tryon, Man. Conch., iii., pl. 81, f. 431. *C. quoyana*, Adams, Pro. Zool. Soc., 1854, p. 313 [not of Kiener, nor of Reeve]. *C. lurida*, Cat. Marine Moll. of N.Z., p. 14 (1873) [not of Philippi].

Hab. Bay of Islands.

Pale brown marbled with reddish brown, and with thin distant dark spiral lines. There are twelve longitudinal plications on a whorl, the two next the aperture often obsolete. The aperture is less than half the length of the shell. The operculum is of the ordinary form; the dentition is unknown.

This species has been very well figured by Quoy. It is distinguished from *C. costata* not only by its form and colour, but also by the tentacles being slender, with the eyes near the middle; whereas in *C. costata*, according to Quoy, the tentacles are "short, thick, and rounded at the tip, close to which the eyes are placed."

Cominella lurida, Philippi, Zeitschrift f. Malak., 1848, p. 137; Icon. iii., p. 46, pl. 1, f. 10; Tryon, Man. Conch., iii., pl. 81, f. 439. *Buccinum funereum*, Gould, Pro. Boston Soc. Nat. Hist., iii. (1850), p. 152; U.S. Exploring Expedition, Shells, Atlas, f. 320; Tryon, l.c., iii., pl. 81, f. 438. *Buc. zealandicum*, Hombron and Jacquinot, Voy. Pôle Sud, Zool. v., p. 74, pl. 21, f. 5, 6 (1854); Tryon, l.c., iii., pl. 81, f. 437 [not of Reeve].

Hab. Throughout New Zealand on mud flats, and in slightly brackish water.

Yellowish-gray to brown-purple, the lighter varieties occasionally showing faint spiral lines of darker, the aperture is about half the length of the shell, and is dark purple, usually mottled with yellow. There are about twelve plications on a whorl. The operculum is normal. The dentition is figured in Trans. N.Z. Institute, xiv., pl. vi., f. c.

This species is quite distinct from *C. acutinodosa*, Reeve, from S. Australia.

Sub-fam. *Nassinæ*.

Animal with the foot large, and carrying at its posterior extremity two small processes. Central tooth pectinated; laterals with two cusps, and sometimes intermediate serrations. Shell with the inner lip usually callous; the canal short and recurved, or a notch. Operculum ovate, the nucleus apical.

Genus **Nassa**, Lamarck.

Shell ventricose; inner lip with a posterior callosity, or blunt, dentiform, plait; outer lip dentated, internally crenulated.

Nassa ephamilla, Watson, Jour. Linn. Soc., Zool. xvi., p. 370 (1882); N.Z. Journal of Science, i., p. 442.

Hab. N.E. of New Zealand in 700 fathoms.

Rather small, thin, chalkily porcellanous; ovate, with a shortish scalar spire, a rounded apex, a marginated suture, and a tumid base with very short pillar. Whorls rounded and beset with small prickles.

I have not seen this species, which was obtained by the Challenger expedition.

Art. XI.—*Descriptions of new Crustaceans.* By Geo. M. Thomson, F.L.S.

[*Read before the Otago Institute, 31st October,* 1882.]

Plates XII and XIII.

Fam. ÆGIDÆ.

Sub-fam. Cirolaninæ.

Genus **Pseudæga**, n. gen.

Eyes rather small. External antennæ hardly separated from one another. Inner antennæ tolerably elongated. Legs all adapted for walking. Epimeræ well-developed, and produced acutely backwards. Abdomen distinctly 5-jointed; last segment large. Caudal appendages reaching its extremity.

1. *Pseudæga punctata*, n. sp. Pl. xii., figs. 11–13.

The body is somewhat oval in outline, concave above, and nearly flat on the under-surface. The head is nearly square, and is inserted into the first thoracic segment, which considerably exceeds the other subequal segments in length. The abdominal segments are very distinct; the 4th and 5th are overlapped at the sides by the preceding segments. The last segment is triangular, with somewhat rounded edges, which are fringed with long hairs, and ends in a sharp point. The eyes are placed in the lower and outer angles of the head, and are nearly hidden by an upward-toothed projection of the 2nd joint of the external antennæ. These organs are very close together at the base, and the point of their flagellum just reaches the suture between the 4th and 5th thoracic segments. The internal antennæ are much more slender, but the peduncle reaches the extremity of the peduncle of the outer pair, while the flagellum reaches to about the middle of the 2nd thoracic segment.

The legs increase in length posteriorly, the 7th pair being considerably the longest. The caudal appendages reach the extremity of the abdomen, and are fringed with long hairs; the inner branch is very broad, and has a long acute tooth on its outer margin; the outer branch is nearly linear.

All the legs and the margins of the epimeræ are furnished with roughish hairs, but the upper part of the body is smooth. The general colour is grey, owing to the integument being covered with minute black stellate markings. Length ·5 inch.

Loc. Washed up on the Ocean Beach, near Dunedin.

I advance this genus and species provisionally, as I cannot satisfactorily place it in any of the existing genera. A revision of the Isopoda is very much wanted.

Fam. IDOTEIDÆ.

Genus **Edotia**, Guérin-Méneville.

1. *Edotia dilatata*, n. sp. Pl. xii., figs. 9, 10.

Female.—Body somewhat flattened and much dilated in the middle, the second, third and fourth segments being progressively broader and bluntly angled at the sides, fifth suddenly narrowing to less than half the width of the fourth; epimera completely amalgamated with the thoracic segments. Post-abdomen 2-jointed, the 1st joint very short, 2nd greatly elongated; distal extremity somewhat excavate.

Head subquadrate, with the anterior margin nearly straight, posterior slightly rounded. Antennules (internal antennæ) very short, 4-jointed, basal joint stout. Antennæ (external antennæ) reaching to the second thoracic segment, flagellum 13–14-jointed. Legs slender, subequal, dactyla of all the feet double-clawed (terminal and sub-terminal claws subequal). Opercular plates elongated, narrow; distal portions sub-quadrate, their extremities terminating in a point on the inner line, rounded outwardly. The whole body is of a light chestnut-brown colour, and the surface is quite smooth; the abdomen bears numerous minute black dots. Length about 1 inch. The whole under-surface was occupied by an ovigerous pouch.

This is a remarkable species intermediate in many respects between *Edotia* and *Idotea*, though apparently on the whole nearest to the former. It differs however from the characters of the genus in which I have placed it, in wanting the characteristic oblique line across the basal opercular plates. From *Idotea* it differs most conspicuously in having the epimeræ anchylosed with the sides of the thoracic segments. The ova in the ovigerous pouch were not sufficiently developed to furnish any characters.

A single specimen was sent to me from Auckland by T. F. Cheeseman, Esq.

Fam. ORCHESTIDÆ.

Genus **Allorchestes.**

Allorchestes recens, n. sp. Pl. xiii., figs. 2–5.

Body tolerably compressed and slender, quite smooth; coxal plates of the first three thoracic segments about as deep as their respective segments; those of the rest of pereion shallower. Eyes rather small, nearly circular. Superior antennæ reaching to or slightly beyond the extremity of the peduncle of the inferior; peduncle about as long as the 5–7-jointed flagellum. Inferior antennæ about one-fourth as long as the body; peduncle about equal with the 8–10-jointed flagellum. In both antennæ a few very short stiff setæ are found at the extremity of each joint. The maxillipedes have an extremely short and pointed dactylos; most of the joints have numerous short stiff setæ at their extremities and inner margins. The first gnathopoda of the male have the joints rather short and dilated on their lower margins; the propodos is about as broad as long, rounded on both margins, and with the palm nearly transverse. In the female the same is more slender, and the joints longer in proportion to their breadth; the propodos sub-quadrate, with the palm quite transverse; and only the carpos has the rounded dilatation. The second gnathopoda of the male have a large, broadly-ovate propodos, narrowing to the extremity. It bears a double row of stiff spine-like teeth along the palm, which extends very obliquely more than half-way along the inferior margin. In the female, on the other hand, this limb is so much reduced anteriorly as to suggest a close approximation to *Orchestia*; the meros, carpos, and propodos have their inferior margins dilated into rounded plates; while the latter bears a minute dactylos, extending only about half-way across it, and not quite at its extremity. The pereiopoda increase in length posteriorly, the last pair being considerably the longest. Length $\frac{3}{8}$ inch.

Loc. Numerous specimens of this species were sent me from Wellington by Mr. J. C. Gully, who obtained them in a small stream into which several drains ran.

Genus **Corophium**, Latr.

Latr. Gen. Crust., i., p. 58.
Brit. Mus. Cat. Amphip. Crust., p. 279.

1. Corophium excavatum, n. sp. Pl. xii., figs. 1–8.

Cephalon laterally produced between the bases of the antennæ into small obtuse lobes, on which the small rounded eyes are placed; seen from above the front margin is nearly straight, and is only pointed (not rostrate) between the bases of the anterior antennæ. Antennæ subequal in length, more than one-third as long as the body: anterior pair slender; 1st and 2nd joints of peduncle long, subequal; 3rd joint very short; flagellum 10-jointed, as long as base: inferior pair very stout, pediform; flagellum very short, 6-jointed: both pairs of antennæ sparingly furnished with setæ. First pair of gnathopoda rather small; ischium and meros very short, the former with a long tuft of setæ; carpus elongated, thickly fringed with hairs on its inferior margin; propodos rather shorter than carpus, slightly distended proximally, furnished with a tuft of setæ on its upper margin and another at the hinge of the dactylos, palm transverse, with a fringe of fine setæ; dactylos slightly curved, impinging closely on the palm. Second pair of gnathopoda longer than first, joints rather slender; meros produced into a scoop-like process, fringed on each margin with long setæ, and into which the carpus lies closely when the limb is folded; carpus elongated, rather widest at its distal end, densely fringed with long setæ along its inferior margin; propodos as long as carpus, sides nearly parallel, produced posteriorly into a tooth, which makes the palm nearly transverse, sparingly setose towards the extremity; dactylos arcuate, nearly twice as long as the palm. First and second pairs of pereiopoda rather short, simple, and nearly destitute of spines or setæ; third pair shortest of all, joints densely fringed with long setæ, and the propodos strongly spined on its inferior margin; fourth pair twice as long as third, dactylos directed backwards; fifth pair longer still, being nearly equal in length to the whole body, the basa of these three last pairs are much dilated and setose on their margins. Three posterior pairs of pleopoda ending subequally, ante-penultimate and penultimate pairs with strong curved spines on their basal joints and rami; ultimate pair very small and feebly developed, with a few setæ, but no spines, internal ramus very minute. Telson short and rounded at its extremity. Colour a dirty-grey, similar to that of the sandy-mud of the creek in which it occurred. Length ⅛ inch.

Hab. Brighton Creek (salt water), near Dunedin.

This species is very distinct from any hitherto described, the form of the meros of the 2nd gnathopod being quite remarkable; a tendency towards a similar development of structure occurs apparently in *C. longicorne*, which is, however, a very different species in many respects.

Fam. OXYCEPHALIDÆ.

Genus **Oxycephalus**, Edw.

Milne-Edwards, Ann. des Sc. Nat., t. xx., 1830, p. 396.

C. Claus, Die Gattungen und Arten der Platysceliden, 1879, p. 44.

Body elongated, slender, cephalon produced into a triangular beak, from the base of the under-surface of which the anterior antennæ project. These have the peduncle greatly dilated in the male, and thickly furnished with olfactory setæ; flagellum 2- or 3-jointed. The posterior antennæ are 5-jointed in the male, and lie behind the snout under the inflated portion of the head, all the joints being folded close against one another; in the female they are wanting. The mandibles are small, and furnished with a slender 3-jointed palp in the male. The maxillæ are totally wanting. The maxillipedes are also greatly reduced in size, and their squamiform plates are smoothly rounded. The gnathopoda have complex chelæ, the carpus being produced into a long narrow point, which meets the dactylos; those of the first pair are shorter than the second. The first two pairs of pereiopoda have the joints very slender, in the third and fourth the basa are broadly dilated, while the fifth pair are very much smaller, but have all the joints present. The three posterior pairs of pleopoda are double-branched, the branches being broadly lanceolate. The triangular telson seems to be anchylosed to the preceding segment.

Spence Bate, in the British Museum Catalogue of the Amphipodous Crustacea, has overlooked the remarkable sexual differences which characterize the Oxycephalidæ, not only in this genus, but also in *Rhabdosoma*, in which he describes the male of *R. armatum* as a separate species, *R. whitei*. The distinctive characters have been clearly brought out by Dr. Claus in a paper on "Die Gattungen und Arten der Platysceliden," which however is not readily accessible to New Zealand students. In this paper, Dr. Claus describes *Oxycephalus piscator*, Edw., at considerable length, and unites *O. tuberculatus*, Sp. Bate, and *O. oceanicus*, Guérin-Méneville, to it—the latter being a young male. He also gives brief descriptions of six new species, from all of which the following species is quite distinct, though apparently nearest *O. latirostris*, a Lagos species. The brevity of the descriptions however, and the want of illustrations, render this resemblance somewhat doubtful.

1. Oxycephalus edwardsii, n. sp. Plate xii., figs. 14–21; pl. xiii., fig. 1.

Male.—The head is widely dilated and produced into a long sharp snout. This snout is more or less sharply ridged on the upper surface, and nearly flat on the under-side, the margins being sharply bent inwards. The sides of the head are nearly completely occupied with the eyes, which resemble those of *Phronima*. The sides of the head are not in close contact below, but form a long groove in which the posterior antennæ lie folded. The anterior antennæ are placed in front of the head just under the base of the beak; they depend nearly vertically, and have their concave side turned outwards. The peduncle has two short basal joints, and then a long, very stout, curved joint, the whole inner (convex) surface of which is thickly coated with olfactory setæ. The flagellum, which projects nearly at right angles from the extremity of the peduncle, is very small and 3-jointed.

The posterior antennæ are placed almost behind the head, and their joints lie folded closely together in the groove under the cephalon, in a zigzag manner; when extended, they are two or three times as long as the head and snout. Dr. Claus calls these organs 5-jointed; they have 4 long, subequal joints, which are extremely slender, but a little dilated at their ends, with a minute terminal hook-like claw, which appears only to be present in mature males. The mandibles are much reduced in size, and project down, behind the insertion of the antennæ, as small tooth-like organs furnished with a slender 3-jointed palp. These and the very much reduced maxillipedes are the only mouth-organs present; and the latter are of very simple structure, consisting each of an oval smooth plate, without any trace of hairs or teeth. The gnathopoda are relatively small, and the first pair are only about half the size of the second. In both pairs the basos is elongated, and the carpus produced on its inferior margin into a long spine, against which the dactylos impinges. In the first pair the carpus is short and stout, its inner surface, as well as that of the propodos, is furnished with a considerable number of short stiff setæ or spines. In the second pair both carpus and propodos are elongated, and their finely-serrated palms are almost destitute of setæ. The 1st and 2nd pereiopoda are long, slender, and sparingly furnished with hairs. The 3rd pair have the basa finely-serrated on the lower front margin, while posteriorly they are dilated into an oblong plate; they are quite naked. In the 4th pair, the basa are dilated into very broadly pear-shaped plates, while the remainder of the limb is finely fringed with pectinate setæ on the front margin. The last pair are small, and have the basa slenderly pear-shaped. The basa of these three pairs act as protective shields to the side of the body, and the remaining joints of the limb when at rest lie folded up under them. The three anterior pairs of pleopoda or swimmerets, have an oblong basal joint, with two finely-setose branches. The three posterior pairs are also double-branched, but are of very unequal length. The first pair have the peduncle more than twice as long as the branches, both of which are movable, and the inner one of which extends to the extremity of the telson. The second pair only extend to the end of the peduncle of the first, and have the outer joint alone movable. The third pair, which are placed at the extremity of the last body-segment are also short, reaching to the end of the telson, and having the outer joint alone movable. In all the pairs the branches are finely-serrated on the margins, and the movable outer one is always smaller than the inner. The telson is elongated, and sharply pointed; its separation from the last joint of the abdomen can be made out on the ventral surface somewhat imperfectly, but from above it seems to be completely anchylosed. The abdominal segments are all produced into a sharp spine posteriorly.

Female.—The sexual differences are very considerable in these animals, showing themselves almost exclusively in the cephalon and its appendages. The head is much more inflated than in the male, being nearly globular, so that the beak is more prominently shown; the sides of the head appear to be completely fused together below, so that there is no groove for the antennæ as in the male. The anterior antennæ are much simpler than in the male: the first joint is tolerably long, the second very short, while the third is also straight and very much more slender than the male, while only a few olfactory setæ are developed on its outer margin; the flagellum is 2-jointed, but the last joint in mature specimens appears to be sometimes divided into two. The posterior antennæ are quite absent, as are also the mandibular palps. The length of the body is from 1 to 1¼ inch. The animal is absolutely transparent and glass-like.

Hab. I found numerous individuals washed up on the Ocean Beach near Dunedin on two different occasions. They appear to come ashore in fine clear calm weather.

EXPLANATION OF PLATES XII. AND XIII., FIGS. 1-5.

PLATE XII.

Figs. 1-8. *Corophium excavatum.*

1. Adult; 2. mandible; 3. second gnathopod; 4. third pereiopod; 5, 6 and 7. ante-penult., penult., and ultimate pleopoda; 8. telson.

Figs. 9-10. *Edotia dilatata.*

9. Adult female; 10. opercular plate.

Figs. 11-13. *Pseudæga punctata.*

11. Dorsal view; 12. lateral view; 13. head, seen from the front.

Figs. 14-21. *Oxycephalus edwardsii.*

14. Adult male; 15. anterior antenna, female; 16. anterior antenna, young male; 17. posterior antenna, young male; 18. mandible-palp; 19. first gnathopoda; 20. second gnathopod; 21. crystalline cones of the lateral eyes.

PLATE XIII.

Fig. 1. *Oxycephalus edwardsii.*

Posterior portion of abdomen, showing telson and three posterior pairs of pleopoda; also the structure of the extremity of the intestine.

Figs. 2-5. *Allorchestes recens.*

2 and 3. female and male anterior gnathopoda; 4 and 5. female and male posterior gnathopoda.

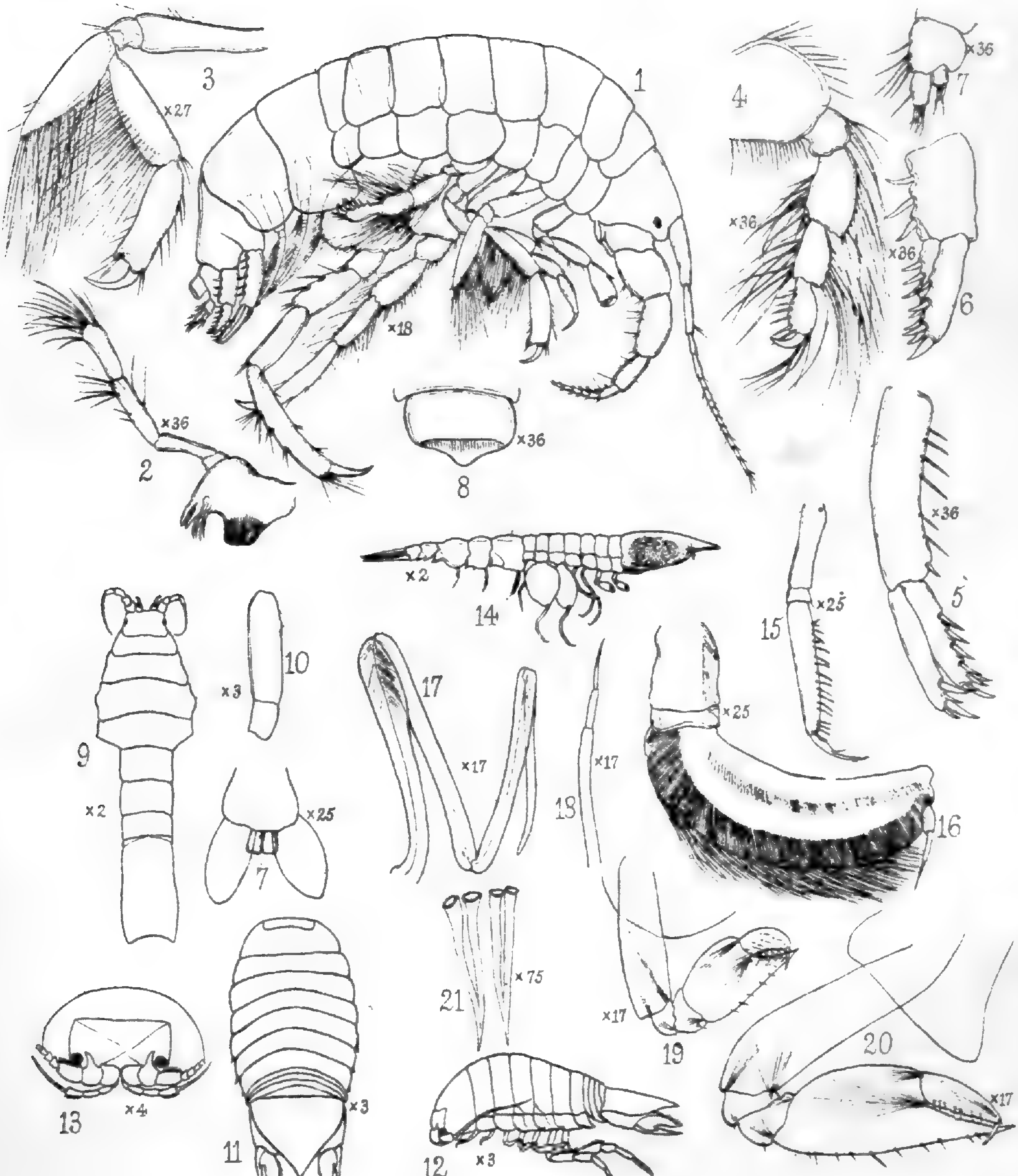
ART. XII.—*On a new Species of* Daphnia. By Geo. M. Thomson, F.L.S.

[*Read before the Otago Institute, 7th May,* 1883.]

Plate XIII., figs. 6–9.

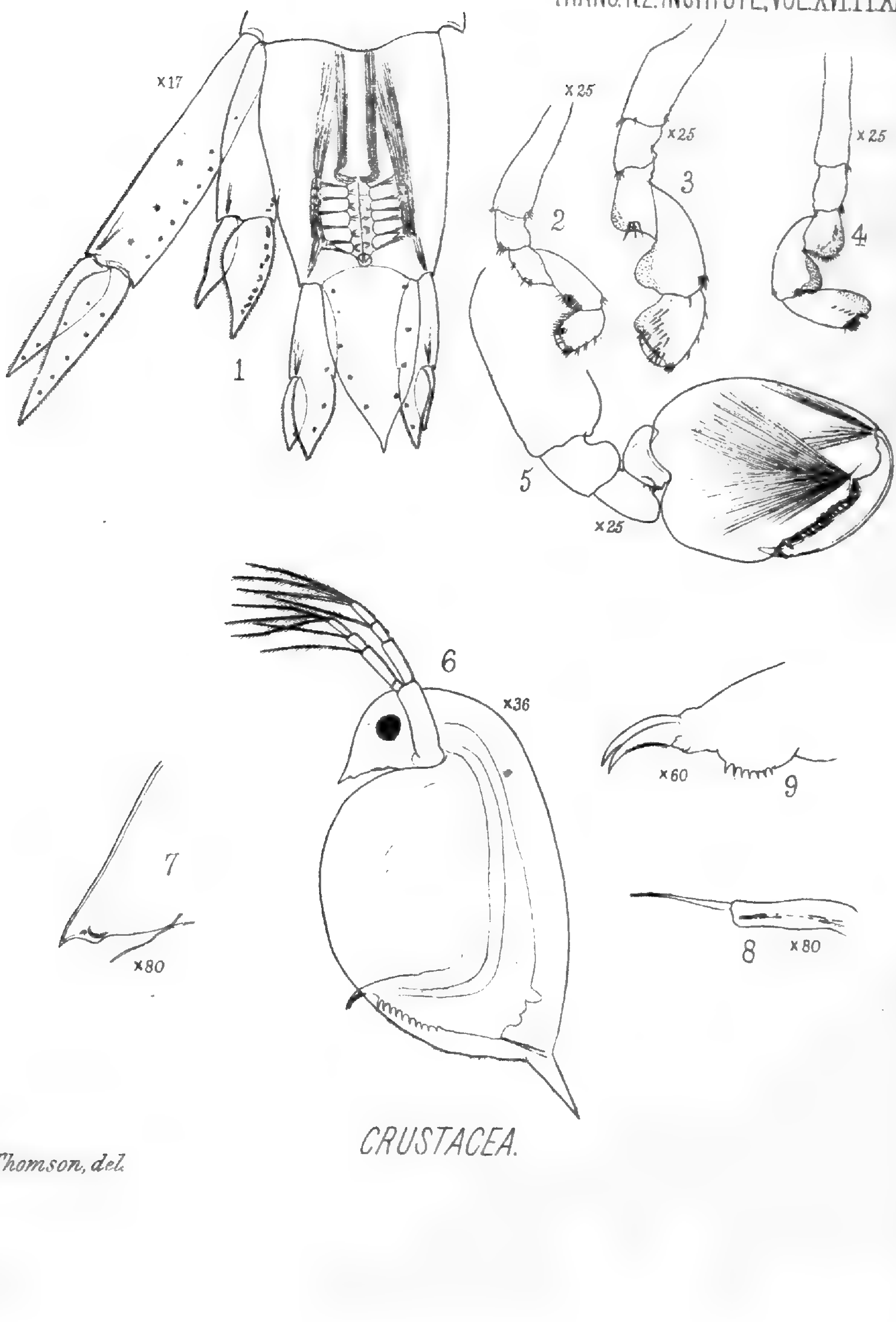
LAST year Mr. Chas. Chilton sent me down specimens of a new *Daphnia* from South Canterbury, differing markedly from the form common about Dunedin, and which was described by me as *D. obtusata* in Trans. N.Z. Inst. vol. xi., p. 261.

It is singular that these two species of *Daphnia* and one of *Chydorus* should be the only representatives of the Cladocera hitherto found in New Zealand. While the general poverty of our fresh-water fauna may no doubt hold good in this case as in so many others, it is yet probable that a search in other parts of our islands will result in the discovery of other forms.



CRUSTACEA

G. Thomson, del.



CRUSTACEA.

G. Thomson, del.

The species described now is very similar in general form to the common European *D. pulex*, and perhaps is only a variety of it. It differs however in several structural points, and is therefore raised provisionally to specific rank under the name *D. similis.*

The following is a brief description of the animal: Valves oval in form, not quite twice as long as broad, and produced posteriorly into a sharp stout spine, which is about one-seventh of the length of the carapace in the male, and about one-sixth in the female. The whole lower margins of the valves, as well as the spine, are fringed with short pectinate hairs.

The head in the male is nearly perpendicular in front, and ends in a blunt beak, which bears the anterior antennæ near its extremity: these are 1-jointed, and bear a single filament, which is flexible and serrated at its extremity. The whole length of these organs is nearly equal to the breadth of the head. In the female the front of the head protrudes considerably, and the beak is very acute. The anterior antennæ are represented by two very minute tubercles, destitute of setæ, which are situated on the underside, close to the extremity. These organs appear to be in a more rudimentary condition in our species than in any other hitherto described. The posterior antennæ are of normal form in both sexes, but are relatively shorter than the same organ in *D. pulex*, being only a little more than half as long as the carapace. All the joints are furnished with minute hairs.

The posterior portion of the body is dorsally produced into four rounded lobes, the upper one of which is the longest, while the lower bears two long setose spines or filaments. The abdomen in the male is much rounded at the anal orifice, and bears at that part on each side about 7 curved teeth, which are somewhat distant from the 2 curved terminal hooks. In the female the abdomen is slightly rounded on the lower margin, and bears 10–12 curved teeth close up to the terminal hooks.

My specimens included one male, $\frac{1}{12}$th of an inch in length, and several females, the largest of which were about $\frac{1}{8}$th of an inch long. When living, their colour, according to Mr. Chilton, was brick-red.

DESCRIPTION OF PLATE XIII., Figs. 6-9.

Figs. 6-9. *Daphnia similis.*

6. Adult female; 7. rostrum of same; 8. anterior antenna, male; 9. extremity of abdomen, male.

Art. XIII.—*On the New Zealand* Pycnogonida, *with Descriptions of new Species.*

By Geo. M. Thomson, F.L.S.

[*Read before the Otago Institute, 7th May and 13th November,* 1883.]

Plates XIV–XVI.

The Pycnogonida form one of the many groups of animals in the New Zealand fauna of which very little is yet known. This is not however to be wondered at, when we consider of how fragmentary a nature the literature of the subject is, and how imperfect our knowledge of the whole group is. Two noteworthy works have however recently appeared, which bring pretty fully together all that is yet known, and at the same time add greatly to the general fund of information. These are "The Report on the Pycnogonida dredged by H.M.S. Challenger," by Dr. P. P. C. Hoek of Leiden, and "Die Pantopoden des Golfes von Neapel," by Dr. Auton Dohrn, both beautifully illustrated. Both works appeared in 1881, but quite independently of one another; and while Dr. Dohrn's work is much the most complete in anatomical detail, it does not help us much in the systematic portion, as the species described are only those new to science which came under the author's observation while working at Naples.

In Dr. Hoek's report a catalogue of all the known species of Pycnogonida is given, and from it we learn that the following species only have been found in the New Zealand seas.

1. *Nymphon compactum*, Hoek.*
2. „ *longicoxa*, Hoek.*

both dredged from a depth of 1,100 fathoms at a station east of Auckland.

3. *Oorhynchus aucklandiæ*, Hoek,* dredged from a depth of 700 fathoms east of Auckland.

In the New Zealand Journal of Science, vol. i., p. 28, I recorded the occurrence of *Ammothea pycnogonides*, Nob., as common along the East Coast of Otago, but the description of that species is so unsatisfactory, and would apply to so many species of *Ammothea*, that I have re-described it provisionally as *A. dohrni*, and figured it.

I am convinced that a close examination of our seas at moderate depths would reveal a considerable number of new forms, and that the apparent absence of them is chiefly due to their having been overlooked.

In describing the accompanying new species, I need make no apology for giving the characters of the genera, and placing in order all the species now known.

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* See N.Z. Journal of Science, vol. i., p. 170-172.

Fam. I. NYMPHONIDÆ.

Mandibles and palpi both present, and strongly developed. Ovigerous legs present in both sexes, and furnished, as a rule, with denticulate spines.

(Only) Genus I. **Nymphon**, Fabr.

Mandibles 2-articulate, cheliform; palpi 5-jointed; ovigerous legs 10-jointed.

1. *N. compactum*, Hoek. (See p. 242.)

2. *N. longicoxa*, Hoek. (See p. 242.)

Fam. II. COLOSSENDEIDÆ.

Mandibles rudimentary or wanting; palpi strongly developed. Ovigerous legs present in both sexes, and furnished, as a rule, with denticulate spines.

Genus I. **Ammothea**, Leach.

Body elongate or disciform, with the segments, as a rule, distinctly separated from one another. Rostrum spindle- or barrel-shaped, usually directed forwards, or sometimes downwards, and generally of considerable size. The abdomen or hind-body is of large size, and usually directed sharply upwards. Ocular-tubercle directed upwards, placed in the centre of the anterior segment.

The mandibles are 2-jointed, but quite destitute of claws. (In immature states they are more or less completely chelate, hence a great confusion has arisen in describing new genera; *Phanodemus*, Costa, *Pephredo*, Goodsir, *Pasithoe*, Goodsir, *Endeis*, Philippi, *Paribœa*, Philippi, *Platychelus*, Costa, *Alcinous*, Costa, and *Achelia*, Hodge, being all probably immature forms of *Ammothea*, as Dr. Dohrn points out.)

Mandibular palpi 8–10-jointed, usually longer than the rostrum, and carried in a bent manner.

Ovigerous legs 9- or 10-jointed, present in both sexes, with or without plumose spines, but without terminal claws.

The legs usually have their terminal claws furnished with secondary claws, and the alimentary cæca reach to the end of their 6th joint.

3. *Ammothea dohrni*, n. sp. Pl. xiv., figs. 5–9.

(*A. pycnogonoides*, Nob., N.Z. Journ. of Sc., vol. i., p. 28.)

Body very small, disciform, lateral processes in close contact. The proboscis is long, cylindrical and directed downwards. The cephalo-thoracic segment is rounded above and slightly elevated; the oculiferous tubercle bluntly conical and bearing 4 distinct eyes on its sides. The abdomen is long and rather slender, and stands in a slanting position from the body. The mandibles are 2-jointed, the last joint being a mere tubercle; they stand nearly erect on the front of the cephalo-thoracic segment. The mandible-palps are rather longer than the proboscis and are 8-jointed; the 1st and 3rd joints are long, the 2nd short, the rest short and subequal, the four last being furnished with a number of blunt spines; the geniculate appearance of these limbs is chiefly due to the fact of the 6th joint being articulated to the middle of the 5th and at right angles to it.

The ovigerous legs are 10-jointed and smooth; the three last joints become progressively smaller, the last being a minute tubercle; these organs show no trace of denticulated spines.

The legs are about 10 mm. long, and are tolerably stout. The joints are considerably geniculated, so that the limbs cannot easily be extended on a flat surface; their lengths (in the 3rd pair) are as follows:—

$$\frac{1,\quad 2,\quad 3,\quad 4,\quad 5,\quad 6,}{3.\quad 5.\quad 4.\quad 12.\quad 12.\quad 13.};$$

the extremities of the joints are all more or less furnished with the characteristic blunt spines, particularly at their apices. The 1st tarsal joint is very short, while the 2nd is rather longer than the 2nd joint of the leg, and has a double row of spines along the inner margin; the claw is about half as long, and is supplemented by two auxiliary claws.

Hab. In rock-pools at Oamaru and near Dunedin, and in Otago Harbour.

4. *Ammothea magniceps*, n. sp. Pl. xv., figs. 1–5; and pl. xvi., fig. 3.

Body moderately robust, distinctly articulated, and with the lateral processes close to but quite separate from one another; total length 7 mm. The rostrum is very large and stout, more than three-fourths as long as the body, very broadly cylindrical or almost barrel-shaped in the anterior portion, with the inferior part chiefly dilated; directed slightly downwards.

The abdomen is about 1 mm. long, slender and cylindrical, and directed obliquely upwards.

The oculiferous tubercle is situated about the middle of the cephalothoracic segment; it is stout, bluntly rounded at the end, but with a posterior notch when seen from the side.

The mandibles are in a very rudimentary condition, their 2nd joint being a rounded tubercle projecting nearly at right angles from the middle of the 1st joint. The palpi are about $4\frac{1}{2}$ mm. long, and are 10-jointed, the 2nd and 4th joints being long, and the others very short; they are all quite destitute of spines.

The ovigerous legs are short (only 3 mm. in length), slender and 10-jointed; the four last joints are each furnished near their distal extremity with an oblique row of 4 or 5 denticulate spines.

The legs of the 3rd pair are 15 mm. long. The following formula represents the relative length of the joints (including the two tarsal joints):—

$$\frac{1,\quad 2,\quad 3,\quad 4,\quad 5,\quad 6,\quad 7,\quad 8,}{2.\quad 5.\quad 3.\quad 14.\quad 12.\quad 14.\quad 1.\quad 4,}$$

All the joints are remarkably smooth, and destitute both of hairs and spines. The 2nd tarsal joint is strongly spined along its inner margin, while its outer margin protrudes beyond the articulation of the large claw and its auxiliary claws into a tubercular prolongation, which is beset with several minute spines.

The genital openings on the 2nd joints of all the legs are very small and inconspicuous.

The integument is everywhere covered with minute rounded tubercles.

Hab. A single specimen of this apparently very distinct species was forwarded by Mr. C. Chilton, who obtained it by the dredge in Lyttelton Harbour.

Genus II. **Oorhynchus**, Hoek.

Proboscis ovate, inserted ventrally on the cephalothorax at a considerable distance from the front margin. Mandibles rudimentary; palpi 9-jointed. Ovigerous legs 10-jointed; the four last joints not furnished with one or more rows of denticulate spines.

5. *Oorhynchus aucklandiæ*, Hoek. (See p. 242.)

Fam. III. PALLENIDÆ.

Mandibles strongly developed, cheliform; palpi rudimentary or quite wanting. Ovigerous legs present in both sexes, and furnished with denticulate spines (*Pallene*), or in both sexes and furnished with simple spines (some species of *Phoxichilidium*), or present in the males only (other species of *Phoxichilidium*).

(Note.—In Dr. Dohrn's monograph, a somewhat different classification of these genera is given:—

Phoxichilidium is placed in the family Phoxichilidæ, and is characterized as possessing mandibles furnished with nipping claws, palpi wanting or only present as a rudiment in the male, *ovigerous legs 5–7-jointed, only present in the males, and furnished with simple spines.*

Pallene is placed in the family Nymphonidæ, and is characterized as possessing mandibles furnished with nipping claws, palpi wanting or only present as a rudiment in the male: ovigerous legs present in both sexes, 10–11-jointed, furnished with leaf-like or finely toothed spines on their terminal joints. From this genus again he separates *Neopallene* as follows:—

a. Sexual organs and their genital openings present in the 2nd, 3rd, and 4th pairs of legs (Extremität V.–VII.), wanting in the 1st pair (Extremität IV.); palpi rudimentary in the male ... ... *Neopallene.*

b. Sexual organs and their genital openings present in all the legs; palpi wanting in the male ... ... *Pallene.*

Under this classification, my new species of *Phoxichilidium* (*P. obliquum*) would not come exactly under any of the above genera. I have, however, followed the classification given by Dr. Hoek in his "Report, etc."

Genus I. **Pallene,** Johnston.

Body usually very slender, distinctly divided into four segments; anterior segment usually contracted like a throat behind the insertion of the mandibles and rostrum. The rostrum is short and broad. Abdomen short, erect. The strong mandibles are placed over the rostrum, and are furnished with powerful claws; the palpi are wanting in both sexes.

The ovigerous legs are present in both sexes and are long and 10-jointed; the last four joints are furnished with a row of closely-placed toothed spines.

The legs are very long and slender, and have the 4th joint in the female considerably enlarged for the reception of the large eggs; claws furnished with large secondary claws.

The ovaries occur only in the 4th joints of all the legs but the 1st pair; and the large eggs after ejection from the genital openings are attached in pairs to the ovigerous legs. The development within the egg is very protracted, and the larvæ emerge in a nearly complete form, differing from the adults only in size, and in a few subordinate points of structure.

6. *Pallene novæ-zealandiæ*, n. sp. Pl. xiv., figs. 1–4.

Body slender and very smooth, with a considerable interval between the lateral processes; length 1·8 mm. The cephalic part of the cephalo-thoracic segment is considerably swollen at the insertion of the mandibles. The proboscis is stout and nearly cylindrical in form, ·4 mm. in length, narrowing abruptly to the rounded extremity; mouth-aperture nearly circular. It is inserted on the ventral surface, and projects considerably downwards.

The oculiferous tubercle is short and blunt. The abdomen is short and bluntly pointed, and is directed nearly straight upwards.

The mandibles are robust and rather long; the first joint reaches a little beyond the extremity of the proboscis; the 2nd is somewhat dilated and bears a movable and a fixed claw, which are both narrow, pointed and slightly curved, and are furnished with a row of small denticles on their inner surface.

Ovigerous legs slender, 2·4 mm. long; the first three joints are short, 4th and 5th much longer, 6th only about half as long as the 5th. The four last joints are subequal in length and somewhat curved, and bear 8 (or 7) denticulated spines on their inner margins. On the last joint the spines are all of a uniform oval shape, the last one being placed quite close to the extremity of the joint. The three preceding joints have all the spines of the same oval form, except the last of each series, which is curved outwards and bears 3 or 4 long marginal teeth.

The legs of the 3rd pair are 7·5 mm. long; the relative lengths of the joints being as follows:—

$$\frac{1,}{4.}\ \frac{2,}{5.}\ \frac{3,}{16.}\ \frac{4,}{34.}\ \frac{5,}{32.}\ \frac{6,}{42.}\ \frac{7,}{2.},$$

the 4th being much the stoutest. The 4th and 5th joints are sparingly furnished with hairs, the slender 6th joint has a considerable number. The tarsal joints and claws are normal.

Hab. Only one specimen of this elegant species was taken in Otago Harbour (27 feet) by the dredge. From its small size, I am afraid it was immature, but the great enlargement of the 4th joints of the legs would show that it was not far from sexual maturity, although no eggs were seen.

Genus II. **Phoxichilidium,** Milne-Edwards.

Body usually cylindrical, sometimes contracted and disc-like. Proboscis always strong, cylindrical, directed forwards; usually inserted considerably behind the insertion of the mandibles. Mandibles 3- (? 2-) jointed, the last joint with movable claws bent down in front of the mouth. Palpi wanting; represented by a small tubercle on the wall of the anterior segment. Ovigerous legs 5–10-jointed, the last four joints never furnished with denticulate spines; (5–7-jointed, only present in the males, *Dohrn*). Legs having all the joints of normal length; tarsal joint strongly spined on its inner (lower) margin; claws long, subsidiary claws rudimentary or wanting.

The male genital openings occur in the 2nd joint of the 3rd and 4th pairs of legs.

The animals of this genus are distinguished from all other *Pycnogonida* by a peculiar mode of development. The young, immediately on emerging from the egg—at which stage they possess an obtuse pyriform body, with 3 pairs of rudimentary appendages—creep into the cavity of the body of a hydroid polyp (*Hydractinia*, *Coryne*, etc.) and undergo the rest of their development in this retreat.

7. *Phoxichilidium obliquum*, n. sp. Pl. xv., fig. 6; pl. xvi., figs. 1 and 2.

Body contracted, lateral processes hardly separated; the dorsal portion somewhat elevated; length 5 mm. The proboscis is very stout and cylindrical, and is directed downwards at an oblique angle; its length is about half that of the body.

The abdomen is about 3 mm. long, and stands rather obliquely upwards from the body; it is abruptly truncated at the end, but bears two long spines at the anterior side of its apex.

The front portion of the cephalo-thoracic segment is elevated into a transversely oval hump or cushion on which the oculiferous tubercle is placed. This organ is prominently developed, and runs up on its anterior face to a tolerably acute point; its summit is crowned with numerous short spines.

The mandibles are indistinctly 3-jointed; the first two joints project horizontally forward in front of the proboscis; the 3rd is placed at right angles to the 2nd, and the nipping claws are at right angles to it and work horizontally in front of the mouth. The palpi are represented by a small tubercle at the base of the mandibles on each side.

The ovigerous legs are about 10 mm. long, and are present in both sexes. They are 8- (? 9-) jointed, the four terminal joints being furnished with simple short spines.

The legs of the 3rd pair are 31 mm. long, the relative lengths of their joints being as follows:—

1,	2,	3,	4,	5,	6,	7,	8,
2.	6.	3.	16.	17.	18.	1.	5.

The upper margin of the 2nd tarsal joint protrudes somewhat beyond the articulation of the claws.

The integument of the body and appendages is everywhere more or less furnished with spines of varying size and strength; these are most numerously developed on the mandibles.

Hab. Lyttelton Harbour, taken by the dredge. I am indebted to Dr. R. von Lendenfeld and Mr. C. Chilton for several specimens of this species.

EXPLANATION OF PLATES XIV.—XVI.

Plate XIV.

Figs. 1-4. *Pallene novæ-zealandiæ.*
1. Body seen from the ventral aspect; 2. claw of mandible; 3. extremity of the ovigerous leg, with toothed spines; 4. claw of leg of 3rd pair.

Figs. 5-9. *Ammothea dohrni.*
5. Body from the dorsal aspect; 6. mandibles; 7. mandible-palpi; 8. ovigerous leg; 9. claw of leg of 3rd pair.

Plate XV.

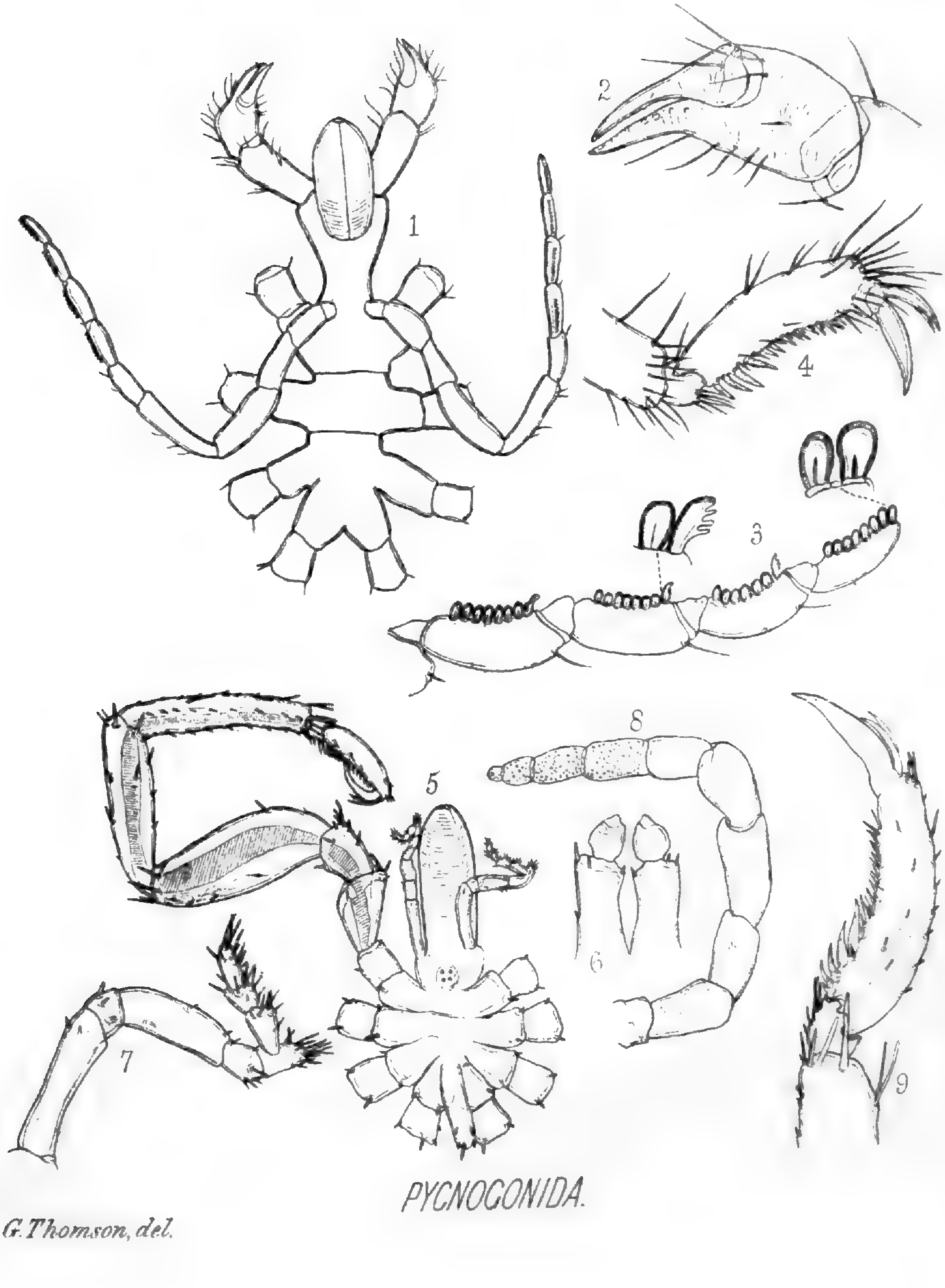
Figs. 1-5. *Ammothea magniceps.*
1. Profile of body seen laterally, with the appendages removed; 2. mandibles; 3. ovigerous leg; 4. terminal joint of ovigerous leg; 5. claw of leg of 3rd pair.

Fig. 6. *Phoxichilidium obliquum.*
Lateral view of body.

Plate XVI.

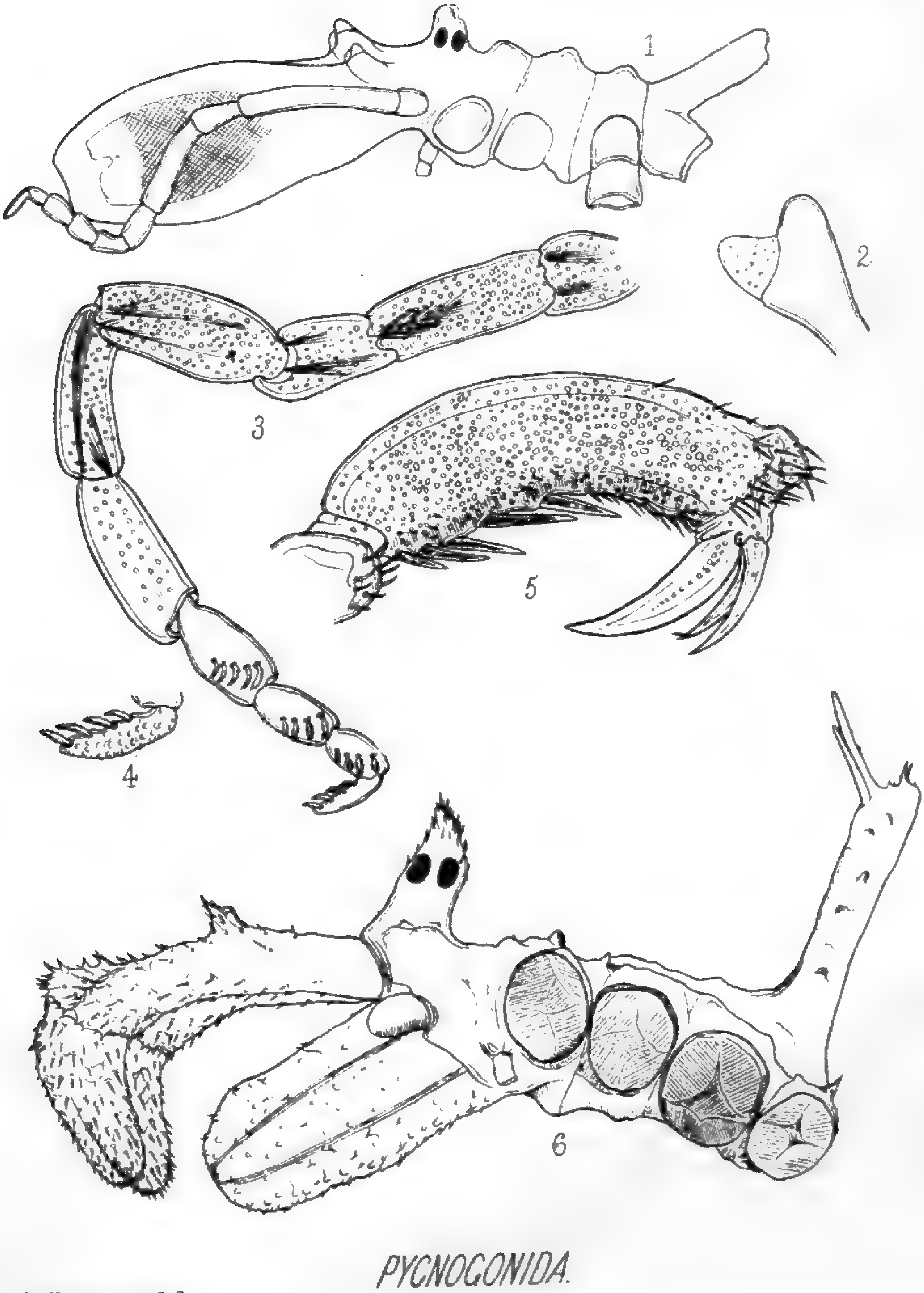
Figs. 1-2. *Phoxichilidium obliquum.*
1. Dorsal aspect of body; 2. ovigerous leg.

Fig. 3. *Ammothea magniceps.*
Dorsal aspect of body.



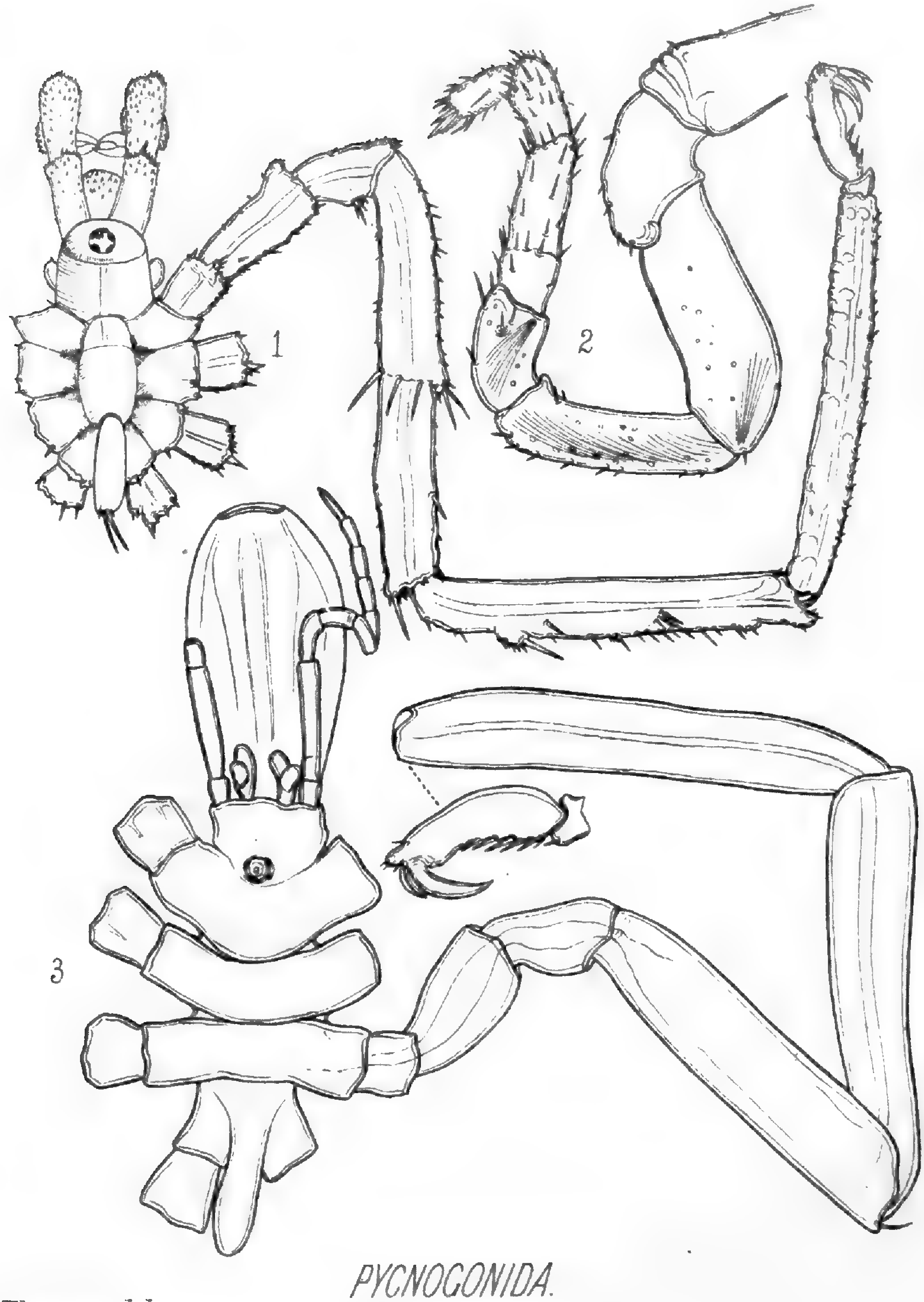
PYCNOGONIDA.

G. Thomson, del.



PYCNOGONIDA.

G. Thomson, del.



PYCNOGONIDA.

G. Thomson, del.

ART. XIV.—*Additions to the Sessile-eyed Crustacea of New Zealand.*

By CHARLES CHILTON, M.A.

[*Read before the Philosophical Institute of Canterbury, 15th November*, 1883.]

Plates XVII.–XXI.

THIS paper is the result of the work I have been able to do on the subject during the year. The species are not arranged in any particular order, but are given as I found most convenient when working them out.

I desire to take this opportunity of thanking Mr. R. M. Laing, of Canterbury College, for having on many occasions brought me seaweed from Lyttelton harbour. From this I have taken many specimens which I should not otherwise have been able to obtain.

ISOPODA.

Genus **Apseudes**, Leach.

(Bate's and Westwood's "British Sessile-eyed Crustacea," vol. ii., p. 144.)

Apseudes latus, sp. nov. Pl. xvii., fig. 1, *a* to *h*.

Body broad, vertically compressed; pereion of same width throughout its whole length; pleon narrowing considerably posteriorily; sides of segments of pereion and pleon fringed with long sparsely plumose hairs. Head produced into a bluntly ended triangle between the antennæ. Upper antenna with the first joint of peduncle rather short, stout, especially at the centre where the width is about half the length, long hairs on outer edge and at inner distal angle; second joint not quite one-third the length of the first, fringed with hairs on both sides; third smaller; secondary flagellum rather more than half the length of the primary, which is slightly longer than the first joint of peduncle. Lower antenna small, about as long as peduncle of upper; of the joints that are visible the first two are short and stout, second bearing a small oval plate with four or five long hairs. First pair of gnathopoda small; carpus more than twice as long as broad; propodos stouter than carpus, produced into a stout fixed finger, which narrows abruptly to a sharp point, has the inner edge minutely crenulated, and is supplied towards the extremity with several setæ; dactylos with a stout tooth on the inner edge near the base, ending very acutely, supplied with short setæ on inner edge, and a few longer ones on the side. Second pair of legs with the carpus nearly quadrangular with two stout spines on posterior margin; propodos not expanded, longer than carpus but more slender, three or four stout spines on posterior margin, one slender one, nearly as long as the dactylos, at the end. Third and fourth pairs of legs similar to the second. Fifth having the ischios and meros both short and supplied with long setæ; carpus about as long as the propodos; a spine at its antero-distal angle; propodos expanded distally, extremity rounded and thickly fringed with pectinated setæ, bearing also one spine above three-fourths as long as the dactylos. Sixth pair of legs with the meros longer than the ischios, nearly as long as the carpus, both bearing long setæ; propodos narrower than carpus, bearing at the extremity the dactylos and a spine about three-fourths as long as the dactylos, and on distal half of the posterior margin a row of about six or seven short stout setæ. Seventh pair similar in form to the sixth; meros rather longer than carpus, both thickly fringed on each side with long plumose hairs, propodos having the end and greater part of the posterior margin bordered with stout straight setæ. First five segments of pleon subequal in length, sixth not quite so long as the two preceding, last segment triangular, rounded posteriorly, and bearing three or four long setæ. Last pair pleopoda long, peduncle stout, reaching as far as the end of last segment of pleon, outer edge bearing long hairs; outer branch short, of three joints; inner branch nearly five times as long as the outer, having about thirteen joints rather irregular in size; both branches bearing numerous long setæ.

Colour, greyish. Length, about ⅛ inch.

Hab. Lyttelton Harbour. A single specimen found creeping in mud at the root of some seaweed.

Genus **Janira**, Leach.

(Bate's and Westwood's "British Sessile-eyed Crustacea," vol. ii., p. 335.)

As this genus is new to New Zealand, I give here the generic characters.

"Pereion serrated along the lateral margins; pleon having all the segments coalesced into a single plate; covered in the female, beneath with a large flat membranous plate concealing the branchial feet; and furnished at the tip with a pair of elongated bifid uropoda. Outer antennæ as long as the animal. Dactyla biunguiculate."

Janira longicauda, sp. nov. Pl. xviii., fig. 2, *a* to *b*.

Eyes large. Head rectangular, rather more than twice as broad as long, produced into a rostrum rounded at the end reaching nearly to the end of the second joint of the peduncle of inner antennæ. Inner antennæ reaching nearly as far as the end of the fourth joint of peduncle of outer antennæ; first joint stout, second about half as long, and with three or four stout setæ at distal end; third about as long as second but more slender; flagellum slightly longer than peduncle, setæ few and delicate. Outer antennæ as long as body; first three joints of peduncle short, the second bearing on its outer edge a small articulated plate, tipped with a few stout setæ; fourth joint longer than the three basal joints together, a few setæ on each side; fifth slightly longer than the fourth, narrowed at the base. Segments of pereion with lateral margins indented and fringed with stout setæ. Body of about equal width throughout. Pleon nearly circular, much narrower than the last segment of pereion, sides fringed with setæ, margins entire; terminal pleopoda longer than the pleon; peduncle short, expanding distally; inner branch nearly twice as long as peduncle, rather broad, narrow at base, margins serrated and supplied with tufts of long fine setæ; outer branch similar but somewhat shorter.

Colour, very light yellow, with numerous black dots scattered over body. Length of body, about $\frac{1}{8}$ inch.

Hab. Lyttelton Harbour. A single specimen.

Genus **Stenetrium,** Haswell.

(Proc. Linn. Soc. N.S.W., vol. v., p. 478.)

As this genus is new to New Zealand, I transcribe the generic characters:—

"Body dorso-ventrally compressed; abdomen short, 1-jointed. Head with a short rostrum. Antennæ inserted on the anterior margin of the head; internal pair very short, external pair very long; both with well-developed flagella. Mandibles provided with a palp. Maxillipedes expanded, operculiform. First pair of thoracic limbs with a large prehensile manus; following pairs ambulatory. First pair of abdominal appendages broad, operculiform. Caudal appendages biramous, inserted on the border of the shield-like abdomen near the extremity."

Stenetrium fractum, sp. nov. Pl. xviii., fig. 3, *a* to *f*.

Inner antennæ reaching slightly beyond the end of third joint of outer antennæ; first joint of the peduncle large, as broad as long; second equal in length to the first, but more slender; third rather longer than the second, both bearing long setæ at their distal ends; flagellum about half as long again as the third joint of peduncle, consisting of about five joints, first joint the longest, being as long as the three following. Outer antennæ as long as the body; first joint of peduncle short, produced acutely at its extero-distal angle; second also short; third as long as the first and second together, produced acutely at its intero-distal angle, bearing on the outer edge an articulated appendage, which has the end rounded and supplied with a few long setæ; fourth and fifth joints very long, fifth slightly longer than the fourth, both with a few rather fine setæ; flagellum with the joints very short, almost linear at the proximal end, increasing gradually in length towards the distal end, the first few united into a single joint; fine setæ at intervals. First pair of gnathopoda with the meros and carpus subequal and supplied with numerous fine setæ; propodos large, expanding distally, both margins fringed with fine setæ, palm transverse, defined by a stout tooth, and armed with strong serrated setæ. Dactylos thick and strong, inner edge thickly fringed with strong denticulated setæ. Lateral margins of the abdomen irregularly serrate and with a few long setæ, ending posteriorly in a sharp point followed by a small concave indentation; portion between the bases of the last pleopoda slightly convex. Last pleopoda with the peduncle short, broadest at distal end, inner ramus larger than the outer, both narrowing distally and supplied with tufts of long fine setæ. Length of body about $\frac{1}{6}$ inch.

Hab. Lyttelton Harbour.

I have only a single specimen, the body of which is unfortunately much crushed. I am therefore unable to describe the shape of the body, and I cannot determine whether the head is produced into a rostrum or not. Judging from the analogy of the Australian species described by Mr. Haswell, the specimen is probably a female.

AMPHIPODA.

Genus **Cyamus**, Lamarck.

(Bate's and Westwood's "British Sessile-eyed Crustacea," vol. ii., p. 80.)

The following is the generic character as given by Bate and Westwood:—

"Head and first segment of the body fused into a pear-shaped mass. Eyes small and vertical. Segments of the pereion with the sides horizontally dilated; the legs attached to the postero-lateral margins; five pairs of strongly cheliform legs, wanting in the third and fourth segments, which are furnished with two pairs of branchial appendages, long and filiform. Pleon rudimental."

Cyamus ceti, Martens, l.c., p. 85.

Specific description:—"Body depressed, elliptical, segments gaping at the sides (male narrower?). Third and fourth segments of the body with one long branchia on each side; armed at the base with two short appendages; second pair of hands armed beneath with two obtuse teeth, between which is a lunate incision. Length nearly half an inch."

I received three specimens of this species from Professor Julius von Haast. In answer to my question as to the name of the whale on which they were found, he writes:—"The parasitic Crustacea were found on *Euphysetes potsii*, which, as it appears now from careful examination of further specimens, is identical with *Viagia breviceps* of the northern hemisphere." With regard to its occurrence in European seas, Bate and Westwood say,—"We have no precise details of the locality and notice of capture of this species, beyond the general statement of its being found on the whale in British seas."

Of the three specimens which Professor Haast kindly handed over to me, two appear to be males, one $\frac{17}{30}$ inch in length of body, the other $\frac{16}{30}$.

The third specimen is a female with a great many young in the pouch beneath the body. It is smaller than the others; body $\frac{12}{30}$ inch in length; it also has the body broader, and the segments do not gape so much at the sides.

I can find no important character by which these specimens can be distinguished from *Cyamus ceti*, as described and figured by Bate and Westwood. The penultimate joints of the last three pairs of legs are not quite so stout as shown in their figure, but this is evidently a character liable to variation according to age, etc. The young taken from the pouch of the female closely resemble those figured by Bate and Westwood on page 90.

Genus **Podocerus**, Leach.

(Cat. Amphip. Crust. Brit. Mus., p. 252.)

I have taken in Lyttelton Harbour several specimens of a species which I have no doubt is the same as *Wyvillea longimanus*, Haswell.

Mr. Haswell's genus will, I think, have to be abandoned, for it appears to have been founded on a misconception of portions of the animal in question. The two chief characters of his genus are the very large second gnathopoda and the structure of the terminal pleopoda. The large second gnathopoda are however only found in the male, the female has them quite small. This is frequently the case with *Podocerus*. It is rather strange that Mr. Haswell has not seen the female, for I have found it fully as abundantly as the male; possibly it was overlooked, for it is usually smaller than the male, and the small size of the second gnathopoda makes its appearance considerably different from that of the male.

The last pair of pleopoda are thus described by Mr. Haswell:—"posterior pleopoda with the outer ramus broad, lanceolate, armed on the borders with a few setæ, and terminating in two short strong setæ." The portion which he describes as the outer ramus is however really the peduncle, which is elongated, as frequently happens in species of *Podocerus*; and the "two short strong setæ" are really the two rami, which are quite small, as in several species of *Podocerus*. As described below one of them ends in three or more teeth; probably Mr. Haswell did not use a sufficiently high power to observe this. There can therefore, I think, be no doubt that the species really belongs to *Podocerus*; it comes very close to *P. cylindricus*, Say, but differs in points specified below sufficiently to warrant its being placed in a separate species for the present at any rate.

In the Transactions of the New Zealand Institute, vol. xi., p. 402, Mr. Kirk has referred three specimens found at Worser Bay to *Podocerus cylindricus*, Say; this identification was however subsequently questioned by Mr. Miers.*

* Ann. and Mag.N.H., series v., vol. v. (1880), p. 125.

Thinking that Mr. Kirk's specimens might possibly belong to the same species as those I had taken at Lyttelton I wrote to him about them, and in reply he very kindly sent me the three specimens for comparison. I have examined these as carefully as possible, and though they differ in some respects from my Lyttelton specimens and from Mr. Haswell's description—approaching somewhat more nearly to *P. cylindricus*, Say—still I am convinced that they belong to the same species, and that although it is very near to *P. cylindricus*, Say, it is advisable to consider it as distinct until a comparison of actual specimens of the two can be made.

Mr. Kirk's three specimens were all very much larger than mine; the largest was ·56 of an inch in length of body, while my largest specimen is only ·12 inch; Mr. Haswell gives the length of his specimens as "about ¼ inch." The inferior antennæ, as in my specimens, and as shown in Mr. Haswell's figure, are about half the length of the body, not more; in *P. cylindricus* they are "more than half the length of the body." The length of the upper antenna compared with that of the lower varied somewhat. In the first specimen it reached to about the middle of the flagellum, in the second only to the end of the peduncle, in the third specimen the lower antennæ were broken off. In my specimens also this character varies, usually, however, the upper antenna reaches to the end of peduncle of lower; with regard to his specimens Mr. Haswell says:—"Inferior antennæ stout, subpediform, with the peduncle equal in length to the superior pair."

All three specimens had the flagellum of lower antenna as long, or very nearly as long, as the last joint of peduncle; in my specimens and in Mr. Haswell's it is as long, and thus differs from *P. cylindricus* where it is "scarcely half the length of last joint of peduncle."

In Mr. Kirk's specimens, as in mine and Mr. Haswell's, the spines found on the end of the lower antenna are only somewhat curved, not hooked, as in *P. cylindricus*. The inner margin of the finger of the first gnathopod was, as in *P. cylindricus*, "serrated, almost pectinated;" this is, to a less degree, also the case with my specimens of the male, in the female it is somewhat roughened only. The Wellington and Lyttelton specimens and Mr. Haswell's agree in having the propodos of the second gnathopod longer than in *P. cylindricus*; it is longer than the cephalon and first *two* segments of pereion. The finger in all has the inner margin smooth, in *P. cylindricus* it is "coarsely serrated." The finger has an enlargement on the inner margin near its base, in Mr. Kirk's specimens the apex of this enlargement is rounded, in mine it is more pointed, and the enlargement is nearer the base of the finger; it is not mentioned by Mr. Haswell. My specimens agree with Mr. Haswell's in having "a blunt tooth at the proximal and another at the distal end of the concave border" of the propodos of the second gnathopod; both are wanting in *P. cylindricus*; in Mr. Kirk's specimens the one at the distal end is present, but the proximal end is simply rounded as in *P. cylindricus*. In Mr. Kirk's specimens, as in some of mine, the outer branch of the last pleopod terminates in more than three teeth, four, five, and even six are found. *P. cylindricus* is described as terminating "in three hooks." I do not, however, attach any importance to this, for it is evidently a character that varies with the size and age of the specimen.

The general description of this species will be as follows:—

Podocerus longimanus. Pl. xvii., fig. 2, *a* to *e*.

Podocerus cylindricus, Kirk. Trans. N.Z. Inst., vol. xi., p. 402. (Not Say.).
Wyvillea longimanus, Haswell. Proc. Linn. Soc. N.S.W., vol. iv., p. 336, pl. 22, fig. 7.

Male.—Eyes round. Superior antennæ about as long as the cephalon and first three segments of the pereion; first segment of the peduncle short, thick; second and third much slenderer, second slightly longer than the third; secondary appendage slender, 2-jointed, nearly one-fourth the length of flagellum; flagellum rather longer than last joint of peduncle. Inferior antenna about half the length of the body, stout, subpediform, peduncle equal in length to the superior antenna; flagellum as long as the last joint of peduncle, armed towards the end with stout curved spines. Both antennæ having the inferior margins fringed with long setæ.

First pair of gnathopoda small; carpus nearly as broad as propodos and about half as long; propodos ovoid with two stout setæ at the point where the dactylos impinges, palm with a few setæ; dactylos with concave margin more or less serrated, almost pectinated in large well-developed specimens. Second gnathopoda very large, carpus very short, propodos longer than the cephalon and first two segments of the pereion, cylindrical, sides parallel, curved, a blunt tooth at the distal end of concave margin, proximal end rounded or produced into blunt tooth; palm broad, more or less thickly fringed with fine setæ. Dactylos nearly as long as the propodos, concave border smooth, with an enlargement near the base. Posterior pleopoda with the peduncle elongated, narrowing slightly towards the end, upper margin with a few short setæ; rami very short, inner styliform, outer ending in from 3 to 6 upturned teeth. Telson conical, blunt.

Female.—Differs from the above in having the concave margin of finger of first gnathopod only slightly roughened, not serrated. Second gnathopod not larger than the first, similar to it in shape, but with the carpus shorter, and propodos rather more narrowed distally. Dactylos with basal half of concave margin roughened, extremity smooth.

Colour, pale yellow, more or less thickly covered with black dots and markings.

Length of largest specimen ·56 inch.

Hab. Lyttelton Harbour; Worser Bay, Wellington (*T. W. Kirk*); Port Jackson (*W. A. Haswell*).

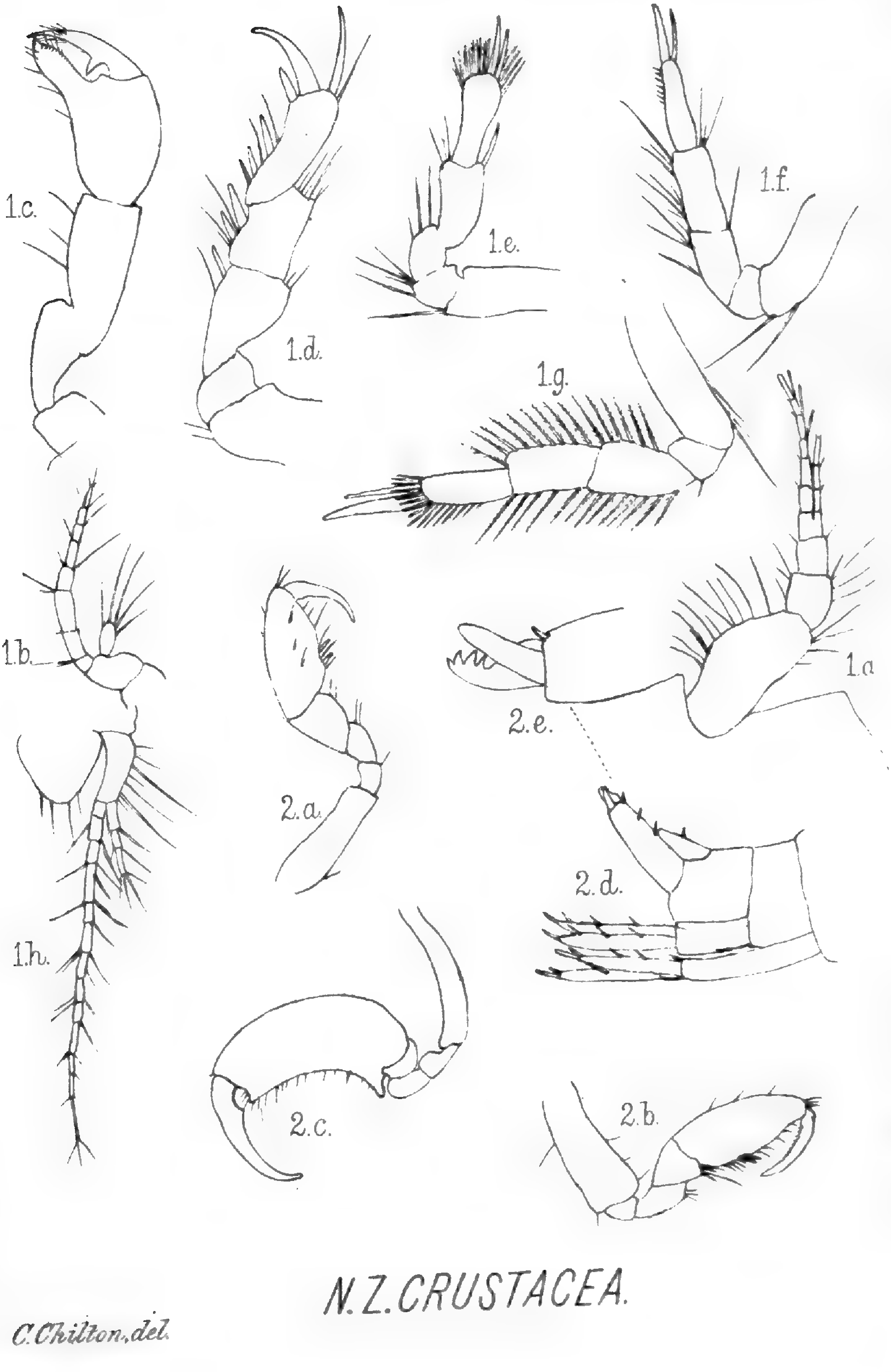
The differences between this species and *Podocerus cylindricus*, Say, have already been mentioned in the general comparison of specimens from the different localities; but for the sake of greater clearness I will recapitulate them.

Flagellum of lower antenna is as long, or very nearly as long, as the last joint of peduncle, the stout spines found on the end of it are not developed into hooks. The inner margin of dactylos of first gnathopod is only roughened in the female, and in the male the serrations, though sometimes as great as in *P. cylindricus*, vary. The second gnathopod is larger than in *P. cylindricus*, and is much larger in the male than in the female. In *P. cylindricus* the female differs from the male only in "the slightly smaller size of the propodos of second pair gnathopoda;" the second gnathopod of female also differs considerably in shape from that of the male. There is a blunt tooth at the distal end of the concave margin of propodos (of male); not found in *P. cylindricus*. The concave margin of the dactylos is smooth in the male, in female roughened on proximal part only.

These differences, though somewhat numerous, are none of them of very great importance; and, if *P. cylindricus* varies as much as *P. longimanus*, I dare say it would be difficult to find constant differences of any importance between the two species. In considering the question it must be remembered that there are other similar cases: *Paranthura costana, Philougria rosea, Lysianassa magellanica, Pinnotheres pisum*, etc.: this, however, is not the place to discuss the general question of the occurrence of the same species in both the northern and the southern seas.

Note.—My reasons for considering the two animals described above as male and female of the same species are these:—(1) They resemble one another so closely in everything but the gnathopoda that they must be considered as belonging to the same species; (2) the form with the small gnathopoda is certainly a female, for I have frequently seen specimens carrying eggs; (3) the form with the large gnathopoda I have never seen bearing eggs.

The large gnathopoda of the male are only possessed by fully-grown specimens. In very young animals they are more like those of the female, having the palm extending only about half way along the inferior edge of the propodos and defined by two or three stout setæ. In slightly older specimens the palm is longer, until it extends along the whole length of the margin of the propodos, and finally the setæ are cast off and the gnathopod assumes the form already described.



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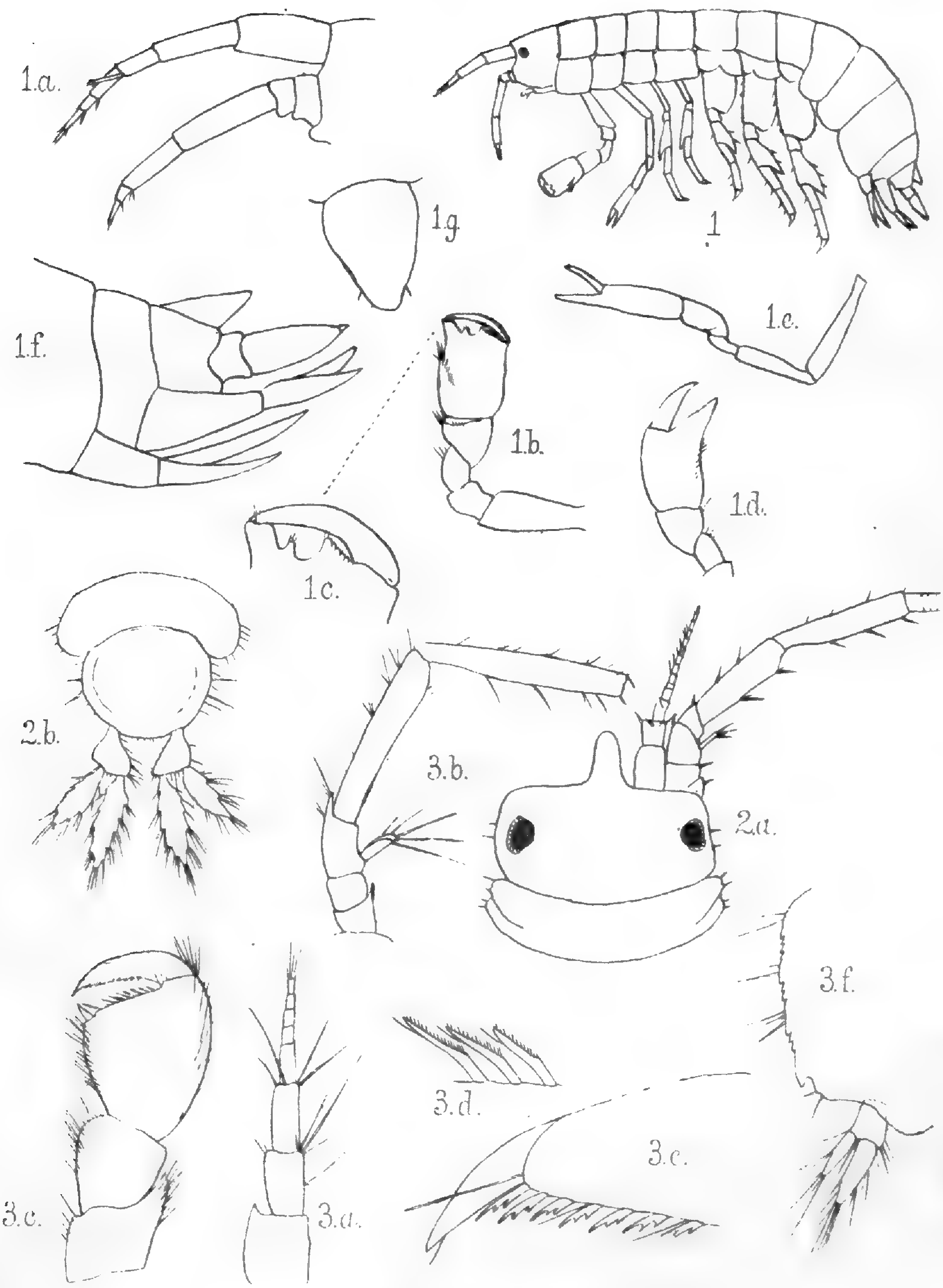

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Genus **Teraticum,** novum.

Body small. Eyes two. Coxæ of first four segments as deep as their respective segments. Antennæ with short flagella; upper antenna with a small secondary appendage. Mandible with an appendage. First gnathopod larger than the second, subchelate; second slender, chelate. Posterior pair of pleopoda uniramous. Telson single, undivided.

I have been obliged to make a new genus for the reception of the following species. In some respects it appears to resemble *Kroyera,* Spence Bate; but it is very distinct in others :—

Teraticum typicum, sp. nov. Pl. xviii., fig. 1, *a* to *g*.

Antennæ subequal, first joint of upper antenna equal in length to the second, but stouter; third about half as long as the second; flagellum of about four joints, only slightly longer than the second joint of peduncle; appendage very small and slender, of one long slender joint followed by a very small short one. Peduncle of lower antenna with the second last joint considerably longer than the last; flagellum not so long as last joint of peduncle. Peduncles of both antennæ quite free from setæ; flagella with a few short setæ. First gnathopod large, carpus triangular, nearly as broad at distal end as the propodos, propodos subquadrangular with an oblique row of short setæ near the centre of posterior margin, palm transverse, the part near the base of dactylos crenated, hollowed in centre with a small rounded projection in the centre of hollow; dactylos strong, curved. Second gnathopod slender, ischios long and slender, rather more than four times as long as broad; meros short; carpus about two-thirds as long as ischios, subtriangular; propodos considerably longer than carpus, subrectangular, produced into a fixed finger against which the dactylos impinges; dactylos as long as fixed finger, and about one-third the length of the whole propodos. First two pair of pereiopoda subequal, last three increasing in size posteriorly, basa broad, that of fifth pair having the posterior margin serrate, meros produced distally and posteriorly; setæ on pereiopoda few and short.

Fourth pleopod with rami longer than peduncle, inner slightly larger than the outer, falciform; fifth with peduncle longer than rami; sixth with peduncle short, the single ramus as broad as peduncle at first, but narrowing distally. All the last three pairs of pleopoda without setæ. Telson triangular, end rounded, margin entire, a very small seta on each side near the end.

Length about $\frac{1}{12}$ inch.

Hab. Lyttelton Harbour. Three specimens only.

Of the three specimens which I have seen, two had the first gnathopoda as described and as drawn (pl. xviii., fig. 1, *b* and *c*); the third had the propodos projecting distally, so that the gnathopod might almost be called chelate, palm even (fig. 1, *d*). In other respects the animal was exactly like the other two specimens; whether the difference in the gnathopoda indicates a difference of sex or not I cannot say.

Genus **Podocerus.**

Podocerus latipes, sp. nov. Pl. xix., fig. 2, *a* to *d*.

Male.—Second gnathopoda stout, propodos produced inferiorly into a stout broad process defining the palm, which is deeply indented; dactylos strong, inner edge serrated proximally, but with distal part smooth. Fourth pereiopoda with all the joints much expanded, all except the propodos being as broad as long. Other pereiopoda normal. In all other respects closely resembling *Podocerus frequens.*

Female.—Differs in having the second gnathopoda not produced as in male, palm concave and defined by two stout setæ.

Colour, yellowish-white. Length about $\frac{1}{8}$ inch.

Hab. Lyttelton Harbour.

This species may prove to be only a variety of *P. frequens.* I should without hesitation have considered it as such had it not differed in the second gnathopoda as well as in the fourth pereiopoda. The peculiar expansion of the fourth pereiopoda appears to be subject to considerable variation, probably it increases with the age of the animal. I am quite ignorant of the function of these expanded pereiopoda.

Genus **Paranænia,** novum.

Antennæ subequal, superior with a secondary appendage, both with multiarticulate flagella. Appendage of mandible of three broad setose joints, as in *Podocerus.* Maxillipedes with well developed plates on ischios and meros. Gnathopoda sub-chelate, first small in both sexes, second small in female, very large in male. Last pair of pleopoda biramous, rami styliform. Telson single, ending posteriorly in two conical projections.

I have made this genus to include three species found in Lyttelton Harbour—namely, *P. typica*, sp. nov., *P. longimanus*, sp. nov., and *P. dentifera = Moera dentifera*, Haswell. It appears to bear a close resemblance to *Nænia*, Spence Bate, but differs in possessing a secondary appendage on the upper antenna, and in the form of the telson.

In *P. typica* and *P. dentifera* the coxæ of the third segment of the pereion is large, and produced along the inferior edge of the coxæ of the second segment in the male, while the coxæ of the female are normal. *P. longimanus* has the coxæ normal both in the male and in the female.

In the description of *P. dentifera* I have embodied Mr. Haswell's description, but have added to and altered it where I thought necessary.

Paranænia typica, sp. nov. Pl. xix., fig. 1, *a* to *h*.

Male.—Eyes rather large, situated on a pointed projection between the bases of the antennæ. Upper antenna with basal joint of peduncle stout, and about two-thirds the length of the second, third joint as long as the first, flagellum about as long as the last two joints of the peduncle, secondary appendage nearly half as long as the primary. Peduncle of lower antenna very slightly longer than that of the upper, last two joints equal in length, flagellum half as long again as the last joint of peduncle. Both antennæ fringed below with numerous long hairs. First gnathopod with carpus as long as propodos and nearly as broad, inferior edge fringed with numerous setæ arranged in about four transverse rows, propodos ovate, both margins with numerous setæ, one or two stouter ones at the point where the end of dactylos impinges. Second gnathopoda with meros somewhat sharply pointed at its distal end; carpus very short, subtriangular; propodos very large, as long as the cephalon and first two segments of pereion, subrectangular, produced on inferior edge into a stout short spine defining the palm, distal portion of the palm nearly transverse, distinctly marked off from the inferior portion by a stout spine, followed by a narrow indentation, between which and the base of the dactylos is a low protuberance with the margin minutely crenate, palm thickly supplied with setæ variously arranged in tufts; dactylos curved, with a low protuberance on the inner margin near the distal end. Coxæ of first pereiopoda (third segment of pereion) deeper than the others, produced as far as the anterior end of the coxæ of the second gnathopoda and ending there in an acute point, margin ornamented with small circular markings at intervals. Fourth pair of pleopoda with the rami equal and as long as the peduncle, slender, with setæ on both sides and two or three longer ones at the ends, peduncle with three or four setæ on the upper margins and with a stout one at the end between the two rami. Fifth pleopoda with the outer ramus as long as the peduncle, inner one slightly longer, supplied with setæ as in the fourth pleopoda. Sixth pleopoda extending beyond the others, inner ramus slightly longer than the outer, both longer than the peduncle and broader (when viewed from above) than the rami of the two preceding pairs of pleopoda, setose on both margins, and ending acutely without setæ; peduncle stout, with a strong seta on the upper margin at the distal end. Telson single, ending in two conical projections each bearing a stout seta.

Female.—Differs from the above in having the coxæ normal; second gnathopoda only slightly larger than the first which it resembles in shape, but has the carpus shorter and subtriangular.

Length about ⅛ inch.

Hab. Lyttelton Harbour.

I have been much puzzled by this and the next two species, and it is only with considerable hesitation that I advance *Paranænia* as a new genus. In order to clear up their affinities as much as possible I give here a few more facts about them which I have not put into the description already given. The inferior antennæ arise considerably behind the anterior antennæ (fig. 1*a*). The mandibles are shown in fig. 1*b*, pl. xix. The appendage consists of three broad joints, the first short and without setæ, the second the longest and fringed on one side with long setæ, the third is narrow at the base, but widens greatly distally, and is rounded at the end and is fringed with about a dozen setæ, each about as long as the joint; on the side of the last joint is an oblique row of about four or five setæ. The maxillipedes present nothing very remarkable, both the basos and the ischios bear well-developed plates, that of the basos is rectangular and has only a few setæ at the end, that of the ischios is rounded at the end and has the inner margin supplied with numerous stout broad spines which increase in size distally, and with several setæ, the other joints except the meros are plentifully supplied with setæ, the dactylos ends in a long slender claw distinct from the basal portion.

The gnathopoda have been already described, the pereiopoda closely resemble those of *Podocerus* but are rather longer and more slender than is usual in that genus. The coxa of the third pereiopod consists of two lobes as in *Podocerus*, the anterior lobe is much larger and deeper than the posterior; in the next coxa the anterior lobe is much smaller in comparison with the posterior; the coxa of the fifth pereiopod is not divided into lobes —these facts *re* coxæ of third, fourth and fifth pereiopoda refer to the male only; I have not yet been able to verify them in the female; the bodies are so delicate and transparent that it is often very difficult to distinguish the coxæ. The telson has one or two very minute teeth at the end of each conical projection, these are very small but may be important as a help to deciding the proper place of this species among the other Amphipoda.

My reasons for considering the two animals I have described above as male and female of the same genus are the same as those already given in the case of *Podocerus longimanus*.

The length of the palm of the second gnathopod of the male increases with age, in well-developed specimens the tooth defining it is near the base of the propodos, but in younger specimens it is often much nearer the distal end.

***Paranænia dentifera*. Pl. xxi., fig. 2, *a* to *c*.**

Moera dentifera, Haswell, Proc. Linn. Soc. N.S.W., vol. iv., p. 332, pl. xx., fig. 4.

Superior antennæ equal in length to the cephalon and first four segments of the pereion; third segment of the peduncle two-thirds the length of the second; flagellum about as long as the last two segments of peduncle, of about ten articuli, each ornamented like the peduncle with several longish hairs. Inferior antennæ slightly longer than the superior; fourth and fifth segments of the peduncle sub-equal; flagellum half as long again as the last segment of peduncle, of about twelve articuli; both peduncle and flagellum armed with slender hairs, which are longer on the former. Anterior gnathopoda small, carpus slightly longer than propodos, thickly fringed on inferior edge with serrated setæ, propodos ovate, setose on both margins, one or two stout setæ at point of impingement of the end of dactylos. Posterior gnathopoda very large; meros with a pointed process at its infero-distal angle; carpus short, sub-triangular; propodos about six times the length of carpus, broad at the base, narrowing distally; palm two-thirds of the length of propodos, concave, with a low protuberance at its distal end, armed with fasciculi of long hairs, defined by a spine-like tooth; dactylos nearly as long as the propodos, with an enlargement on its inner edge near the base. Coxæ of third segment of pereion extending anteriorly slightly beyond the middle of coxa of second segment, antero-inferior angle rounded, margin ornamented with small circular or elliptical markings at intervals. Rami of posterior pleopoda scarcely larger than the others, lanceolate, armed with a few bristles. Telson small, ending in two conical projections, each bearing a stout seta. Colour, light olive with minute black dots. Length $\frac{1}{5}$ inch.

Hab. Lyttelton Harbour. Also "Clark Island, Port Jackson; amongst seaweed" (*Haswell*).

This species so closely resembles the preceding one in everything but the second gnathopoda that it must be placed in the same genus. It has a certain puzzling resemblance to *Moera*, to which it was referred by Mr. Haswell, but differs in the broad setose appendage of the mandible, and in the strong fringe of setæ on the antennæ (wherein it approaches *Podocerus* and other allied genera), and in the telson.

I do not know the female of this species as such. It probably would be almost indistinguishable from that of *Paranænia typica.*

The mandibles and maxillipedes are almost exactly the same as those figured for *Paranænia typica*. When dissecting out the mouth-parts I came across the part figured in pl. xxi., fig. 2 *a*. It evidently corresponds with and closely resembles the "epistoma" of *Cerapus abditus*, figured by Bate and Westwood in vol. i., p. 455, of the "British Sessile-eyed Crustacea." It consists of a transversely elliptical portion, with short setæ pointing inwards on the posterior margin, and, springing from this, a long pointed process.

Paranænia longimanus, sp. nov. Pl. xx., fig. 2, *a* to *c*.

Male.—First gnathopoda with the meros ending distally in an acute point; carpus considerably longer than the propodos; inferior margin thickly fringed with setæ, chiefly arranged in short transverse rows;

propodos not broader than the carpus, tufts of setæ on both sides; dactylos long, slightly curved, and acutely pointed, much longer than the palm, which is slightly concave and defined by a short stout seta. Second gnathopoda with the meros acutely produced at the distal end; carpus triangular, more than half as long as the propodos, and as wide distally as the propodos; propodos rectangular, with tufts of setæ arranged in three longitudinal rows, end transverse, dactylos short, curved, and impinging against the side of the joint, instead of along the margin. Fifth pleopoda with the rami unequal; sixth with the rami smaller than in the two preceding species, not reaching beyond the extremity of the fifth pleopoda, and only slightly longer than the peduncle; setæ on the upper margin and at the end.

Female.—Differs from the male in having the palm of the first gnathopod slightly convex, and not defined. Second gnathopod smaller than that of the male, resembling that of the female of *Paranænia typica*, but with the palm slightly concave. Length $\frac{1}{5}$ inch.

Hab. Lyttelton Harbour.

Genus **Corophium**, Latr.

(Cat. Amphip. Brit. Mus., p. 279.)

Corophium lendenfeldi, sp. nov. Pl. xx., fig. 1, *a* to *e*.

Eye rather large, elliptical, placed on a rounded lobe between the bases of the antennæ. Antennæ subequal; upper with basal joint large, stout, about twice as long as broad, second about two-thirds as long as the first and half as broad, third about two-thirds as long as the second and more slender, flagellum of about nine joints, nearly as long as the last two joints of the peduncle, a secondary appendage of two or three joints is also present; setæ very few and delicate. Inferior antennæ with the second joint short, produced inferiorly and anteriorly into a sharp point, third joint nearly as broad as long, fourth longer and stouter than the fifth; flagellum nearly as long as the last joint of peduncle, bearing below numerous stout setæ which become stouter and more curved towards the end. First gnathopod rather short and stout, ischios and meros short, the latter with a tuft of setæ towards distal end, carpus broader than the propodos and about two-thirds as long, thickly fringed with plumose setæ on inferior margin; propodos narrowing slightly distally, fringed on both sides with plumose setæ, dactylos long curved and acutely pointed, not impinging against the propodos. Second gnathopoda similar in form to the first, but longer and more slender, carpus considerably broader than the propodos and of the same length, bearing two longitudinal rows of sparsely plumose setæ which are as long as the joint itself; propodos narrow, tapering distally, fringed on both margins with long setæ, dactylos slender, not impinging against the propodos. Third, fourth, and fifth pereiopoda similar in form, increasing somewhat in size posteriorly, basa much expanded. Lower portions of the sides of the second and third segments of pleon supplied with numerous setæ. Pleopoda short, all reaching to about the same point. Fourth pair with peduncle stout, produced into a sharp point between the rami, upper margin with strong setæ, rami equal, with strong setæ on upper margins and at the extremities, fifth pair similar but with rami unequal, peduncle of sixth pair stout, outer ramus nearly as long as peduncle, with thick tuft of setæ about as long as the ramus at the end; inner ramus rudimentary with one or two small setæ, telson narrowing greatly towards the end, posterior margin sinuous, convex in centre, concave on each side, on the upper part of the telson towards the end is a rather long seta on each side, and between this and the postero-lateral angle are two sharp teeth pointing upwards. Colour greyish.

Length $\frac{1}{5}$ inch.

Hab. Lyttelton Harbour.

This species appears to differ from other species of the same genus in the presence of a secondary appendage to the upper antenna, and in having the first gnathopoda simple, not subchelate; the plumose character of the gnathopoda is however, I think, sufficient evidence of its near relationship.

I take pleasure in naming this species after Dr. R. von Lendenfeld, by means of whose scraper I obtained several specimens off one of the buoys in Lyttelton Harbour.

Genus **Panoplæa**, G. M. Thomson.

(Ann. and Mag. N.H., ser. v., vol. vi., p. 2.)

Panoplæa translucens, sp. nov. Pl. xxi., fig. 3, *a* to *c*.

Closely related to *Panoplæa debilis*, but larger and lighter in colour and differing in the following points. None of the segments produced posteriorly into spines. The two pairs of gnathopoda similar in shape and equal in size, much stouter than in *P. debilis*, basos with longish setæ on both sides, carpus nearly as long as propodos, propodos rectangular, slightly more than twice as long as broad, palm oblique extending about one-third along the inferior margin of the propodos, one stout seta on each side of the point where the dactylos impinges, numerous tufts of stout short setæ along inferior margin of propodos. Three last pairs of pleopoda very slender, fourth pair with peduncle considerably longer than the rami, concave above, upper margins with short stout setæ, outer ramus longer than the inner, both with setæ on the upper margin and at the end; fifth pair similar, but with outer ramus shorter than peduncle, and the inner one longer than the peduncle; sixth with peduncle stout, naked, rami equal, longer than peduncle, broad when seen from above, both margins with setæ. Telson slightly concave above, narrowing towards the end, near which are two very small setæ on each side. Colour, whitish, semi-transparent. Length $\frac{11}{30}$ inch.

Hab. Lyttelton Harbour. Three specimens taken in company with numerous specimens of *P. debilis.*

Genus **Bircenna**, novum.

Body broad, coxæ very shallow. Antennæ sub-equal, upper without a secondary appendage. Mandibles without an appendage. Maxillipedes with well-developed plates on both basos and ischios. Gnathopoda equal, not subchelate. Last segment of pleon and its appendages rudimentary. Telson simple, not divided.

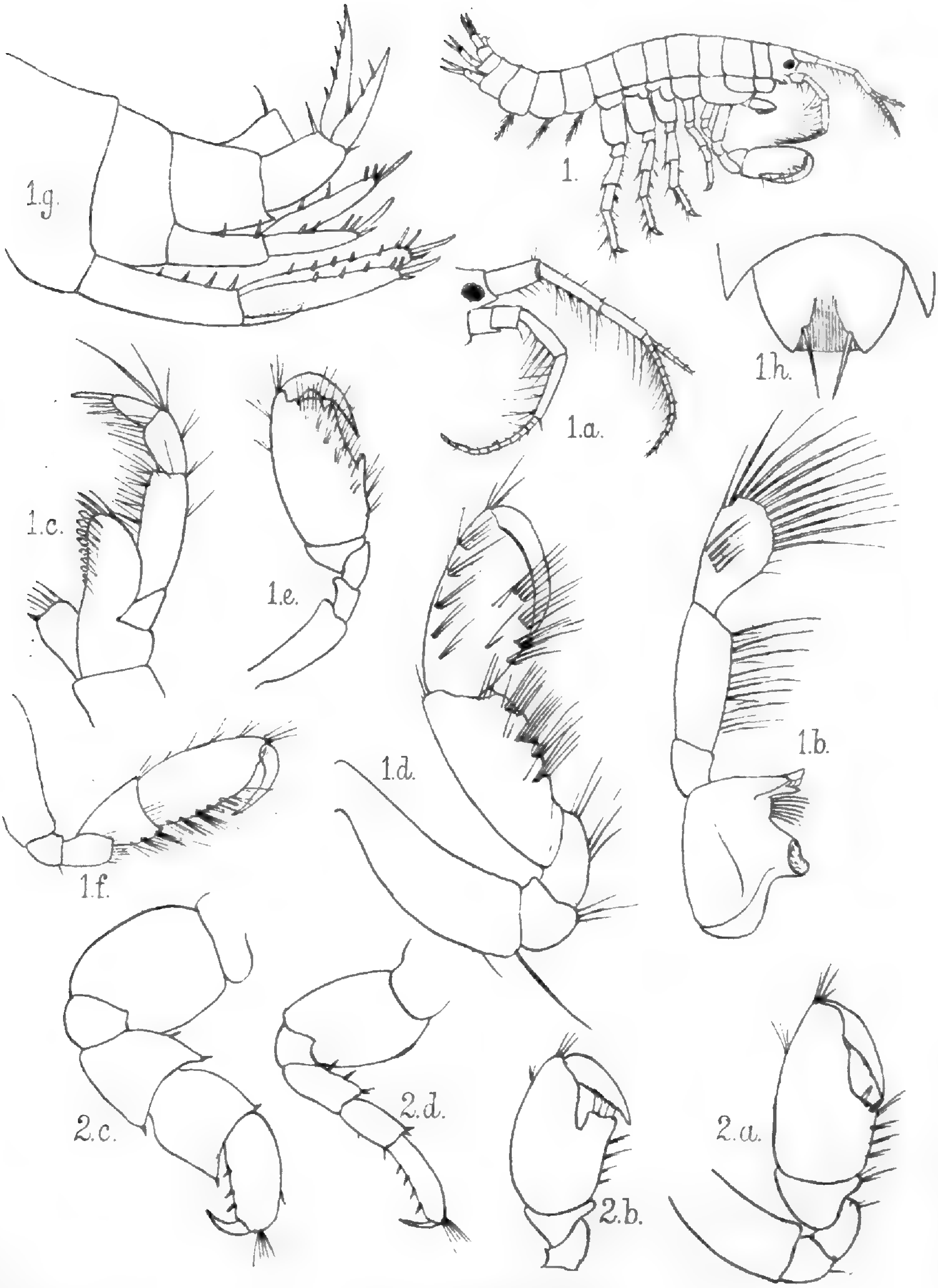
Bircenna fulvus, sp. nov. Pl. xxi., fig. 1, *a* to *e*.

Head broad, depressed in front, antennæ short, not longer than the head; both pairs of same length, slender. Peduncle of upper not distinguishable from the flagellum, first joint about as long as the second, but stouter, third shorter than the second, flagellum of about six joints, each bearing some simple auditory cilia. Peduncle of lower antennæ with four joints distinguishable, the last as long as the two preceding, flagellum of about four joints. Both antennæ with a few small setæ. Maxillipedes short, the plates on the basos and ischios reaching to the same point and nearly to the end of the maxillipede itself. Gnathopoda equal and similar, ischios as long as meros which is rounded at the end, carpus slightly longer than the meros, expanded slightly distally, propodos slightly longer than the carpus, of same width throughout, produced very slightly at its infero-distal angle, a few small setæ on inferior margin, dactylos stout, with a tooth on inner margin, not bent back upon the propodos.

First and second pereiopoda short, meros produced at antero-distal angle. Three last pairs of pereiopoda increasing in size posteriorly, basos of each much expanded. Coxæ very shallow, broader than deep. Fourth pleopoda with rami both longer than peduncle, acutely pointed, curving upwards, one nearly twice as long as the other, fifth similar but stouter, fifth segment of pleon very short, sixth apparently absent, sixth pleopoda represented by a single joint bifid at end, outer piece rounded, inner ending in a sharp point and bearing on inner margin four or five longish setæ. Telson short, triangular, with a seta on each side near the end. Length $\frac{1}{8}$ inch. Colour, yellow.

Hab. Lyttelton Harbour.

I do not know where to place this peculiar-looking little Amphipod; it may come near to *Phlias*, but the species of that genius given in the Catalogue of the Amphipoda in the British Museum are not described in sufficient detail to warrant one in forming any definite conclusion as to their relationship. I have only a very few specimens.



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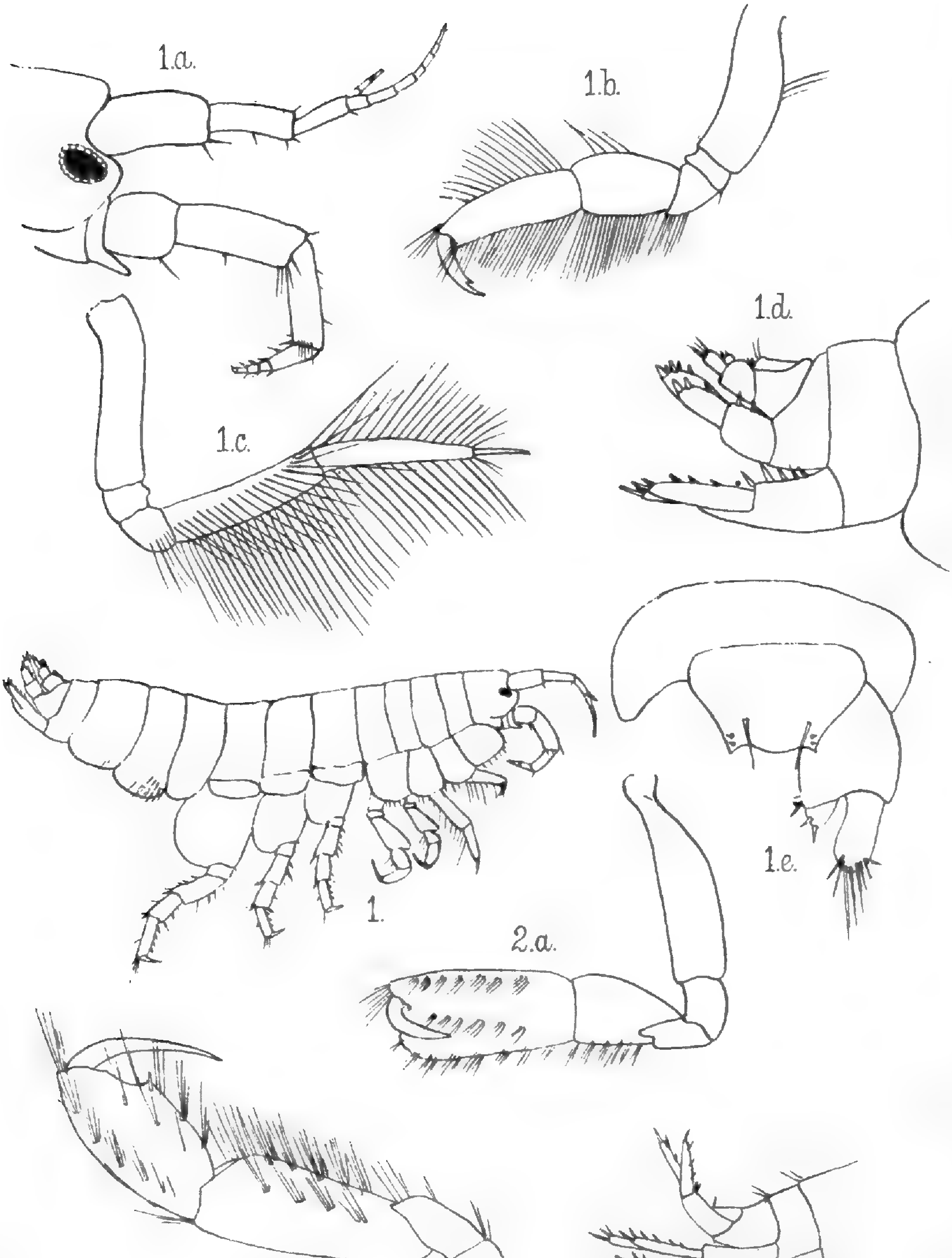

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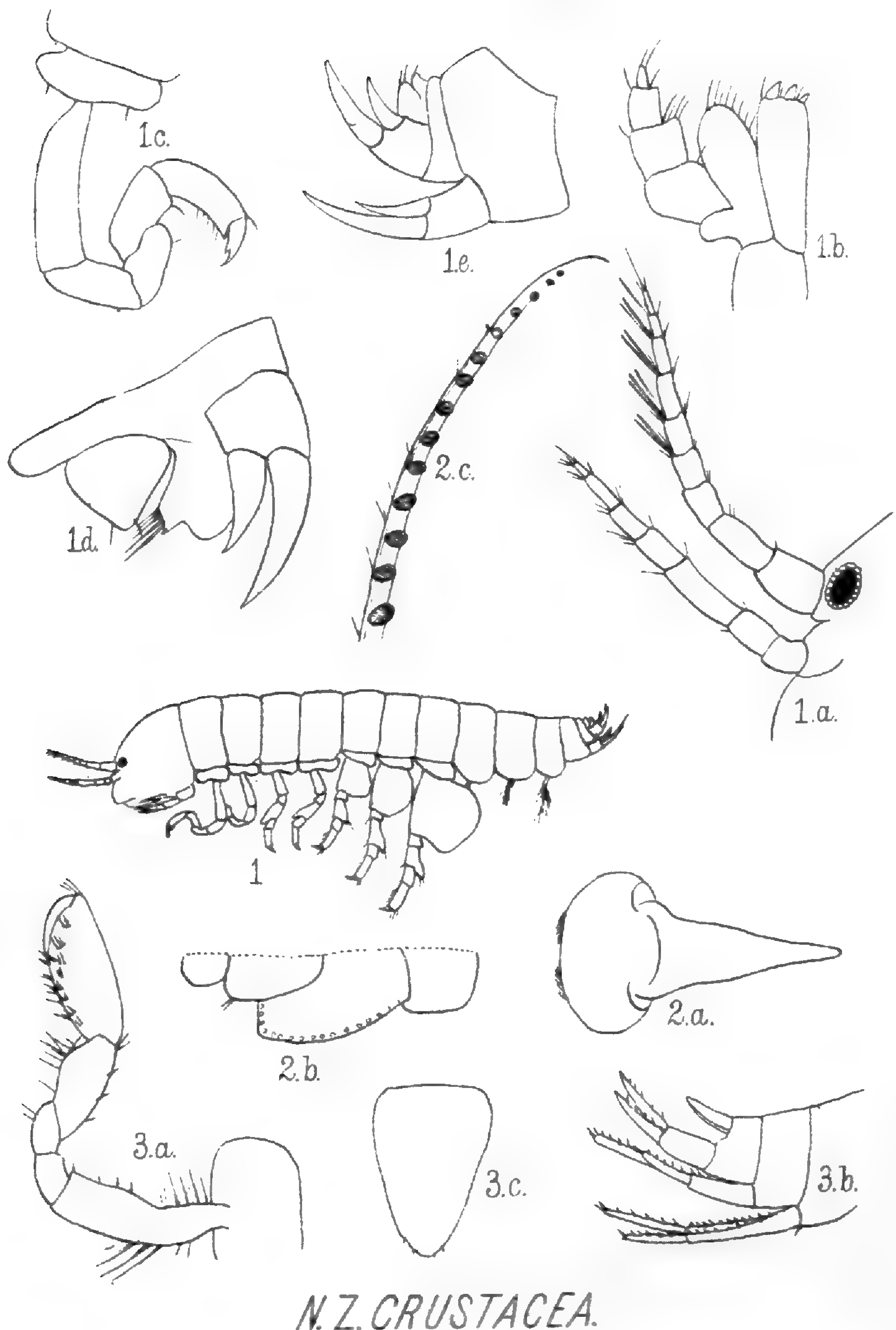

N. Z. CRUSTACEA.

C. Chilton.

EXPLANATION OF PLATES XVII.—XXI.

PLATE XVII.

Fig. 1. *Apseudes latus* (details). *a*, upper antenna × 70; *b*, lower antenna × 120; *c*, first thoracic leg × 70; *d*, second thoracic leg × 70; *e*, fifth thoracic leg × 70; *f*, sixth thoracic leg × 70; *g*, seventh thoracic leg × 70; *h*, end of pleon and last pleopod × 47.

Fig. 2. *Podocerus longimanus* (details from Lyttelton specimens). *a*, first gnathopod of female × 70; *b*, second gnathopod of female × 70; *c*, second gnathopod of male × 30; *d*, end of abdomen × 70; *e*, extremity of last pleopod × 244.

PLATE XVIII.

Fig. 1. *Teraticum typicum* × 30. *a*, antennæ × 120; *b*, first gnathopod × 56; *c*, palm of same × 120; *d*, another form of first gnathopod × 60; *e*, second gnathopod × 56; *f*, end of pleon × 120; *g*, telson × 120.

Fig. 2. *Janira longicauda* (details). *a*, head and antennæ × 24; *b*, last segment of thorax, abdomen, and last pair of pleopoda × 15.

Fig. 3. *Stenetrium fractum* (details). *a*, inner antenna × 60; *b*, outer antenna × 30; *c*, first gnathopod × 35; *d*, setæ from palm of same × 244; *e*, extremity of dactylos of same × 244; *f*, abdomen and last pleopod × 30.

PLATE XIX.

Fig. 1. *Paranænia typica* (male) × 15. *a*, antennæ × 24; *b*, mandible × 120; *c*, maxillipedes × 81; *d*, first gnathopod of male × 120; *e*, second gnathopod of male × 30; *f*, second gnathopod of female × 70; *g*, end of abdomen × 70; *h*, telson from above × 120.

Fig. 2. *Podocerus latipes* (details). *a*, second gnathopod of mature female × 70; *b*, second gnathopod of male × 38; *c*, fourth pereiopod × 38; *d*, fifth pereiopod (for comparison) × 38.

PLATE XX.

Fig. 1. *Corophium lendenfeldi* × 13. *a*, antennæ × 30; *b*, first gnathopod × 30; *c*, second gnathopod × 30; *d*, end of abdomen × 30; *e*, telson and last pleopod (from above) × 70.

Fig. 2. *Paranænia longimanus* (details). *a*, second gnathopod of male × 24; *b*, first gnathopod of male × 120: *c*, end of abdomen × 30.

PLATE XXI.

Fig. 1. *Bircenna fulva* × 20. *a*, antennæ × 70; *b*, maxillipede × 150; *c*, first gnathopod × 70; *d*, telson and last two pairs of pleopoda (from above, compressed) × 120; *e*, end of pleon (side view) × 70.

Fig. 2. *Paranænia dentifera* (details from a Lyttelton specimen). *a*, "epistoma" highly magnified; *b*, coxæ of first four segments of pereion × 30; *c*, margin of coxa of third segment of pereion × 120.

Fig. 3. *Panoplæa translucens* (details). *a*, first gnathopod × 30; *b*, end of pleon × 15; *c*, telson × 38.

Art. XV.—*On the Habits of Earth-Worms in New Zealand.*

By A. T. Urquhart.

[*Read before the Auckland Institute, 12th November*, 1883.]

The masterly way in which the habits of earth-worms have been treated by Mr. Darwin, in his valuable work on "Vegetable Mould," has not left much room for original research. However, as Professor Hutton informs me that little or nothing is known of the New Zealand earth-worms, a few observations may not be superfluous, especially as their habits differ to some extent from the European species. As these observations were not made with a view to publication, they may not in some instances have been carried out to the extent they deserved, but they may be accepted as fairly accurate. Having mainly followed Mr. Darwin in my experiments, it is unnecessary to give much more than the results.

The New Zealand species of *Lumbricus*, to which these few notes refer—namely, those which burrow into the ground and eject castings more or less on the surface,—are not well known, but they will probably not differ much in number from the Scandinavian species.

In a mild and humid country like this earth-worms work more or less the whole year round, especially in moist and shady situations. During the drier months they retire to a depth of 9–15 inches, a few occasionally as much as 40 inches, into the sub-soil, where they remain, apparently hybernating, either at the bottom of the burrows or coiled up one or more together in the terminal cells, until the rains set in. The dry weather we had in September caused many of them to retire temporarily into their chambers. The burrows run down generally a little obliquely, sometimes perpendicularly, occasionally they turn and run horizontally—in solid ground. Mr. Darwin says: "They are said to sometimes branch, but as far as I have seen this does not occur, except in recently dug ground and near the surface." I have met with instances in which the burrows branched in solid ground, but the branching has merely consisted of two short lateral passages at the termination of the burrow, leading into two distinctly separate chambers. The surface portion of the burrows appears to be generally lined with cement, half a mm. or more thick. This is accomplished by the worms ejecting little pellets of viscid humus on the sides of the walls, then spreading them by gliding up and down. When partially dry this cement not only strengthens the walls of the burrow, but affords a smooth surface to the worm's body, which is a necessary protection, as its movements are often rapid; the interior is kept moist with slime secreted by the worm. When the subsoil is favourable, the walls are occasionally merely smoothed off with light-coloured castings, no defined layer being perceptible. Many of the burrows, especially the deeper ones, end in a chamber, which is often lined in a similar manner with dark- or light-coloured castings; probably the castings are spread with the aid of its tail. It is not unusual for two separate burrows to terminate in the same chamber.

In Europe earth-worms line their chambers with other materials besides the usual viscid black earth. In reference to this instinct, Mr. Darwin says :—"The sole conjecture which I can form why worms line their winter quarters with little stones and seeds, is to prevent their closely coiled-up bodies from coming in contact with the surrounding cold soil." I have not been able to obtain any information regarding the habits of earth-worms in the colder portions of New Zealand, but as our northern worms do not line their chambers with other materials besides their viscid castings, it is probable his conjecture is correct; our worms are not subjected to the same severe and rapid changes of temperature as those in Europe, consequently do not need the extra protection.

Darwin was the first to point out that the mouths of the burrows were in addition often lined with leaves. This habit does not obtain in our worms, and would not be necessary, for, although they may be often observed lying close to the mouth of their burrows—probably for warmth—the short sharp frost to which they are occasionally subjected does not influence the temperature of the ground to any depth; and the warm sunny day, which almost invariably follows a frosty night, soon raises the temperature of the soil sufficiently to allow of their return to the surface.

It is not improbable that it is our equable climate that renders it unnecessary for earth-worms to plug the mouths of their burrows to the same extent as in Europe. As far as my experience serves, they seem content with occasionally loosely drawing in petioles, portions of leaves, and blades of grass—some are evidently merely meant for food. Mr. Darwin believes that "the use of the plugs is to check the free ingress of the lowest stratum of air, when chilled by radiation at night, from the surrounding ground and herbage." Judging from the loose way his worms plugged the mouths of their burrows when kept in pots in a warm room, and the actions of our own worms in their natural haunts, there is little doubt that the exclusion of cold air is the chief cause of the burrows being plugged. At the season of the year when earth-worms in New Zealand are occasionally subjected to chilled air, the mouths of their burrows are generally protected by their castings.

The habit of closing the mouth of the burrow by heaping-up little pellets of earth and stones, when no castings are being ejected, obtains in the New Zealand worms, and the object is probably to conceal the mouth from their enemies, the greatest of which are, in the vicinity of Auckland, the mackerel gull (*Larus scopulinus*) and the curlew (*Limosa baueri*). But if Hoffmeister's statement is correct—which is very probable—that the Scolopendra are their bitterest enemies, this instinct must subserve some other purpose as well, as they almost invariably open their burrows at night. As earth-worms habitually lie close to the mouths of their burrows, the stopping may not only tend to give them a sense of safety, but exclude the light.

In loose ground worms rarely void their castings on the surface, using old burrows and cavities. Henson's statement that worms habitually use old burrows—in solid ground—for this purpose, is doubted by Darwin; if he meant that the filling-up of the burrows was entirely due to this cause, he is probably in error, for it is evident, in some soils, that heavy rain causes the walls of the burrows to flow and slide inwards; portions of the sub-soil then collapse, forming alternate streaks of black and light soil. (Mr. Darwin points out that when the soil is not viscous enough to flow inwards, the same end is attained by another agency.) At the same time my own observations lead me to agree with Henson as to the habitual use of the old burrows for the purpose of voiding castings in. During the winter months and wet weather fresh castings retaining their convolutions are to be met with at various depths in the solid ground, and in positions which preclude the idea of their having been washed down; and it appears to me that the amount of black humus used in lining the walls, is inadequate to fill up the burrows and chambers to the extent they often are. Again, fresh castings are to be found in the holes left by decayed roots, and sun-cracks. These holes are generally filled up with fine black earth, most of which is apparently worm-castings. Owing to the nature of the sub-soil, in which my researches have been chiefly carried out, portions of the burrows, and especially the chambers, often retain their form for many months without being filled up with humus. This of course is favourable for observations.

Want of leisure time has prevented my systematically collecting worm-castings off a measured piece of ground, so as to form an estimate of the amount of earth annually thrown out on an acre of land, fairly stocked with worms; but Darwin who has carefully gone into the matter says:—"In many parts of England a weight of more than ten tons of dry earth annually passes through their bodies and is brought to the surface on each acre of land." Compared with the European, worm-castings in New Zealand are light, the larger castings, fresh and well-dried, weigh about ·3 of an ounce; the smaller and most numerous weighing only ·07. Although the worm-castings are light, the amount of earth ejected in favourable ground in the course of years is considerable, apparently equal to some parts of Britain. This is to be attributed to there being—the conditions being equal—a far greater number of worms in an acre of ground in this country.

Darwin says that the number of worms in old pastures is unknown, but assumes that there may be 26,886 per acre. According to Henson there are 53,767 worms in an acre of garden ground, and about half that number in cornfields; possibly this estimate may be found too low for many parts of Britain. My own estimate of the number of earth-worms (348,480) living in an acre of pasture land, in the vicinity of Auckland—which appeared in an early number of the "N.Z. Journal of Science"—although a low average was given, was so high compared with Henson's, that I went through the work of counting the worms over again this winter; the plan adopted was to take a straight course across several parts of a field, taking out a square foot of soil every twenty paces. The worms have evidently increased since my former observations, so that the results were still more striking. My accurate friend Mr. T. F. Cheeseman, F.L.S., thinking it possible that I might be unconsciously influenced in selecting a spot for examination, suggested the work should be systematically done with the aid of a tape. Accordingly fresh lines were run between some of the former ones, in a portion of a field 17 years in grass. A piece of fair average ground was laid out in squares of 120 feet, a square foot of soil was then taken out at each corner. As the accuracy of my former observations was being put to the test, and at the time (September) most of the worms were in the turf, instead of carrying out my research merely with the aid of a spade, I picked every particle of turf with my fingers; over three hours work gave the following results:—

Number of Earth-worms in each square foot of soil.

6. 3. 10. 27. 56. 19. 5. 10. 0. 12. 12. 20. 25. 17. 9. 11. 36. 17.
12. 3. 20. 14. 48. 22. 24. 27. 40. 14. 12. 10. 15. 18. 18. 26. 13. 19.

Worms hanging to the side-walls were not counted, and the blank hole—only the second in that field—was surrounded with worms.

These figures give an average of 18 worms per square foot, or 784,080 per acre. Although this average is rather striking compared with Henson's, the difference in the actual weight of the worms is not so marked. Von Henson's standard weight of a single worm is 3 grams, accordingly the 53,767 worms would weigh 356 pounds. The greater proportion of the worms met with in our fields are the common *L. campestris*; the larger forms of this species weigh 12 grains—50 averaged 6½ grains; allowing for the few intermixed lighter species, the average of the entire number of worms may be taken at 6 grains, this would give a weight of 612 lbs. 9 ozs. As my former tests in other parts of the farm, where the conditions were equally favourable, did not differ from those taken in this field at the same time, it may be fairly assumed that if fresh tests had been made with equal care, the results would have been as great. As far as my experience goes, worms seem to be, as a rule, less numerous in worked ground. This does not appear to be the opinion of other observers. In an orchard, originally grass land and favourable for worms, but kept ploughed the last four years, the average was 12 worms per square foot. Several acres in another orchard, light, deep, dry soil, formerly in grass, only averaged 2¼. The number of worms found in garden ground varies considerably; in the drier portions they are often scarce, but in the moist and shady places they are numerous, especially large worms (*L. uliginosus*) weighing 27–30 grains.

From this it appears that worms abound in most cultivated lands in New Zealand; earth-worms are also numerous in moist open spaces beneath high manuka (*Leptospermum*); they affect the edges of swamps in considerable numbers, spreading backwards year by year up the ridges, when the conditions are favourable, largely contributing to form the good soil often found there. Under furze, dense manuka and *Pomaderris*, if the soil is dry, worms are scarce. In fern lands they are rare, except in the damp open spaces, or half-dry swamps covered with dwarf manuka, from whence they spread upon the land being cultivated. I have not had the opportunity of observing native grass lands during the wet season, but from the work done they seem to be fairly represented in some places.

The length of time that land of this class—*i.e.*, fern land—takes to become stocked with worms when laid down in pasture, of course depends upon the extent, moisture, and surroundings. Fields of no great area in the vicinity of older cultivations and swamps appear to get well stocked in about fifteen years. In a portion of a 100-acre field laid down in pasture ten years ago the average of the tests was equal to those given above, but the conditions were extremely favourable. In the remoter portion sown two years later, although increasing, worms are still scarce.

It is unnecessary to enter to any extent into the amount and value of the work done by earth-worms, as the subject has been ably discussed by our illustrious master; but it may be of interest to describe a section I observed when forming an orchard in October, 1875. The vegetation burnt off the newly-cleared land—a raised beach, Manukau Harbour—consisted mostly of manuka and flax, apparently the growth of about thirty years. The trench opened in digging the ground exposed a section consisting of about 4½ inches of black mould, and a horizontal layer, nearly 1 inch thick, of wood-ashes, burnt clay, small stones, and fragments of pumice, lying on a brownish-green arenaceous clay. The black mould was perfectly free from stones, etc., and when a spit was taken up it readily split off from the coarser layer, which adhered to the sub-soil. A long strip was left intact, and is being preserved for future observations. Similar layers, which consist chiefly of the charred wood, are to be met with in patches, at the same average depth, over several acres of ground.

The section at the present time shows an even depth of 5¾ to 6 inches of black mould. The charred wood, especially where holes have been dug, has decayed considerably the last twelve months, reducing the average width to nearly ½ an inch, but the layer remains horizontal and parallel to the surface, showing that the worms are evenly distributed, and doing an equal amount of work. The regular way in which the embedded objects sink, independently of their specific gravity, as Mr. Darwin points out, "are the striking features of the case." Pieces of burnt clay 1¾ inches in length, weighing over an ounce, small pebbles of jasper rock, fragments of pumice, and the charred wood, have all sunk to the same depth, within the same time, retaining an even thickness that would hardly be expected; the regular depth of the mould, of course, is partially caused by the levelling action of rain.

From this it appears that our earth-worms work with the same regularity as the British species, and eject—their greater number considered—an equal amount of earth. An addition of about 1¼ inches to the superficial surface in eight years, compares favourably with the average cases recorded by Mr. Darwin. Of course the more rapid accumulation of mould the last few years, is owing to the great increase of worms—consequently of worm-castings; although in uncleared lands of this description the annual contribution of decayed vegetable matter is in excess of grass-land, its effect in increasing the thickness of the mould is not equal to the work of the greater number of worms. As the flat is cut off from the higher land by a drain, there is no sedimentary deposit; and the dust blown from desiccated ground is so trifling, that the present increase of mould may be entirely attributed to the work of worms.

It is probable that when a sufficient depth of vegetable—or perhaps more correctly animal—mould is formed for the worms to live in, that the annual increase of thickness decreases; for, as a rule, under those circumstances worms do not penetrate the subsoil to any depth, except when driven down by dry weather. However, in the present case they burrow into the subsoil to a greater depth than worms generally do in the winter months; as it is of a loose nature it probably contains nutritious matter.

It may be worth recording that in May, 1876, I placed an angular block of trachyte—measuring 9 inches in length, 8 in breadth, and 5¾ in thickness—on the same ground; in about four years it had sunk nearly 1 inch; the next two years, it was in the possession of a colony of ants, who no doubt contributed to undermine it; upon their deserting the stone, the work was again resumed by worms. When measured in August, 1882, the most protuberant point was down 1 inch; in October, 1883, the point was exactly 2 inches below the level of the surface. One end of the ground beneath the stone is considerably excavated; when these burrows collapse, the stone will again sink. In September, 1882, a small stone with a flat base, rounded at the edges, 6½ inches long, 3½ broad, and 3⅜ in thickness, was laid on the turf; on the 15th of last October it had sunk 1 inch, and became sufficiently embedded to require some force to raise it; the same day four fresh stones were placed on the ground, and layers of broken brick and wood-ashes were spread for future observations.

Darwin states that some writers doubt if worms ever swallow earth solely for the purpose of excavating their burrows. Worms effect an entrance into loose soil by inserting the attenuated anterior extremity of their body into any crevice or hole, or forcing aside the particles by alternately withdrawing and driving in the stretched-out body, the pharynx is then pushed forward, and the swollen extremity presses the earth aside; not only would it be impossible—although possessing considerable muscular power—for worms to penetrate into our hard sub-soils by these means, but on three occasions when large worms (*L. uliginosus*) were placed in a pot of very compact earth, they only effected an entrance after about 40, 29, and 32 hours' work, ejecting a considerable amount of castings; again, three small worms were placed in a pot of firm moist siliceous sand, they were only able—in about 30 hours—to bury themselves by swallowing and ejecting the sand; pure sand castings were thrown out for some time afterwards; as the sand had been well washed there could have been no nutriment in it.* Mr. Darwin has shown in a similar experiment, with fine ferruginous sand, that under the circumstances worms are compelled to swallow a large amount of matter unfit for food.

Claparède doubts whether worms swallow any quantity of earth merely for the sake of obtaining nutriment from it; my own observations lead me to agree with Darwin, who has clearly shown that it is not improbable.

Mr. Darwin remarks ("V.M." p. 14) that after heavy rain, succeeding dry weather, an astonishing number of dead worms may sometimes be seen lying on the ground; he further says:—"I believe that they were already sick, and that their deaths were merely hastened by the ground being flooded." As I did not clearly understand whether he meant that when worms, under those circumstances, came to the surface and wandered about during the day, they were necessarily sick, I thought it right to experimentally test whether it was the case, although I had no doubt, as far as our worms were concerned, that a large proportion were healthy.

* These worms have been fed, and are forming a layer of humus on the surface.

On the 10th of last July, 3 worms were picked up at half-past 11 a.m., and placed in a pot of earth; 3 more were treated in the same way on the 18th, but they escaped ten days afterwards. On the 28th there was heavy rain up to nearly 9 a.m., when it cleared there were upwards of 450 large worms crawling about a favourite portion of the garden walk, within a length of 59 yards, all apparently healthy: at 10 the sun shone out; by twenty minutes to 11, most of them had entered some of the old burrows in the turf or beds; a few wandered about, in shady spots, until evening, and, with the exception of a few accidentally crushed, none were seen dead. Six of these worms were placed in a pot of mould, and 6 in a jar of earth and water; the latter were all dead in 58 hours. August 15th, at 9 a.m., 6 worms were placed in two pots, and 6 in a jar of earth and water; in 27 hours 4 of the latter were dead, the remaining 2 in 40 hours. After 30 hours of unusually cold rain, on the morning of the 24th August, there were about 30 worms on the same portion of the walk, some were dead, and many appeared weak and dying. This was an unusual number, although a good many dead worms may occasionally be seen in open drains, apparently drowned; probably the weak worms fall in, and are unable to escape.

What the cause may be that either induces or compels worms to leave their burrows and wander about, under these circumstances, appears not to have been determined; but, as worms do not habitually come to the surface in any great number—especially in the day time—during continued wet weather, but close after rain succeeding dry weather, it is not improbable that they take advantage of the moisture to seek fresh burrows and food; the weak and sickly worms succumbing on the road, especially if it be cold. But whatever the cause may be, it is evident as far as New Zealand earth-worms are concerned, that they are not all sick, for on November 1st when the captured worms were let loose—some of them having been incarcerated for 115 days—they glided away apparently in perfect health.

In regard to worms leaving their burrows at night, Darwin remarks that:—"It has often been said that under ordinary circumstances healthy worms never, or very rarely, completely leave their burrows; but this is an error, as White of Selbourne long ago knew." Like the British worms, our own generally wander about at night after rain, all the year round; probably they leave their burrows in search of animal food; for I have on several occasions seen them, as late as half-past seven, on warm moist winter mornings, gliding with the greatest ease about the trunks of the *Eucalyptus*, evidently searching for animal matter. I have never observed higher than about 12 feet, but as they are occasionally found in gutters on the roofs of houses, probably they ascend to a greater height.

I omitted to test the length of time that earth-worms would live immersed in water during the summer, but Morren found that they endured immersion for 15 or 20 days; like our own, they soon died in winter. Although worms often frequent very wet places, it is probable—except perhaps in the summer months—that those we are concerned with, do not remain completely submerged for any length of time. Some examples of *L. campestris*, that were put into a jar of earth and water, in October, and kept in a room, died in 18½–20 hours; this species appears least able to live for any length of time under water, they desert their burrows when flooded by temporary ponds during the winter months.

Our worms act with the same judgment as the European species, when they drag any object into their burrows; but the amount drawn in, both by worms in confinement and out in the open, appears to be less. The sense of taste is well developed, a preference being shown for special kinds of food; half-decayed onion and cherry leaves being especially relished. The secreted fluid has the usual effect of turning fresh, or half-fresh, leaves a dark brown colour; leaves placed on the surface in pots become in time almost entirely stript of the epidermis and parenchyma, the veins appear not to be eaten, as the skeleton remains entire.

Up to the present time my own experiments have not satisfactorily proved that worms possess a sense of smell; but it seems evident that they are not without it. The effect of light as a rule is not immediate, although in some instances a sudden illumination caused worms to retire rapidly into their burrows; if feeding, a light was either not regarded, or, if they retired, they sometimes soon returned to the surface and continued nibbling at the leaves, taking no further notice of it.

Worms evidently do not possess the sense of hearing and, beyond being affected by light, have no power of vision; the absence of these two senses is compensated for by extreme sensitiveness to currents of air and vibration in any solid matter; which, no doubt, as a rule is advantageous to them.

If, especially, moist loose ground is trodden on sufficiently to cause a slight succussion, it often has the effect of driving out the worms; once on the surface they appear to seek the first opportunity of again retiring below. I would not have alluded to this habit had it not been generally entirely attributed to an instinctive effort of the worms to escape from their enemy the mole; and that some writers, even recently, have drawn erroneous conclusions from the supposed fact. As birds are the chief enemies of worms in this country, and when they are lying near, or on the surface, vibration has the reverse effect of driving them below, it is not improbable that their actions, in this case, are not caused by any definite purpose, but the result of extreme timidity.

In examples of *Lumbricus uliginosus* dissected in the month of March, the calciferous glands were well developed. According to Morren these glands disappear during the winter; and Mr. Darwin has also observed their partial or entire disappearance at the same season. Whether these glands ever shrink sufficiently in New Zealand to be indistinguishable, I cannot say, but in specimens of *L. uliginosus* and *campestris* examined in July–August, although considerably shrunken and empty, the glands were quite perceptible, with the exception of one example of *L. campestris*, in which a lens was required for their satisfactory determination. They commence to swell again during the spring months.

From Charles Darwin's admirable researches it seems probable that such lowly organized forms as earth-worms are not devoid of intelligence; they appear to have a certain amount of social feeling, and their passions are strong: the diversity of their actions when exposed to light or vibration, implies the faculty of attention; from their highly developed sense of touch, they appear to gain some notion of the form of an object; and I hope to show, in a future paper, to what extent they possess the sense of direction.

ART. XVI.—*Effect of Cold on Fishes.* By NEIL HEATH.

[*Read before the Auckland Institute, 2nd July,* 1883.]

IT is asserted by many people that, though shallow rivers and fish-ponds have been occasionally converted into solid ice in countries where the winters are protracted and severe, all the imprisoned fish have not been destroyed, but that, when the ice had completely thawed, many of them have been found to be in possession of their usual health. Imprisonment in their ice-bound home had thus done them no harm. Dead to all appearance they might have been, but they were only asleep—hybernating, and, like many animals that pass the long winters in a state of lethargy, they would, when freed from life-suspending causes, recover their usual animation.

It is not an easy matter to ascertain that, in such rivers and ponds, the whole of the water is unquestionably frozen, and, obviously, the acceptance of the truth of such an assertion must be held over until we can prove to demonstration that the waters *were completely* frozen, and that the fish, which are said to have come again to life, had *actually* been imprisoned in the solid ice.

It struck me that as the "Mataura," with her freezing chamber, was lying at the wharf, an effort might be made to procure a few facts that would help us to arrive at a satisfactory conclusion as to the truth or otherwise of the assertion. The "Mataura" lay here freezing her cargo of sheep for the London market, and why should she not, if intense and continuous cold only suspended the life of the fish, bear away to old England slabs of ice holding in their rigid embrace numerous specimens of fish hitherto unknown in that land, which only required to be thawed in its rivers that there they might live and thrive! Why put ourselves to the great trouble, anxiety and expense, of bringing out to our New Zealand home *ova* that have hitherto proved to be dainty morsels for the discriminating natives of our waters! Could life be suspended, then fish of all kinds, and from all countries, and *arrived at a vigorous maturity*, could, when allowed to recover from their prolonged sleep, do successful battle with eels and other foes in asserting their rightful claim to a fair share of all the good things in our rivers. It would be good for us, if experience could demonstrate that such a procedure must necessarily prove successful if conducted with ordinary care. Our fish markets, that are at present distinguished by their absence, would then become realities and sources of comfortable incomes for energetic and enterprising men, and the gentle disciples of Izaak Walton would find abundant employment for their rods and tackle that are at present laid regretfully aside.

It is my duty to place before you a very brief statement of the steps that have been taken to prove, or to disprove, that fishes can return to life and energy after imprisonment in ice.

Captain Greenstreet, of the Mataura, and his enthusiastic chief officer, cordially helped me to make the best use I could of the freezing chamber in their vessel, and in it were placed two pannikins, the one containing a salt-water fish in salt water, the other a goldfish in fresh. At the same time (10 a.m.) two other pannikins were placed in the "*shoot*," the coldest part of the freezing apparatus, the one containing a salt-water fish, and the other not a gold- but a silverfish. The water in these vessels was at the ordinary temperature. The cold in the shoot being many degrees below zero. F., it did not take long to convert the water into ice, and at the end of an hour and a half, I was satisfied that all the water—the salt and the fresh—had become solid, and that the two fishes were as hard and firm as the sheep that were hanging in the freezing chamber. Both pannikins were then removed and placed in two tubs filled with water at the ordinary temperature—the one containing salt water for the salt-water fish, the other fresh for the silver one. In a short time the heat of the water in the tubs found its way to the surface of the ice in contact with the interior of the pannikins, and the blocks becoming in consequence reduced in bulk the two parted, the former finding its way to the bottom, the latter remaining at the surface. On examining these blocks of ice it was observed that both fishes must have retired from the surface of the water towards the bottom during the process of congelation, and that about half an inch of the lower part of the silver fish had actually rested on the bottom of the vessel, and must therefore have been outside the ice. The other fish was entirely surrounded. The appearance of each was identical, they both lay on their side, the head was higher than the tail, the distended gills were filled with ice, and the iris of the eyes had neither dilated nor contracted but the aqueous humour was apparently frozen. The rays of light no longer penetrated to the retinæ, and the eyes presented the appearance of balls of opaque ice. It was an anxious time to those gentlemen who joined me in watching the interesting prisoners as they came out from their icy shroud. The silver fish was the first to be free, and it was observed that at the moment when the fin near the gill was freed from all restraint the little organ commenced to move gently, *very gently*, so much so that it was impossible to say whether the movement motion was due to the parting of the ice, or to the action of the muscles of the animal. A few moments afterwards, however, there was no mistake about the matter, the *fish was alive.* The tail awoke to its usual activity, and, as soon as the ice had disappeared from the gills, they began to open and close, and the little fish moved about in the water languidly, dreamily, and to all appearance groping its way. Up to this time the aqueous humour of the eyes had not thawed, all was darkness to the fish, which seemed to be literally *feeling* its way, but soon the ice was dissolved, light entered, and the silverfish in a very short time was swimming as easily and nimbly as it now does in a glass globe in my house. Meantime, the salt-water fish was being steadily detached from the encircling ice, but the most watchful attention failed to notice any signs of returning life. When entirely free it sank to the bottom —dead. Perhaps the sudden contraction of the water at freezing point following so rapidly upon the expansion had in some way injured the fish, obviously the air-bladder had burst, for all buoyancy had departed. I cannot answer the question, "Why did the animal, which had been taken from the sunny waters of the Pacific but a few weeks previously survive an ordeal that proved fatal to one fresh from the cooler waters of the Waitemata?" A more extended and more efficient series of experiments may yet prove that, after all, the fish, which is usually classed among the cold-blooded animals, *may* survive imprisonment in ice. It has been suggested that even the slight injury caused by the fishing hook to the salt-water fish may have contributed to its death, but hypothesis is of small value in a case of this kind, unless it leads us to absolutely indisputable facts.

During the day I paid frequent visits to the freezing chamber to see how the other prisoners were faring. The former two had been placed in the "shoot," and consequently I had had no opportunity of observing how they behaved as the ice gradually closed around them, but in the freezing chamber there was every facility for doing so. At 11.10 a.m. the increasing coldness of the water in the pannikins was rendering their movements less active. They glided from one side to the other, and from the surface to the bottom, but in such a manner as to leave in one's mind the impression that they anticipated something. Their attidude was that of expectancy. An hour afterwards they were apparently going to sleep, the goldfish on its side, the other in its ordinary position. The fins kept moving in a lazy manner, there was no twitching, no abrupt action. The motion reminded one of the vibration of a wire that is slowly but surely coming to rest. The eyes were clear, and to all appearances a deep and placid sleep was falling stealthily upon them. Two hours afterwards they were in the same position, but now there was no movement, the ice was seen advancing upon them like an attacking army with bayonets in front. Some of the spikes of ice had already reached parts of the bodies, and catching the light from the candle produced a strikingly beautiful combination of colour. In fact the two creatures were sleeping in the light of a gorgeous sunset. After eight hours' exposure to the temperature of the freezing chamber, and two more to the much lower temperature of the *snow-box*, another part of the freezing apparatus, and feeling convinced that the ice was solid throughout, I removed the pannikins to the thawing tubs and sat down to watch for any indication of life. But, alas for this experiment, there were no signs of returning vitality. When freed from the ice, the salt-water fish kept floating about for a short time in the same position as that it occupied when inside the block of ice, and then slowly sank to the bottom, while the goldfish on being freed continued to float for upwards of an hour during which I sat watching it. Next morning it was still floating, not erect like the other, but on its side with the tail slightly depressed. The fish was apparently dead. At night it maintained the same position, and I concluded that life had gone from my goldfish for ever.

Such is a brief statement of what was done in a few hours of leisure. I have made it in the hope that others who have more time at their disposal and more enlarged facilities for carrying out a series of experiments will proceed with the investigation, and perhaps some new and valuable information regarding the conditions of life may crown their efforts.

The deeply-pathetic words that so briefly told the fate of the brave men who accompanied Franklin are, with some slight modification, applicable to my two fishes:—"When they lay, they slept; and when they slept, then they died."

Art. XVII.—*On the Occurrence of* Phalaropus fulicarius, *Pennant* (the red Phalarope), *in New Zealand*. By Julius von Haast, C.M.G., Ph.D., F.R.S.

[*Read before the Philosophical Institute of Canterbury, 15th November*, 1883.]

The Canterbury Museum has lately received from Mr. M. Studholme of Waimate a small bird, shot about middle of June of this year on the narrow strip of sandy beach separating the Waimate lagoon from the ocean. It was flying alone without any companions.

On examination it proved to be a specimen of *Phalaropus fulicarius*, a truly arctic species, quite new to the southern hemisphere. Unfortunately I did not receive the bird in the flesh, but judging from its total length (8·25 inches), it is most probably a female. The plumage, fully agreeing with the descriptions of European and North American specimens, proves that this Waimate specimen is in its breeding or fine summer dress. The occurrence of this bird is, therefore, one of the most curious facts on record as an addition to our New Zealand avi-fauna; but as it resembles in general appearance, at least at a distance, some of our smaller *Grallæ*, it may, although probably only an occasional straggler, have hitherto escaped detection by our naturalists.

The following remarks as to its habits and migrations may demonstrate this strange appearance in the southern hemisphere still more clearly.

In winter the red Phalarope is found regularly in Scotland and England, but not so frequently on the coasts of Germany, France, Italy, or North Africa. In Asia it has often been observed in the Black, as well as in the Japanese, Chinese, and Indian Seas; and, though essentially a marine bird, it winters regularly in some parts of the interior of Asia, as for instance in Persia.

It also occurs in the arctic regions of America, leaving for the south when the arctic autumn fairly sets in, and travelling as far as Mexico and Guatemala.

The occurrence of this bird in the southern hemisphere, as far as the latitude of New Zealand, is therefore very remarkable, especially in the middle of the arctic summer, and can only be accounted for by assuming that this bird, or more probably a flock, have been driven southwards by stress of weather when the time arrived for their returning to their home in Eastern Siberia or Western North America.

However, the most curious fact is, that the specimen before us is in its most brilliant summer or breeding dress, and quite in accordance with the time of the year when it is breeding in the arctic regions; while according to all accounts accessible to me it has always been observed after its emigration to its winter quarters in the more southern regions to be clothed in its more sober white and ash-coloured winter dress, instead of the rich rufous and black tints our specimen possesses so conspicuously.

Might this not suggest to us that when the usual breeding time of the straggling flock came round, although in the middle of our winter, the season did not prevent the change of colour, together with the pairing in the flock !

At first sight the idea might not appear unreasonable that this bird occurs also in the antarctic zone, hybernating in the more temperate regions of the southern hemisphere, but, in that case, the specimen under review would not have been found in full breeding or summer dress.

Having drawn the attention of ornithologists to this interesting stranger, I have no doubt that, as was the case with *Strepsilas interpres* (the Turnstone), more light will be thrown upon its occurrence in this part of the world now that this has been proved beyond a doubt.

Art. XVIII.—*On the Occurrence of the Spinous Shark* (Echinorhinus spinosus) *in New Zealand Waters.* By T. Jeffery Parker, B.Sc.

[*Read before the Otago Institute, 10th July,* 1883.]

This species is stated by Günther* to be confined to the Mediterranean and Atlantic, extending from the coast of England to the Cape of Good Hope. I believe the present specimen to be the first which has been recorded beyond the usual range. It was caught off Dunedin by fishermen in the employment of the Deep Sea Fishing Company during the present month (July).

The fish, which was quite new to the captors, was cut up for bait, only the mutilated remains being brought to Dunedin. Fortunately the teeth were preserved, and the tail was hardly at all injured, so that there was no difficulty in identifying the species.

Echinorhinus belongs to the family *Spinacidæ.* I extract the following generic and specific characters from the "Catalogue of Fishes":—

"Genus **Echinorhinus.**

"Two very small dorsal fins, without spine, the first opposite to the ventrals; no anal fin. Skin with scattered large round tubercles. Mouth crescent-shaped, a labial fold round the angle of the mouth. Nostrils midway between the mouth and the end of the snout. Teeth equal in both

* "Catalogue of Fishes," vol. viii., p. 428.

jaws, very oblique, the points being turned outwards; several strong denticulations on each side of the principal point. No membrana nictitans. Spiracles small; gill-openings of moderate width.

"*Echinorhinus spinosus.*

"Spiracles behind the eye, behind the vertical from the angle of the mouth. Teeth $\frac{22-26}{22-26}$. Dorsal fins close together. Each tubercle with a small spine in the centre. Brownish-violet, with or without dark spots."

Art. XIX.—*On a Torpedo* (T. fusca, *? n. sp.*) *recently caught near Dunedin.* By T. Jeffery Parker, B. Sc. Lond., Professor of Biology in the University of Otago.

[*Read before the Otago Institute, 7th May,* 1883.]

Plate XXII.

The specimen upon which the following description is founded was caught at Purakanui, Otago, towards the end of last year. As far as I know it is only the second example of the genus which has been recorded in New Zealand,* the other having been caught at Napier, in 1868, by Captain Fairchild, and named by Professor Hutton† *Torpedo fairchildi.*

The present specimen agrees in most respects with *T. hebetans,*‡ of which I should be disposed to consider it a variety, but for the fact that it differs from that species in at least one character considered by Günther to be of specific importance. I therefore propose to name it provisionally *T. fusca.*

The species of *Torpedo* are divided by Günther into two groups, containing respectively those with fringed and those with unfringed spiracles. My specimen belongs to the latter subdivision, in which only two species, *T. hebetans,* and *T. narce,* are included in the "Catalogue of Fishes." A query is, however, placed against *T. emarginata* of McCoy,‖ indicating that its position as a synonym of *T. hebetans* is doubtful. Hutton's *T. fairchildi* has also unfringed spiracles, and it is apparently the only new species of *Torpedo* which has been recorded since the publication of the "Catalogue of Fishes."

* Since this paper was written, two specimens of *Torpedo* have been caught in Napier Harbour, but the description of them (N.Z. Journ. of Sci., July, 1883) is not sufficiently exact to allow of their identification.

† Hutton and Hector, Catalogue of N.Z. Fishes, 1872.

‡ Günther, Catalogue of Fishes, viii., p. 449.

‖ Ann. and Mag. Nat. Hist., 1841.

There are thus three species and a doubtful fourth with unfringed spiracles: from these the Purakanui specimen differs in the following characters:—

(1.) From *T. hebetans*:

a. In the position of the first dorsal fin;

b. In the presence of well marked emarginations separating the pectoral fins from the head;

c. In colour.

(2.) From *T. narce*:

a. In the comparative size of the first and second dorsal fins;

b. In the absence of a well-marked longitudinal pit at the angle of the mouth;

c. In colour.

(3.) From *T. emarginata*:

a. In the position of the first dorsal fin;

b. In the anterior boundary of the head being curved instead of straight;

c. In the breadth of the disc being greater than the length;

d. In the tail being shorter than the disc;

e. In the absence of tubercles on the dorsal surface.

(4.) From *T. fairchildi*:

a. In the position of the first dorsal fin;

b. In the relative size of the two dorsals;

c. In the more rounded form of the disc;

d. In the distance between the emarginations being fully six times the distance between the eyes, instead of the two distances being about equal.

According to Günther, the most important of these characters are those relating to the dorsal fins, namely, the position of the first dorsal with regard to the pelvic fins,* and the relative size of the two dorsals. For instance, in *T. hebetans*, "the first dorsal fin is twice as large as the second, and situated nearly entirely behind the root of the ventrals," while, in *T. narce*, "the first dorsal fin is not twice as large as the second, and only its anterior half is opposite to the base of the ventrals."†

* Dr. Günther would earn the gratitude of morphologists if he would give the weight of his authority to a much-needed change in the nomenclature of fins. Every one knows that the fins of fishes are divisible into median and paired; the former being either dorsal, ventral, or caudal; the latter pectoral or pelvic. If, then, the name "anal" could be abolished, the so-called anal fins being called ventrals, and the so-called ventrals pelvics, a very great improvement would be effected: the authority of such a book as the "Catalogue of Fishes" could not fail to effect the change of names within a reasonable period.

† Günther, l.c.

Similarly in *T. fairchildi*, the first dorsal is said by Hutton to be "over the ventrals, with the posterior edges of both in a line," and to be "about one and a half times the size of the second."

Unfortunately it is not stated by either Günther or Hutton whether by "size" is meant area, or greatest length, or vertical height, or length of base; nor whether, in giving the position of the first dorsal with regard to the ventrals, its base or line of attachment should, as one would naturally think, be made the standard. A reference to fig. 3 (pl. xxii.) will show the necessity of a strict definition of terms, in a case where such apparently insignificant differences are considered as of specific importance. The figure shows the two dorsals of *T. fusca* of the natural size, and it will be seen that while the line of attachment (*a b*), and the vertical height (*c d*), of the first dorsal are almost exactly twice the corresponding dimensions (*a′ b′*, *c′ d′*) of the second, yet the greatest length (*a c*) of the first is considerably less than twice that of the second (*a′ c′*), the proportions of the two being, in fact, as 13 to 8. The figure also shows that the actual posterior boundary of the first dorsal (*c*) projects considerably beyond the posterior end of the base (*b*), and that it is therefore important to state which of the distances *a b* and *a d* is to be taken in considering the position of the fin with regard to the ventrals.

It is rather strange that the peculiarity of the caudal fin of *Torpedo* is not mentioned in the "Catalogue of Fishes": it is certainly worthy of notice that, although belonging to an order in which heterocercality is the general rule, *Torpedo* has a tail-fin which is diphycercal, at the same time simulating in a remarkable way the homocercal tail of a *Teleost*.

The characters of the specimen described are as follows:—

Torpedo fusca, ? n. sp.

Pl. xxii., fig. 1.

Spiracles not fringed, their distance from the eyes little more than their own diameter. The greatest length of the first dorsal fin (fig. 3) is to that of the second as 13 is to 8: the base and the vertical height of the first dorsal are almost exactly twice those of the second. The posterior end of the base of the pelvic fin is nearly opposite the middle of that of the first dorsal. No distinct longitudinal pit at the angle of the mouth, but several irregular folds (fig. 2). The length of the band of mandibular teeth has the same proportion to the gape as in *T. narce*. Dark brown above, mottled with irregular lighter patches: greyish-brown beneath.

Total length	26·0	inch.
Length of disc	16·5	,,
Breadth of disc	14·0	,,
Length of electric organ	7·5	,,
Average breadth of organ	2·5	,,

There are about 70 columns to the square inch in the anterior, about 40 in the posterior part of the electric organ.

EXPLANATION OF PLATE XXII.

Fig. 1. *Torpedo fusca*, from above ($\frac{1}{8}$ nat. size).

Fig. 2. „ „ The mouth and adjacent parts ($\frac{1}{2}$ nat. size); *f.n.p.*, fronto-nasal process; *na*, nostril; *pt. qu*, upper jaw; *mck*, lower jaw.

Fig. 3. „ „ The dorsal fins ($\frac{1}{2}$ nat. size); *ab*, base of 1st and *a′b′* of 2nd dorsal; *ac*, greatest length of 1st and *a′c′* of 2nd; *cd*, vertical height of 1st and *c′d′* of 2nd.

Art. XX.—*On a Specimen of the Great Ribbon Fish* (Regalecus argenteus, *n. sp.*), *lately obtained at Moeraki, Otago.* By T. Jeffery Parker, B.Sc.

[*Read before the Otago Institute*, 12*th July*, 1883.]

Plates XXIII. and XXIV.

The genus *Regalecus* includes a few species of highly specialized deep-sea fishes, which are among the rarest members of the class. Günther, in his "Catalogue of Fishes,"* describes six species, some of which are apparently founded upon single specimens, while some again are rendered decidedly doubtful, owing to the imperfections of the original descriptions and figures, and the absence of further specimens.

The total number of examples recorded is very small. Günther states† that only sixteen captures have been made in England between 1759 and 1878. Of these eleven at least were referable to a single species, *R. banksii*, while one is assigned to *R. grillii*. Two or three specimens at least have apparently been obtained in Norway (*R. glesne*), several in the Mediterranean (*R. gladius* and *R. telum*), one at the Cape of Good Hope (*R. gladius* ?), one at the Bermudas (*R. gladius* ?), and one at Vizagapatam (*R. russellii*). In New Zealand a specimen (species doubtful) was found at Nelson in 1860, and described by Mr. W. T. L. Travers.‡ Another was caught at New Brighton, near Christchurch, in 1876, and was described by Dr. von Haast,‖ who made it the type of a new species (*R. pacificus*). A third was cast ashore on Little Waimangaroa Beach, on the West Coast of the South Island, in 1877; but of this the only description extant § is not exact enough for the

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* Vol. iii., p. 307.

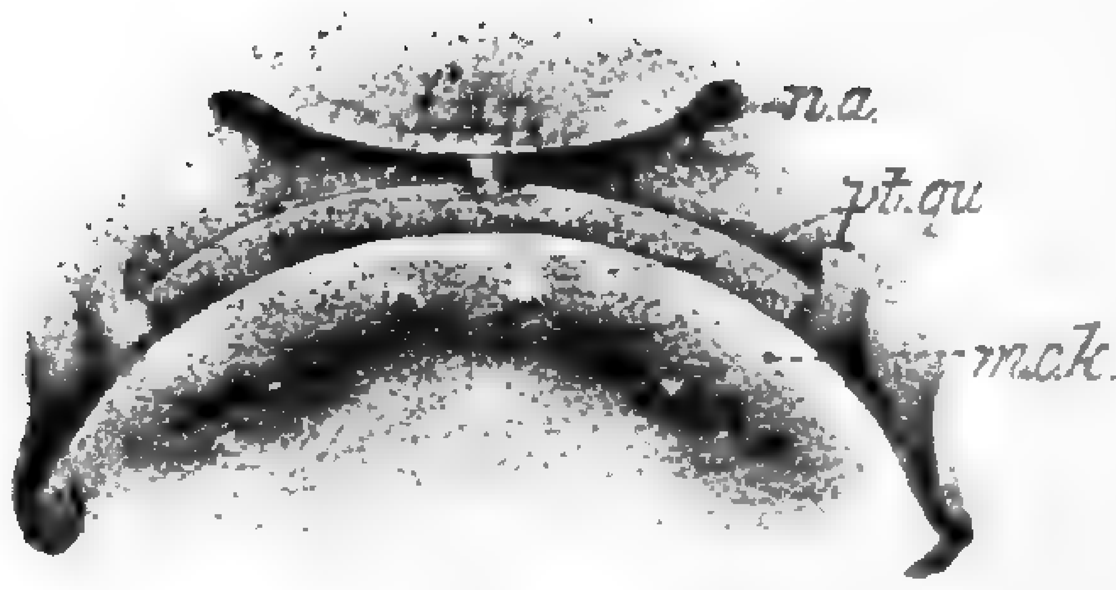
† "Study of Fishes," p. 522.

‡ Günther, "Cat. of Fishes," iii., p. 307; Hutton and Hector, "Fishes of New Zealand," p. 35.

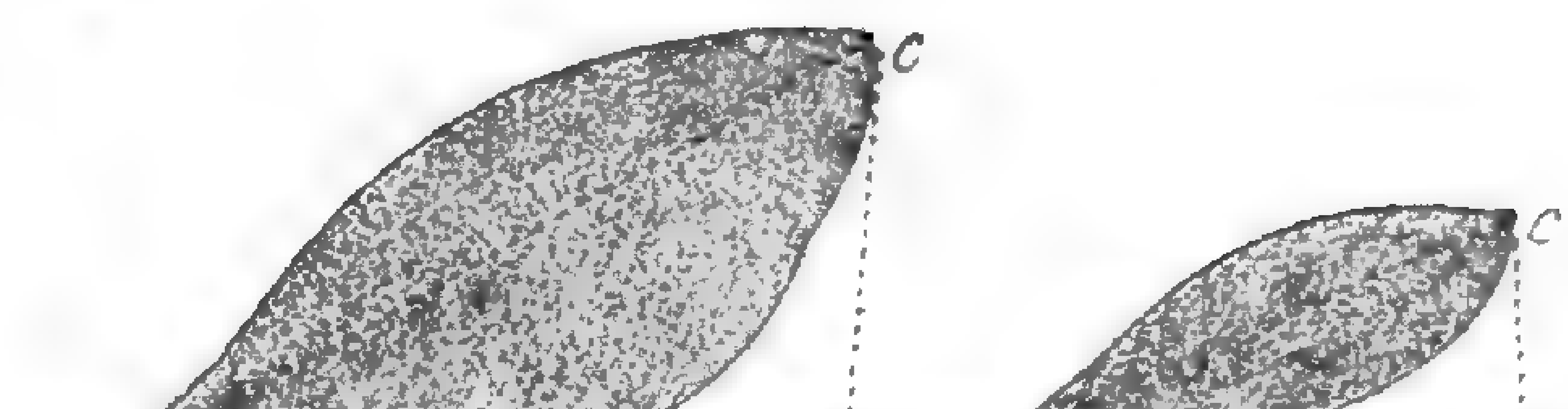
‖ Trans. N.Z. Inst., vol. x., p. 246.

§ Quoted by v. Haast, *loc. cit.*

1
× 1/8



2
× ½



3
× ½

TORPEDO FUSCA, n.sp.

T.J.P. ad nat. del.

determination of the species. From information received from Mr. G. L. Sise, I have no doubt that a large fish cast ashore near Moeraki about two years ago belonged to the same genus, so that the specimen I am about to describe makes the fifth known to have been found in this country within a period of twenty-three years.*

The species which has been most thoroughly worked out is *R. banksii*, the subject of an excellent and well-illustrated paper by Hancock and Embleton.† *R. pacificus* is figured and described at some length by von Haast and Powell.‡ Besides these papers, brief accounts in the works of Günther, Gray, Yarrell, and Cuvier ‖ include all the information at my disposal on the genus. There are, however, numerous references in the "Catalogue of Fishes" to the works of Bloch, Cuvier and Valenciennes, and other foreign ichthyologists.

The published figures of *Regalecus*, like the descriptions, have in many cases been either very incorrectly drawn, or taken from damaged specimens. Nearly all are, however, valuable as showing more or less of such structures as the anterior dorsal and the ventral rays, the precise relations of which in the various species are still extremely doubtful. As specimens may at any time be cast upon our shores, I give in pl. xxiv. outline copies of the head, and, in some cases, of the tail of all the figures I have been able to find: these will, I hope, furnish any local naturalist, who may be fortunate enough to see an example of the great ribbon-fish, with some notion of the chief differences between the species and of the points to be kept in view in making descriptions or drawings. For the same reason the ensuing description will be much fuller than would be necessary in the case of any but an extremely rare and fragile fish.

The following is a list of all the figures to which I have found references, those reproduced in the present paper being marked with an asterisk:—

1. *Regalecus gladius*, Cuvier and Valenciennes, "Hist. Nat. des Poissons."
2.* ,, ,, Cuvier, "Règne Animal" (Poissons), pl. 69.
3. ,, *telum*, Cuvier and Valenciennes, *op. cit.*
4.* ,, *banksii*, Hancock and Embleton, *loc. cit.*, pl. 1 and 2 (copied in Yarrell's "British Fishes").

* The so-called *Regalecus jacksonensis* of Ramsay (Proc. Linn. Soc. N.S.W., vol. v., p. 631, pl. xx.) is certainly wrongly named; it is either a large *Trachypterus* or belongs to a new genus.

† Ann. and Mag. Nat. Hist., 2 ser., iv., 1849, p. 1.

‡ Trans. N.Z. Inst., vol. x., 1877, p. 246; and vol. xi., 1878, p. 269.

‖ Günther, *op. cit.*; J. E. Gray, "On the British Specimens of *Regalecus*," Proc. Zool. Soc., 1849, p. 80, and Ann. and Mag. N.H., 2 ser., vol. v., 1849, p. 501; Yarrell, "British Fishes," p. 300; Cuvier, "Règne Animal" (Poissons), p. 148.

5. *Regalecus banksii*, Illustrated London News, June 2, 1849, p. 384.
6.* ,, ,, Gray, *loc. cit.*: copies of two original drawings in
7.* Sir J. Banks's copy of Pennant's Zoology.
8. ,, ,, (?) (*Gymnetrus hawkinsii*), Bloch, "Naturgeschichte der auslœndischen Fische," xii., pl. 425 (copied by Yarrell, *op. cit.*, p. 302).
9. ,, ,, Lütken, "Videnskabelige Meddelelser fra den naturhistoriske Forening" for 1881, p. 190.
10. ,, *glesne*, Ascanius, "Icones Rerum Naturalium," pl. 11.
11.* ,, ,, Schneider, "M. E. Blochii Systema Ichthyologiæ," pl. 88 (copied by Yarrell, *op. cit.*, p. 301).
12. ,, ,, "Encyclopédie Méthodique," fig. 358.
13. ,, *grillii*, Lindroth, Vet. Akad. handl., pl. 8.
14. ,, *russellii*, Shaw, "General Zoology," iv., pl. 28.
15.* ,, *pacificus*, Haast, *loc. cit.*, pl. 7.

The specimen from which the following description is taken was cast ashore at Moeraki, about 40 miles north of Dunedin, on the 14th of June. It was purchased by a fisherman, who, previously to bringing it to Dunedin for exhibition, cut it into four pieces for convenience of transit! After it had been exhibited for two or three days I was able to secure it for the Museum.

As the specimen was thus wantonly injured, and was moreover by no means fresh when it came into my possession, it was useless to attempt to stuff it, and I decided instead to have the skeleton prepared: of this I hope, as very little seems to be known of it, to publish a detailed description. In the present communication I propose to give a general description of the fish with especial reference to one or two points left more or less uncertain by other observers.

All the species of *Regalecus* are distinguished by their great length in proportion to their height and thickness, most of them being from 8 to 18 feet long, 6–15 inches high, and not more than 2 or 3 inches thick. In the species recorded up to the present time the proportion between height and length varies from 1 : 24 (*R. telum*) to 1 : 11 (*R. pacificus*): in the Moeraki specimen this proportion is as 1 : 10, the total length being $12\frac{1}{2}$ feet, and the greatest height 15·25 inches, so that the fish is higher in proportion to its length than any former specimen.

The length of the head varies from $\frac{1}{13}$th of the total length (*R. gladius* and *pacificus*) to $\frac{1}{16}$th (*R. banksii*); in my specimen the head is $\frac{1}{17}$th the length of the whole body, being 9 inches long with the jaws retracted.

In correspondence with the great length of the fish, the number of rays in the continuous dorsal fin is very considerable: it varies from 134 (8/126) in *R. glesne* to 406 in *R. grillii*. In the present specimen the number is

15/190; that is, there are 205 rays in all, the first 15 being lengthened to form a crest, and, in accordance with the usual method of counting, being considered as the first dorsal, the remaining 190 forming the second.

In the various descriptions and figures to which reference has been made there is great discrepancy with regard to the number and character of the rays forming this crest or anterior dorsal fin.

Hancock and Embleton say of *R. banksii* (see pl. xxiv., fig. 3):—"The anterior part of the fin, more prominent than the rest, is composed of twelve rays, which were stated by the captors to have been 12 or 14 inches in length when the fish was taken, and to be each furnished with a membranous expansion on its posterior edge, increasing in width upwards something like a peacock's feather.

"The first ray is a pretty strong spine arising just within the frontal curve, the three next are very slender, and much closer together than the rest, and when we first saw the fish, united for 4 or 5 inches (their length at that time) by a membrane; the next is equally slender with the preceding, but rather farther apart; the three or four after this are nearly as strong as the first, the rest diminish in strength and length, and become uniform with the rays of the dorsal fin.

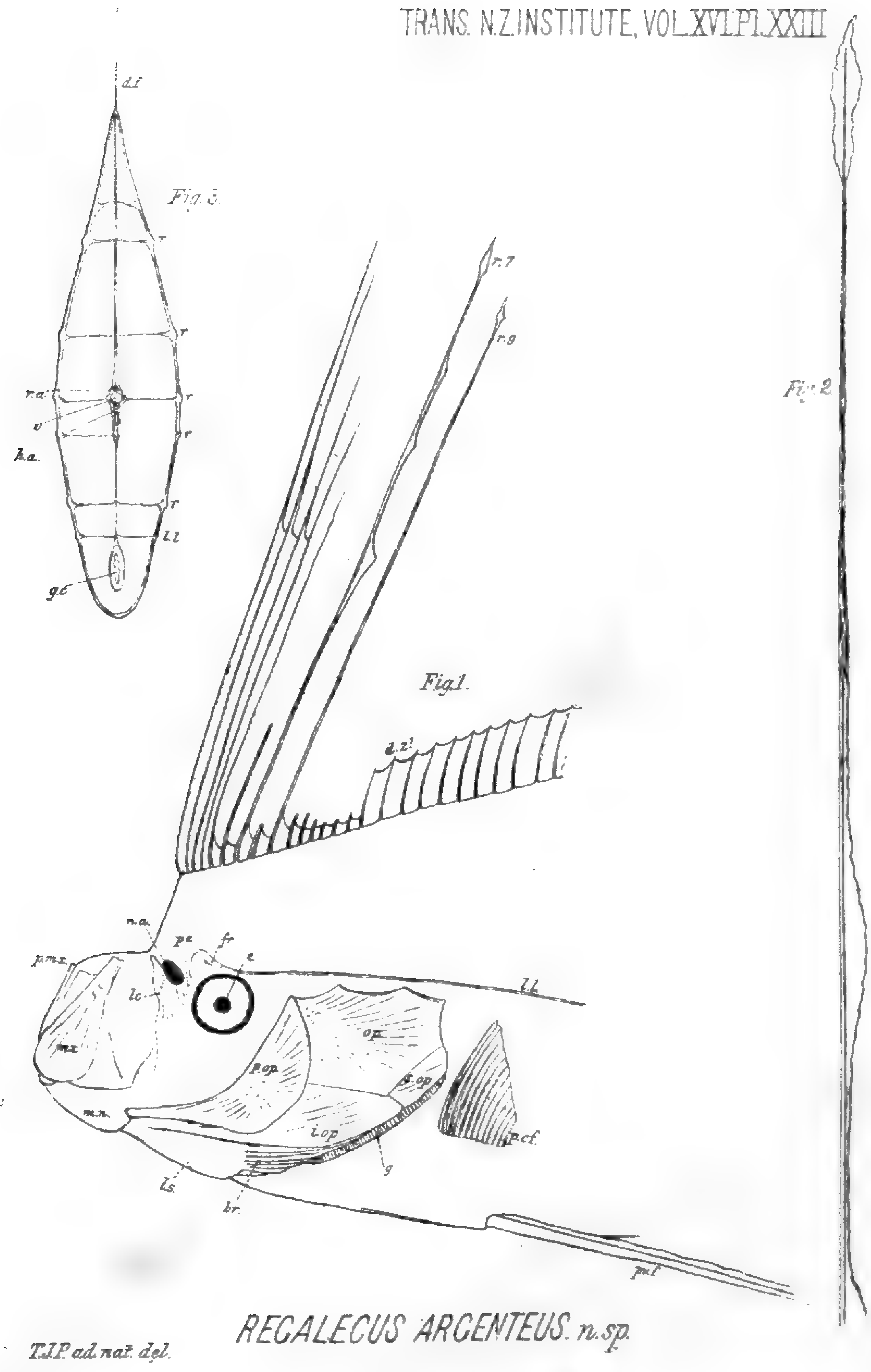
"It is difficult for us to say whether the twelve front rays constituted a detached crest or formed merely the anterior continuation of the dorsal fin, though after careful and repeated examinations we found shreds of membrane in each interval between them, and their bases also were connected with a continuous membrane. In the interval between the twelfth and thirteenth rays the remains of a membrane were found connecting the bases of these rays, and their shafts were ragged and woolly-looking, as if a membrane had been torn off from them. We are, therefore, inclined to conclude that the crest was really a continuation of the dorsal fin and not a separate structure, though it is probable enough that the ends of its rays may have been for some distance free and even furnished with a membrane on their posterior margin widening at the top, giving them the appearance of peacock's feathers, as asserted by the fishermen. This probability is heightened by the fact of the head of the *Gymnetrus* [*Regalecus*] from the Cornish coast being provided with two long rays having broad membranous expansions at their ends, which would justify a casual observer in comparing them in form to the above feathers. It is not unlikely besides that the second, third, fourth, and fifth rays, on account of their resemblance in delicacy to the ordinary fin rays, may have terminated differently to the rest. The rays having been broken we cannot say of ourselves whether they are uniform in size [*i.e.* length] or not; but by what we have learnt by questioning those who saw the fish, we conclude that the middle rays were the longest, those in front and behind them gradually decreasing in length. The rays of the crest are more closely set than those of the rest of the dorsal fin, which stand about half an inch apart."

Lütken,* describing a drawing of a specimen from the Faroe Islands, obtained in 1852, and probably referable to the same species, states that immediately in front of the true dorsal fin "there were two high and pointed nuchal fins, the total number of rays in which cannot be stated exactly," but is probably about 11. None of these rays exhibit terminal dilatations.

Von Haast says of *R. pacificus* (pl. xxiv., fig. 1) "the first nine spines form a crest. These spines enlarge at their termination to a lobe, as shown by the two only perfect ones when the fish was obtained; they cover a space of 2·5 inches. The first of these spines is broken off at 3 inches from the base; it is the stoutest of the whole series. No. 2 is considerably thinner, and 7 inches long. It is one of the complete ones. The three next spines (3, 4, and 5) were all broken off at 4 to 6 inches, and were nearly as thick as the first. From here they get thinner, the thickness of the seventh having only the thickness of the second. This spine, which is entire, is 7·75 inches long, and has, like the second, a lobe at its termination. The eighth is still thinner, and broken off 1 inch from its base, and there is only a fragment of the ninth, which is not thicker than one of the rays of the dorsal fin proper. All of these spines, which have minute hooks directed upwards on their anterior and posterior edges, are united with each other by a small membrane about ·45 inch high. They had, like the two ventral rays, a red colour, very bright in their upper portion when the fish was first obtained, which, however, gradually faded to a dull light pink." Nothing is said as to the form of the lobes terminating the two perfect spines, but the latter appear from the figure to have been merely bluntly clavate. It is further stated that the proper dorsal fin begins half an inch behind the last of these rays. This statement would seem to imply that the two dorsals were separate in Haast's specimen.

In the Nelson specimen the crest is thus described by Travers:—"from the back of the head rose several rigid circular spines, about eighteen inches long, three-quarters of an inch in diameter at the base, tapering to a point, curving slightly backwards, hollow and bristling along their whole surface with small spines directed upwards. These long spines appear to have been very brittle, as they broke off short when the fish struck the rock. The person who saw the fish run ashore described *these spines* [sic] *as presenting the appearance of three small masts to a boat, through the whole length of the fish, disposed in pairs as follows,—one pair just below the back and*

* Ann. and Mag. N.H., Ser. 5, vol. xi., p. 181.



REGALECUS ARGENTEUS. n. sp.

T.J.P. ad. nat. del.

the other pairs immediately above." I have italicized the concluding portion of this quotation, as I am totally unable to make it tally with the first part, or indeed to understand its meaning.

In *R. gladius*, Günther states that "the anterior twelve dorsal rays are produced, the first five forming a separate division above the eye, the seven following terminate in cutaneous lobes." This description is probably taken from Cuvier and Valenciennes and tallies exactly with the figure (see pl. xxiv., fig. 6) in the "Règne Animal," in which the five anterior rays are united by membrane for fully three-fourths of their length and taper away distally to a point; the seven posterior are only united for a short distance from the base, terminate in lanceolate lobes and show a progressive diminution in length from before backwards, the sixth ray being more than four times the height of the head, the twelfth little more than half that height. The terminal lobes on these seven posterior rays are definitely lanceolate, instead of being formed by a gradual widening of the membranous investment of the spine as in Haast's and Hancock's figures.

The Bermudas specimen is similarly described* as having "a series of ten or eleven erect quill-like flexile filaments, from 2 to 3 feet in extent, gradually tapering from base to apex, and possessing, in the case of the three longest, lanceolate points."

Of two specimens caught off the Northumberland Coast and described to Hancock and Embleton,† it is said that "there were four processes about 18 inches long from the head, of a red colour, like the feelers of boiled lobsters; they tapered gradually towards their ends, which were enlarged to the form and size of a large button."

These are all the detailed descriptions of this curious crest which I have been able to find. Of the two drawings in the Banksian Copy of Pennant's Zoology, one (see pl. xxiv., fig. 4) shows a crest of eleven rays, all tapering distally and not united by membrane; the length of the first is more than twice the height of the head and it is curved forwards and downwards; the second is barely longer than the height of the head; the rest diminish progressively. The second of these drawings (pl. xxiv., fig. 5) is evidently taken from a specimen in which all the rays except the seventh were so broken as to give no indication that they were longer than those of the second dorsal. Probably the specimen from which the Bloch-Schneider figure of *R. glesne* is taken was similarly damaged, as this figure (pl. xxiv., fig. 8) gives a small anterior dorsal fin supported by 7 rays all equal in length to those of the second dorsal. Bloch's semi-mythical *Gymnetrus hawkinsii* has a continuous dorsal with all the rays of about equal length.

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* J. M. Jones, Proc. Zool. Soc., 1860, p. 185.

† *Loc. cit.*, p. 15.

In the Moeraki specimen the seventh and the ninth rays are perfect (pl. xxiii., fig. 1, *r* 7, *r* 9): the seventh is 1 foot 5·5 inches long, the ninth 1 foot 3·5 inches. Both taper gradually to the distal end and terminate in a somewhat irregularly lanceolate or spear-head shaped lobe about 1 inch long by rather less than half an inch wide (pl. xxiii., fig. 2). This lobe is formed by an expansion of the cutaneous covering of the bony ray, and is considerably thickened and corrugated on the surface. The bony ray also tapers gradually to its extremity and ends in a very fine point about $\frac{1}{4}$ inch from the end of the cutaneous lobe.

The relative thickness of the spines corresponds very well with Hancock and Embleton's description quoted above: the first ray is about $\frac{1}{8}$ inch thick at the base, the second to the fifth about $\frac{1}{26}$ inch; the sixth and seventh a little more than $\frac{1}{8}$ inch; from the eighth to the fifteenth the diameter gradually decreases. The first four, also, are closer together than the rest.

The first five spines, although broken, have evidently not lost much of their length. The first is 1 foot 5·5 inches long, the second a little less, the third, fourth, and fifth about 13 inches; all the rest are broken off short.

All the rays are connected by membrane with one another, and the last is similarly connected with the first ray of the so-called second dorsal, so that, as in some other specimens described, the two dorsals are continuous. The membrane uniting the first four rays extends to a distance of 9 inches from the base, and its edges do not appear to be perfect. In the 7th (perfect) ray (pl. xxiii., fig. 2) the terminal lobe is continued proximalwards by a thin membranous expansion along the posterior edge. The border of this expansion is evidently unbroken to a distance of 9 inches from the extremity, and I think it may be assumed that, for the rest of its extent, this membrane extended to the next ray. All the rays are quite smooth, presenting no trace of the spines or hooks described in some other specimens.

My specimen would therefore seem to show that the rays of the crest, or so-called first dorsal fin, are united for about the proximal half of their length by membrane, that for the rest of their extent they are fringed posteriorly by membrane, and that they terminate in somewhat thickened lanceolate expansions. I have no means of determining whether all terminate in the same way, or whether, as in Cuvier's figure of *R. gladius* (pl. xxiv., fig. 6), some of them simply taper to a point. One would like, by the by, to know certainly whether Cuvier's figure is an exact representation of the specimen for which it was taken, or whether it is in any way "restored." The extreme brittleness of the rays of the crest would seem to render the capture of an absolutely uninjured specimen extremely improbable; and it is therefore not unlikely that the figure in question either gives the result of the examination of several specimens, or is restored more or less conjecturally. It would be interesting to know the precise history of the figure, but I have, unfortunately, no means of getting at it.

In some species of *Regalecus* a caudal fin is present. Günther states that in *R. russellii* the caudal rays are distinct. In *R. glesne* he says, "it appears very doubtful whether the dorsal fin really was continuous with a caudal." A distinct caudal fin continuous with the dorsal is, however, shown in the Schneider-Bloch figure of that species (pl. xxiv, fig. 9). The ordinary forked homocercal tail in Bloch's figure of *Gymnetrus hawkinsii* is certainly mythical. Cuvier's figure of *R. gladius* shows a delicate caudal fin (pl. xxiv, fig. 7), consisting of seven very fine rays standing out from the slightly enlarged extremity of the tail, and unconnected by any membrane. Of this fin Günther makes no mention in his systematic description of the species. In *R. banksii* and *R. pacificus* the tail ends in a bluntly-pointed extremity quite devoid of fin rays. In both there is a slight emargination on the ventral side, a short distance from the end. In all these respects the Moeraki specimen agrees exactly with the two last-named species. Lütken is of opinion that this absence of a caudal fin is due to "the peculiar mutilation or curtailment which the caudal extremity always seems to suffer to a greater or less extent in these fish." I fail to see any evidence of such mutilation in my specimen.

The number of rays in the pectoral fin is tolerably constant in the different species, the range being from 11 (*R. banksii* and *R. russellii*) to 14 (*R. gladius* and *R. glesne*): in my specimen there are 13 pectoral rays.

In the present specimen the pectoral fin is remarkable for its vertical position, its line of attachment being almost perfectly horizontal. This appears to be the case also in *R. gladius* (pl. xxiv, fig. 6), and in *R. pacificus* (fig. 1). In *R. banksii* (figs. 3–5), and *R. glesne* (fig. 8), the fin has a markedly oblique position.

The pelvic (ventral) fins are represented in all species each by a single long ray, the biradiate ventrals of *Gymnetrus hawkinsii* having been shown to owe their origin to an error on the part of the artist who drew the figure. The ventrals of *R. russellii* have also been erroneously described as biradiate. In the figures I have seen, the ventrals are represented as perfect in nos. 2 (pl. xxiv, fig. 6), 6 (fig. 4), 8 and 10 (fig. 8) of the list on pp. 285–6 above. In *R. gladius* the ventral is represented as terminating in an irregularly lanceolate cutaneous lobe, and as having a second somewhat triangular lobe on the post-axial side of the middle third of its length: no fringe of membrane is shown on either side of the ray. In the Banksian figure of the Nelwyn Quay specimen, (*R. banksii?* fig. 4), the terminal lobe is represented as regularly oval and marked by radiating lines or ridges. In Schneider's *R. glesne* (fig. 8) the lobe is somewhat spatulate; neither in this nor in the preceding figure is there any fringing membrane. In *R. gladius* the length of ray is represented as nearly four times the height of the body, in *R. glesne* as fully three and a half times, in the Nelwyn Quay specimen as barely twice the height.

In *R. banksii*, the pelvic rays are described by Hancock and Embleton as being fringed with membrane along the posterior (post-axial) edge: the same is shown in the Banksian figure of the Filey Bay specimen (fig. 5). Another specimen, probably of *R. banksii*, is described* as having ventrals three feet long and "fringed with a thin membrane on two sides." No fringe is either mentioned or figured by von Haast in *R. pacificus*.

In the Moeraki specimen the pelvic rays were both broken; the longer of the two was 37 inches in length, about ⅓ inch thick at its proximal end, tapering gradually to the fracture and fringed postaxially for a considerable distance by a delicate red membrane.

In the form of the head the specimen under consideration resembles on the whole *R. banksii*; the "forehead" is, however, nearly straight instead of slightly concave as in that species and in *R. gladius*: in *R. pacificus* it is distinctly convex. There is also no difference of importance in the position and size of the eye, which, as in *R. pacificus* is slightly wider than high. The nostril (pl. xxiii., fig. 1, *na*) is apparently perfect on one side, and forms a single large oblique oval aperture, much larger and nearer to the eye than in *R. banksii* (fig. 3): in *R. gladius* (fig. 6) two widely separated nasal apertures are shown in Cuvier's figure. In Haast's figure no nostril is shown, but this is very probably owing to the coarseness of the photo-lithograph, in which most of the details of the head are completely lost.

From the same cause the form of the operculum cannot be made out in Haast's large figure, but luckily the small outline figure shows it to have had a somewhat convex upper border produced into three points (pl. xxiv., fig. 1). The same is the case with *R. gladius* (fig. 6), with which, as with *R. pacificus*, my specimen agrees closely, differing mainly in the dorsal border of the operculum being, as a whole, less arched. As in *R. gladius*, too, the dorsal border of the opercular bone (*op*) is produced into two points, a third being formed by the anterior and a fourth by the posterior boundary of that border. The posterior boundary of the opercular is produced in the Moeraki specimen into a single point, which also marks the dorsal end of the sub-opercular: in *R. gladius* the latter bone apparently extends much further upwards. In *R. banksii* the opercular has an even border, its dorsal edge is somewhat concave and the sub-opercular is not indicated, having been mistaken by Hancock and Embleton for a branchiostegal.

* Quoted by Hancock and Embleton, *loc. cit.*, p. 17.

The jaws have essentially the same characters as in other species, being extremely protrusible, and there are as usual six branchiostegal rays. The whole form of the head, including the mouth, in the figure of *R. glesne*, is probably incorrect, as it differs entirely from the most authentic figures. The specimen from which fig. 5 was taken had evidently had the jaws completely destroyed, and the artist has made the hinder boundary of the preopercular take the form of a mouth with a very remarkable grin.

Regalecus gladius (and by implication *R. telum*) is said by Günther to possess small teeth: Yarrell makes the same statement of *R. glesne*. My specimen like all the remaining species of the genus is quite edentulous.*

In the Nelson specimen Mr. Travers states that "from the lower lip depended a large number of rigid slender barbules, about sixteen inches long and of a brilliant red colour." No such structures appear to have been met with by any other observer. Is it possible that this part of the description was "compiled from information given" to the writer, as he himself says is the case with some portions of his account?

None of the species of *Regalecus* possess scales, except on the lateral line; but the skin in *R. banksii* and *R. pacificus* is studded with numerous bony tubercles. In most of the other species it is raised into soft warts. Probably in all, also, the skin is covered externally with a delicate silvery coating, removed by the slightest friction. In *R. gladius* and *R. telum* the body is marked with greyish spots of somewhat less diameter than the eye. In *R. banksii* and *R. pacificus* there are instead irregular blackish wavy lines, more or less vertical in position, on the anterior part of the body. In both these species, as well as in *R. glesne* and *R. grillii*, the tubercles into which the skin is raised are arranged in four (three or four, *R. glesne*) longitudinal bands; or more correctly (in *R. banksii* and *R. pacificus* at any rate) the sides of the body are raised into four longitudinal ridges, cut off obliquely in front by the lateral line, and having the tubercles on them larger than in the intervening depressed bands.

Von Haast's description of *R. pacificus* as resembling frosted silver seems to me more applicable to the present specimen than any of the terms used in describing other examples. The dark irregular bands had the same general disposition as in Hancock's and von Haast's specimens. When I first saw the fish, within twenty-four hours of its capture, they were very

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* There is a strange discrepancy between Mr. Travers's account of the Nelson specimen, and the systematic description of *R. gladius*, copied in the "Catalogue of N.Z. Fishes" as applying to that specimen. *R. gladius* as the description sets forth, possesses teeth, whereas Mr. Travers distinctly states that in his specimen "the jaws appeared to be entirely destitute of teeth.

indistinct, appearing like greyish clouds seen through the silvery coating. As the latter wore off, they appeared black and well-defined, the silvery coating at the same time assuming a tarnished appearance.

The four longitudinal raised bands were well marked, and above the uppermost of them was a fifth less conspicuous band, becoming very indistinct in front. A transverse section of the body (pl. xxiii., fig. 3) shows that each of the five bands (*r*) corresponds in position to the line of attachment of one of the strong intermuscular septa, of which there are altogether six, the ventralmost corresponding in position to the lateral line (*l.l.*). If I understand Haast rightly, the lines of attachment of the intermuscular septa corresponded, in *R. pacificus*, to the depressed bands.

The tubercles with which the skin is studded are hard to the touch, and I at first thought they were bony. As a matter of fact, however, they are composed of strong fibrous tissue, and consist, as shown by thin vertical sections, of pyramidal elevations of the dermis.

The internal organs agree in every respect with Hancock and Embleton's description. The specimen was an adult female, but the ovaries contained no fully-formed eggs, the time of capture being evidently not near the breeding season. The muscles were white and firm when fresh; by no means "little coherent," as stated by Günther. The vertebræ were roughly estimated by Hancock and Embleton at 110, in the present specimen they amount to 93.

From the above description it will be seen that the Moeraki specimen of *Regalecus* differs

(*a.*) From *R. gladius* (?), *R. telum* (?), *R. glesne* (?), and *R. russellii* in the absence of a caudal fin,

(*b.*) From *R. glesne* (?), *R. gladius*, and *R. telum* in the absence of teeth,

(*c.*) From *R. pacificus* in the great length of the anterior dorsal fin rays, in the absence of spines thereon, in the shape of the head, and in the fibrous nature of the dermal tubercles,

(*d.*) From *R. banksii* in the shape of the operculum and in the non-ossification of the dermal tubercles,

(*e.*) From all species in the number of fin rays and in the proportion between height and length.

It is therefore impossible to assign it to any of the hitherto recorded species, and I propose to make it the type of a new species to be called *R. argenteus*. It must be borne in mind, however, that the analogy of *Trachypterus* lends strong support to Lütken's opinion that the proportions of the head and body, the number of fin-rays, and the characters of the tail differ greatly at different ages: this being the case the present species, like many of those previously established, must be looked upon as more or less provisional.

Regalecus argenteus, T. J. P.

D. 15/190: P. 13: V. 1: Br. 6.

Height of the body about one-tenth, length of the head about one-seventeenth of the total length. Eye one-sixth of the length of the head. Length and height of the head about equal. The fifteen anterior dorsal rays form a crest the height of which is more than double that of the head: its rays have their lower halves united by membrane, their upper halves having a narrow membranous fringe; three or four of them terminate in lanceolate cutaneous lobes, and they are not spinose. Ventral rays fringed posteriorly by membrane. No caudal fin. Four longitudinal ridges and an indistinct fifth extend from head to tail above the lateral line, by which they are obliquely cut in front. Surface studded with numerous hard but not bony tubercles which are largest and most elevated on the ridges; those forming the ventral edge are not perceptibly hooked backwards. Teeth absent. Silvery, with irregular wavy sub-vertical stripes and spots; forehead and membranous portion of snout blue-black; fins crimson.

Measurements.

	FEET.	INCHES.
Total length (jaws retracted)	12	6
Length of head (jaws retracted)...	0	9
,, ,, (jaws protruded)	0	11
Height of head (through centre of eye)... ...	0	9
Height of body at posterior boundary of operculum	0	11
Height of body 2 ft. from head	1	2 ·5
,, ,, 4 ft. ,, ,, ...	1	3 ·25
,, ,, 5 ft. 6 in. from head (level of vent)	1	2 ·5
Height of body 4 ft. from tail	0	11 ·25
,, ,, 2 ft. ,, ,, ...	0	9
Thickness of body 3 ft. 2 in. from head ...	0	3 ·5
,, ,, 5 ft. 11 in. ,, ,, ...	0	3
,, ,, 9 ft. ,, ,, ...	0	2
Diameter of iris	0	1 ·35
,, pupil	0	0 ·5
Length of 1st dorsal ray (broken)	1	5 ·5
,, 7th ,, ,, (perfect)	1	5 ·5
,, 9th ,, ,, ,, ...	1	3 ·5
Height of 2nd dorsal fin	0	2 ·25 to 3
Length of pectoral fin	0	3
Base ,, ,, ,, ...	0	1 ·25
Length of ventral ray (broken)	3	1

Key to the Species of Regalecus.

A. More than 250 dorsal rays.

  a. Teeth present: a caudal fin (?).

    α. Height = $\frac{1}{19}$ length ... ... 1. *R. gladius.*

    β. " = $\frac{1}{24}$ " ... ... 2. *R. telum.*

  b. Teeth absent: no caudal fin.

    α. Height = $\frac{1}{13}$ length: D. $\frac{12-15}{264-290}$ ... 3. *R. banksii.*

    β. " = $\frac{1}{18}$ " D. 406 ... ... 4. *R. grillii.*

B. Fewer than 250 dorsal rays.

  a. Teeth present (?): a caudal fin (?).

    D. $\frac{8}{120}$ — $\frac{8}{160}$ ... ... 5. *R. glesne.*

  b. Teeth absent.

    α. A caudal fin: D. $\frac{4-5}{223}$ ... ... 6. *R. russellii.*

    β. No caudal fin.

      i. Height = $\frac{1}{11}$ length: D. $\frac{9}{223}$ ... 7. *R. pacificus.*

      ii. " = $\frac{1}{10}$ " D. $\frac{15}{190}$ ... 8. *R. argenteus.*

EXPLANATION OF PLATES XXIII. AND XXIV.

Plate XXIII.

Fig. 1. *Regalecus argenteus*, side view of the head ($\frac{1}{4}$ nat. size).

br, branchiostegal rays: *d.* 2^1, first ray of 2nd dorsal fin: *e*, eye: *fr*, preorbital process of frontal bone: *g*, gills: *is*, isthmus: *i.op*, inter-opercular: *lc*, lachrymal bone: *l.l*, lateral line: *mn*, mandible: *mx*, maxilla: *na*, nostril: *op*, opercular: *pc.f*, pectoral fin: *p.e*, par-ethmoid (pre-frontal): *p.mx*, pre-maxilla: *p.op*, pre-opercular: *pv.f*, pelvic (ventral) fin: *r.* 7, seventh, and *r.* 9, ninth rays of crest: *s.op*, sub-opercular.

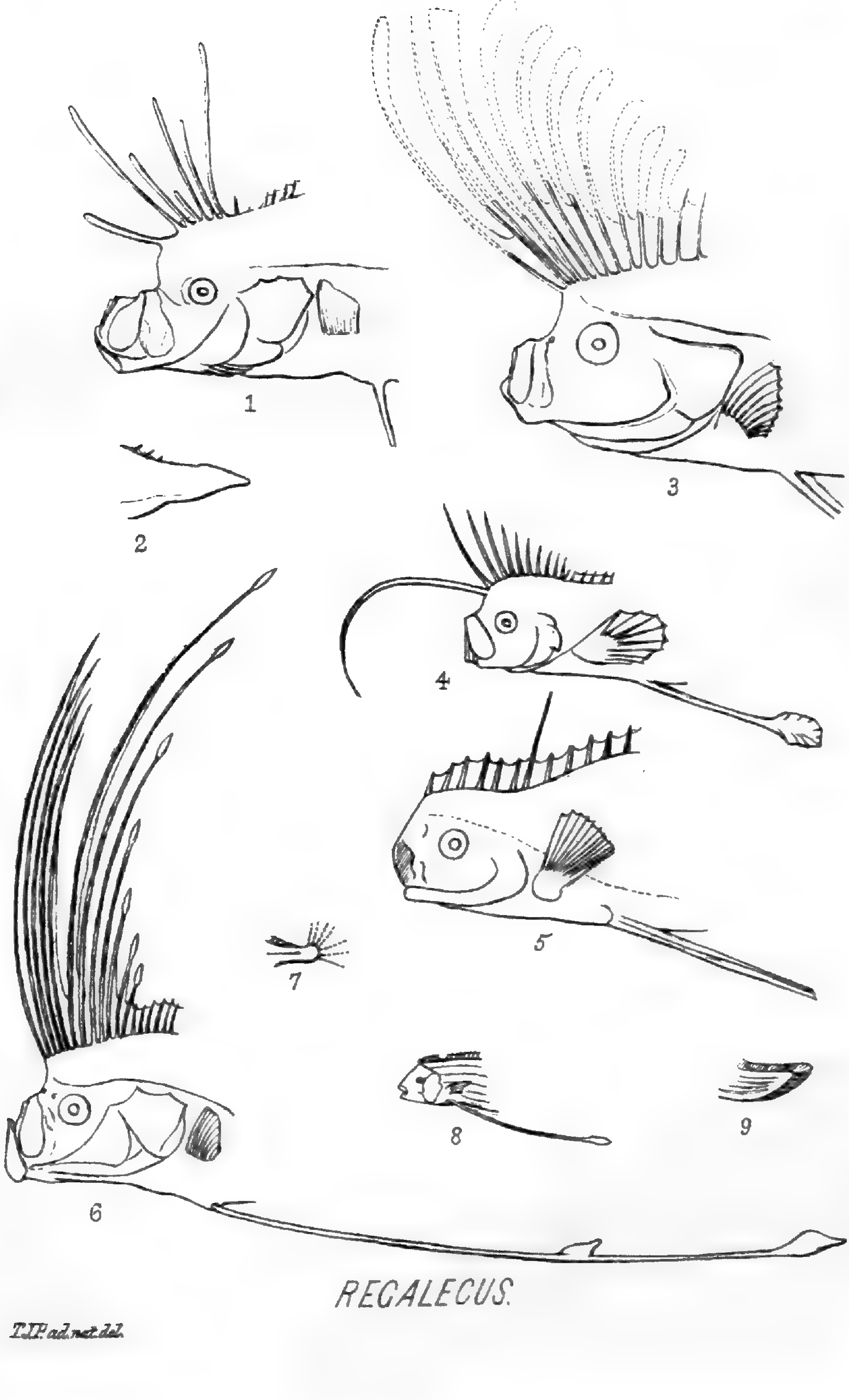
Fig. 2. *Regalecus argenteus*, distal portion of 7th ray of crest (nat. size); *x*, point at which membrane became broken.

Fig. 3. *Regalecus argenteus*, transverse section through the body, at about the middle ($\frac{1}{4}$ nat. size).

d.f, dorsal fin: *g.c*, gastric cæcum: *h.a*, hæmal arch, enclosing caudal artery and vein: *l.l*, lateral line: *n.a*, neural arch, enclosing spinal cord: *r.r*, tuberculated ridges: *v*, centrum of vertebra.

Plate XXIV.

Fig. 1. Head of *R. pacificus* } after von Haast.
2. Tail " " } after von Haast.
3. Head of *R. banksii*, after Hancock and Embleton.
4. " " (?), from Gray.
5. " " (?), "
6. " *R. gladius* } after Cuvier.
7. Tail of " } after Cuvier.
8. Head of *R. glesne* } from Yarrell, after Schneider.
9. Tail " " } from Yarrell, after Schneider.



REGALECUS.

T.J.P. ad nat. del.

ART. XXI.—*On the Structure of the Head in* Palinurus, *with especial Reference to the Classification of the Genus.* By T. JEFFERY PARKER, B.Sc.

[*Read before the Otago Institute, 11th September*, 1883.]

Plate XXV.

ON my voyage out from England I was much interested to find that the marine crayfish (*Palinurus lalandii*), brought on board at the Cape of Good Hope, differed in a remarkable way from the common English species *P. vulgaris*, in that it had no trace of the stridulating organ, one of the most specialized characteristics of this very specialized genus.

The species of *Palinurus* are arranged by systematists in two groups or sub-genera, originally founded by Milne-Edwards,* who defines them as follows:—

" *Sous-genre des Langoustes ordinaires.*

"Les Langoustes ordinaires présentent sur le milien du front une petite dent rostriforme plus ou moins saillante; l'anneau antennulaire est très-étroit, de façon que les antennes externes se touchent presqu' à leur base, et recouvrent les antennes internes; enfin celles-ci se terminent par deux tigelles multi-articulées très-courtes.

" *Sous-genre des Langoustes longicornes.*

"Dans cette division naturelle il n'existe sur le bord anterieur de la carapace aucun vestige de rostre médian; l'anneau antennulaire est très-large et presque carré, de manière à écarter beaucoup les antennes externes et à laisser à découvert les antennes internes; enfin ces derniers organes se terminent par deux tigelles multi-articulées très-longues."

The two species mentioned above (*P. vulgaris* and *P. lalandii*) as presenting such remarkable differences, occur in Milne-Edwards's work as the first and second species of *Langoustes ordinaires*; they are also placed together in Heller's table† as the third and fourth species of the same subgenus, no hint being given in either work, or in any other at my disposal, of any important morphological differences between them.

In the present paper I hope to show that a more natural classification of the species of *Palinurus* may be obtained by taking into consideration certain points in the anatomy of the head, which have hitherto been largely ignored by systematists, although, as it seems to me, of fundamental importance. The chief of these have to do with the sound-producing or stridulating organ, first mentioned, I believe, by Leach,‡ in *P. vulgaris*, and described at length, in the same species, by Möbius,|| and subsequently by myself.§

* Hist. Nat. des Crustacés, ii., p. 289.

† Reise der Novara, Zool. ii., Crustacea, p. 94.

‡ Malacostraca Podophthalmata Britanniæ.

|| Archiv für Naturgeschichte, 1867.

§ Proc. Zool. Soc., 1878, pp. 292 and 442.

An examination of several species of *Palinurus* has shown that while the stridulating organ is present in all the *Langoustes longicornes* associated with long antennulary flagella and obsolete rostrum, there are some *Langoustes ordinaires* in which it is well developed, others in which it is wholly absent; and further that in the latter group some species have a rostrum quite comparable with that of the *Astacidæ*, others having one so small as to merit special description only from its position.

I propose to describe, somewhat in detail, the structure of the head in *P. edwardsii*, *P. vulgaris* and *P. interruptus*, in order to bring out the points of likeness and of difference in three typical forms.

In *Palinurus edwardsii*, one of the common New Zealand species, the carapace is produced in front into an upturned rostrum (figs. 1 and 4, *r*) which is confluent laterally with the large supra-orbital spines (*s. or. sp*). The ventral faces of these latter pass insensibly into the "epimeral plates" (*epm. pl.*)* which form the posterior walls of the orbits, and are fused externally with the anterior border of the carapace and internally with the antennulary sternum (*ant. st.*). This latter is a vertical bar, just wide enough below to furnish the articular facets for the antennules (*ant.* 1′), and narrowing to its dorsal end where it becomes bent backwards at a right angle (fig. 1) to join with the epimeral plates. The latter, which are considered by Huxley as representing antennulary epimera,† bound a transversely oval area, consisting of uncalcified chitin, and bearing the small movable ophthalmic segment (*oph.*) or pseudo-segment, the middle portion of which is calcified, forming the so-called ophthalmic sternum. The epimeral plates are thus united with one another above and below the eye-bearing space forming *supra-ophthalmic* and *infra-ophthalmic bars*.

The infra-ophthalmic bar gives off on each side of the middle line a pedate process (*cl. pr*) which extends forwards in contact with, but quite free from, both its fellow of the opposite side and the dorsal or horizontal portion of the antennulary sternum. Each of these processes ends in a sharp spine and, from its proximal end, sends off an upwardly directed off-shoot ending in two small spines, which is so closely applied to the lateral surface of the rostrum that the latter appears to be actually squeezed between the two *clasping processes* as they may be conveniently termed (*cl. pr*, figs. 1 and 4).

These clasping processes appear to have been very imperfectly described hitherto. Milne-Edwards merely says that there are two small spines below the base of the rostrum (in *P. lalandii* which agrees in all important

* Huxley, "The Crayfish," p. 156, fig. 40.

† Is it not more likely that these plates represent the ventral region of the unsegmented præstomium? If embryology should answer this question in the affirmative it will be convenient to speak of a single *præstomial plate* consisting of lateral, supra-ophthalmic, and infra-ophthalmic portions.

respects with *P. edwardsii*), and the same statement is made by Miers* and by Haswell.† The processes are perfectly distinct from the rostrum, either being removable without injury to the other, and clearly belong to the epimeral plates, so that if the latter are, as Huxley supposes, antennulary epimera, the clasping processes are to be looked upon as epimeral—or possibly as partly sternal and partly epimeral—outgrowths of the antennulary segment.

The true relations of the rostrum are very imperfectly seen in an external view: owing partly to the presence of the clasping processes which form an apparent proximal boundary to it, partly to the fact that on its dorsal surface it widens out suddenly and becomes confluent with the supra-orbital spines, it appears externally as a very small structure, hardly larger indeed than the clasping processes (fig. 4). But a longitudinal section (fig. 1) shows that it is really a structure of considerable size, being continued backwards some distance behind the clasping processes, and a short distance behind the ophthalmic segment where its ventral plate turns sharply forward and becomes continuous with the supra-ophthalmic bar of the epimeral plates.

A short distance on each side of the middle line the supra-ophthalmic bar is produced into a small hollow *procephalic process* (fig. 1, *prc. p.*) which passes backwards, upwards, and outwards into the interior of the head quite like the homologous structure in *Astacus* and *Homarus*, from which it differs only in its small size: in a moderate sized specimen (8 or 9 inches) of *P. edwardsii* it is only about $\frac{1}{10}$ inch in length.

The proximal segments (coxocerites) of the antennæ are, as in other species of the genus, fused with the carapace, so that the apparently proximal segment is really the second or basicerite (*bc*); of the coxocerites only the ventral portions are left, their lateral and dorsal regions being as it were squeezed out of existence by the immense development of the free portions of the antennæ, the articular cavities for which are thus bounded above by the epimeral plates, internally by the antennulary sternum, externally by the anterior borders of the carapace, and only below by the coxocerites. The fused coxocerites thus come to occupy the position of the epistoma of *Astacus*,‡ from which, however, they are at once distinguished by bearing the renal apertures. Posteriorly they are continued in the middle line into a projecting transverse bar (*ep*) which gives attachment to the labrum, furnishes the antero-internal articular facets for the mandibles, and apparently is the much reduced representative of the true epistoma.

*Cat. of the Stalk- and Sessile-eyed Crustacea of N.Z., 1876.

†Cat. of the Australian Stalk- and Sessile-eyed Crustacea, 1882.

‡ Huxley, "The Crayfish," p. 155.

The bonndary between the two coxocerites is marked externally by a short median longitudinal groove; the point of a fine scalpel pushed into this is found to penetrate easily a short distance into the interior of the head. When the soft parts are removed, and the head is examined from within, the instrument is found to have passed into an extremely narrow cleft between two delicate closely applied plates (*i.cx. pl*), which together form a median crest projecting upwards into the cavity of the head. These plates evidently represent a small portion of the applied inner walls of the coxocerites, and may be called the *internal coxoceritic*, or, for shortness, *coxal plates*. The posterior and outer edge of each coxocerite is similarly produced into a vertical obliquely-set plate (*e.cx. pl*), which may be called the *external coxal plate*. It is very possibly formed, in part, by the epistoma.

The basicerite (*bc*), or proximal segment of the movable part of the antenna, articulates with its socket (*ant.* 2′) in the usual way by two hinges; one of these is dorsal and internal (fig. 4, *h*), and is situated at the upper end of the antennulary sternum just where it turns sharply backwards; the other is ventral and external, and is situated at the junction of the coxocerite with the carapace. The articulation is thus an oblique one, elevation being accompanied by abduction, depression by adduction.

The rule in Crustacea is for each segment of a limb to be moved by two muscles, inserted into its proximal edge at points intermediate between the hinges. There are two such muscles to the basicerite of *Palinurus edwardsii*: one inserted dorso-externally, arising from the inner surface of the carapace and acting as combined elevator and abductor; the other ventro-internal, arising bi-pinnately from the outer surface of the internal, and from the inner surface of the external coxal plate, and acting as combined depressor and abductor. But besides these, the proximal edge of the basicerite is produced, immediately below the insertion of the elevator, into a strong serrated ridge, into which is inserted a muscle arising from the outer face of the external coxal plate. This being inserted above and external to the ventro-external hinge, must act as an additional elevator and abductor.

Essentially the same structure of the anterior part of the head is seen in *P. lalandii* and in *P. hügelii*: in the latter species, as I am informed by Mr. T. W. Kirk, the clasping processes are smaller than in *P. edwardsii*, but there is no difference of importance.

In *P. vulgaris*, on the other hand, great and important differences are at once apparent. A vertical section (fig. 2) shows that the rostrum (*r*) is a mere insignificant spine, smaller than those on the lower edge of the supra-orbital spines (*s. or. sp*), and no larger than the spiniform tubercles with which the surface of the carapace is covered. As a result of this, the ophthalmic sternum (*oph*) is quite bare and fully visible in a view from above (fig. 5), there being, further, no trace of "clasping processes" developed from the antennulary sternum.

Still more striking are the modifications of the antennulary sternum (fig. 2, 5, and 7, *ant. st.*): it "forms a projecting vertical keel, with a rounded anterior border, and slightly convex sides; the anterior border is grooved in the middle line, the groove being bounded on each side by a strong smooth ridge (*r*); each lateral surface is marked with a shallow groove (*g*), and between the groove and the border, to which it is parallel, the surface (*s*) is so smooth as to have the texture of polished ivory."* This keel, which constitutes the fixed portion of the stridulating organ, is broad at its postero-dorsal extremity, and thus interposes a wide space between the dorsal ends of the basicerites, but ventrally it becomes much narrower, so that the basicerites, being applied closely to its lateral surfaces, are very closely approximated at its antero-ventral extremity (fig. 5). For this reason the bases of the antennules are concealed, in a view from above, by those of the antennæ, as in *P. edwardsii.*

The articulation of the basicerite with its socket presents the noteworthy peculiarity of the absence of the dorso-internal hinge. From the spot where this hinge occurs in *P. edwardsii*, a strip of uncalcified chitin extends distalwards, and is so modified as to form the movable portion of the stridulating organ. The upper edge of the strip of chitin is produced into a large outstanding flap (figs. 5 and 8, *fl.*), immediately beneath which "the chitin becomes thickened and takes on the form of an oval area or pad (*p*) marked by a number of fine parallel ridges. In relation with the inferior edge of this pad is a small calcified tubercle (*t*). When the antenna is in place the flap works over the ridge (*r*) on the corresponding side of the anterior border of the antennulary sternum, the tubercle fits into the groove (*g*) on its lateral surface and the ridged pad is closely applied to the smooth space (*s*) between the groove and the border. Under these circumstances, when the antenna is moved upwards, the friction of the pad against the smooth surface produces a loud and grating noise, the principle being similar to that of the sound produced by the friction of india-rubber against paper. The apparatus can at any time be thrown out of gear and the antenna move noiselessly by slightly abducting the latter."†

In consequence of the absence of the upper hinge the movement of the antenna is not, as in *P. edwardsii*, confined to one plane. I am disposed to think that the additional abductor muscle, described above in that species, has, in *P. vulgaris*, the special function assigned to it of abducting the antenna when it is to be moved noiselessly.

* Proc. Zool. Soc., 1878, p. 292.

† Proc. Zool. Soc., 1878, p. 292.

The internal coxal plates (*i. cx. pl.*) have the same relations as in *P. edwardsii*, indicating imperfect fusion of the coxocerites: external coxal plates are also present. There is, however, no trace of procephalic processes.

In *P. trigonus*, another of the *Langoustes ordinaires*, I am informed by Mr. Haswell that there is a prominent squarish rostrum covering the ophthalmic segment, but that in other respects the resemblance to *P. vulgaris* is very close, there being a well developed stridulating organ, and no clasping processes.

In *P. interruptus*, as well as in all other *Langoustes longicornes* which I have examined or obtained descriptions of, there is a stridulating organ of essentially the same structure as in *P. vulgaris*. The antennulary sternum (figs. 3 and 6, *ant. st.*) is, however, truncated in front instead of pointed, so that no part of it overhangs the articular ends of the antennules, which are therefore visible in a view from above. Moreover, the antennulary sternum is nearly as broad in its antero-ventral as in its postero-dorsal region, so that the basicerites (*bc*) are kept widely separated, and do not, as in all the *Langoustes ordinaires*, partly hide the bases of the antennules when the animal is viewed from above.

As in *P. vulgaris*, there is no trace of procephalic processes. The rostrum also is completely aborted.

The fused coxocerites present no trace of the median groove mentioned in the preceding species, and in correspondence with this the internal coxal plates are absent (fig. 3), so that fusion of the coxocerites is complete. Instead of there being two distinct external coxal plates, one for each coxocerite, there is a single transverse sub-vertical *posterior coxal plate* (*p.cx. pl*) consisting of two laminæ, an anterior formed by the posterior walls of the coxocerites, and a posterior furnished by the epistoma (*ep*).

Coming now to the general bearing of these facts, it seems clear, to begin with, that the *Langoustes ordinaires* do not form a natural assemblage, since some of the species included in the sub-genus have a well-developed rostrum, simple unmodified antennulary sternum, etc., while others possess a perfectly formed stridulating organ,—always a mark of high specialization, rare under any form in Crustacea,* and in the present case of a quite unique type of construction.

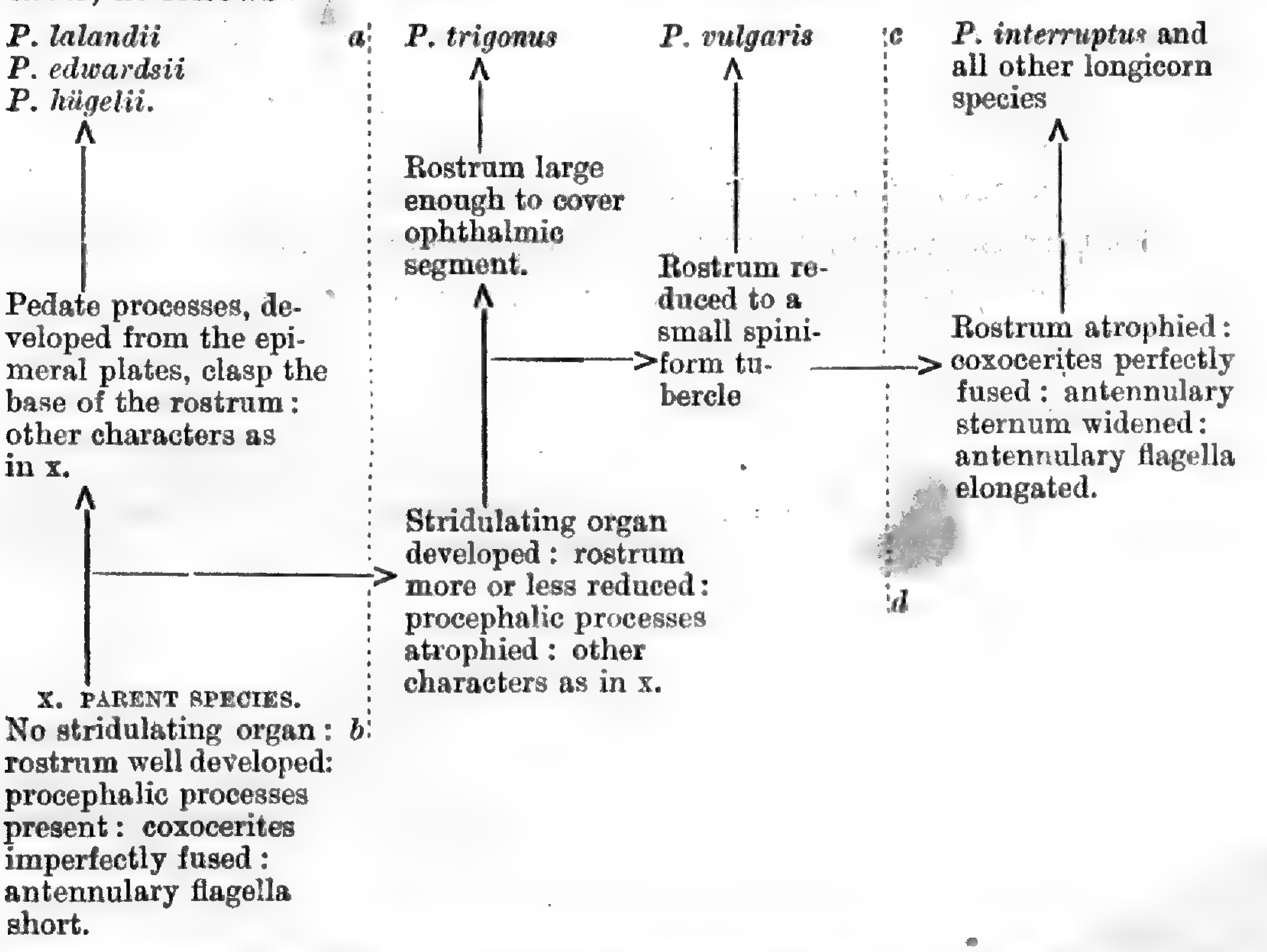
The *longicornes* on the other hand form a strictly natural group, since they all possess the stridulating organ and long antennulary flagella, while none have any trace of a rostrum.

* See Wood-Mason, Proc. Entom. Soc. Lond., Nov. 1877, p. xxvii.

Moreover *P. vulgaris* and *P. trigonus* are seen to be intermediate between the species without a stridulating organ and the longicorns, approaching more nearly, however—at least so it seems to me—to the latter, in virtue of the possession of that mark of high specialization the stridulating organ.

Assuming, as I think one is bound to do, that the *Palinuridæ* are descended from some Astacine or Homarine ancestor, probably through some such intermediate form as *Palinurellus*,* one cannot but conclude that the species which have no stridulating organ, a well-developed rostrum, and imperfectly fused coxocerites come nearest to the primitive stock, and that those species in which the stridulating organ is present, the rostrum atrophoid, and the coxocerites completely fused, have undergone the widest divergence from that stock and present us with the extreme of modification of the Palinuroid type.

These views may be conveniently expressed in the form of a phylogenetic table, as follows:—



Assuming that this table is an accurate expression of the relationships of the species of *Palinurus*, I think there can be no doubt that, in classifying the species, the most important division must come along the line *a b*, which divides the comparatively generalized non-stridulating forms from

* I have unfortunately neither specimen nor description of this interesting genus, and take the fact of its being the most primitive of the *Palinuridæ* from a brief notice of a paper by Boas (Studier over Decapodernes Slaegtskabsforhold) in the "Zoological Record for 1880," p. (Crust.) 32.

those which possess the stridulating organ. A second very natural subdivision, but of less importance than the first, is indicated by the line *c d* which divides the stridulating species into brevicorn and longicorn forms.

For systematic purposes it will probably be convenient to employ both these boundary lines, that is, to divide the species into three sub-genera instead of two as heretofore. The non-stridulating species or *Silentes* form the first sub-genus, which I propose to call *Jasus*:* the stridulating forms or *Stridentes* fall into two sub-genera, one of brevicorn species, to which the name *Palinurus* may be restricted, and one of longicorn species, equivalent to Milne-Edwards's *Langoustes longicornes*, Gray's *Panulirus*, and Pfeiffer's *Senex*.

Put in a tabular form the classification I propose is as follows:—

Genus **Palinurus**, Fabr.

A. Silentes. Stridulating organ absent; rostrum well developed, clasped by paired pedate processes of the epimeral plates; procephalic processes present; coxocerites imperfectly fused; antennulary flagella short.

Sub-genus **Jasus**, T.J.P.,

Includes *P. lalandii*, *P. edwardsii*, and *P. hügelii*.

B. Stridentes. Stridulating organ present; rostrum variable, but rarely (? never) as well developed as in *A*; pedate clasping processes absent; procephalic processes absent.

a. Antennulary sternum narrow below and bases of antennæ consequently approximated; bases of antennules hidden, in a view from above, partly by the antennulary sternum, partly by the antennæ; coxocerites imperfectly fused; antennulary flagella short.

Sub-genus **Palinurus**, Fabr., in part.

α. Rostrum well developed, covering ophthalmic segment.

P. trigonus.

β. Rostrum reduced to a small spiniform tubercle; ophthalmic segment uncovered.

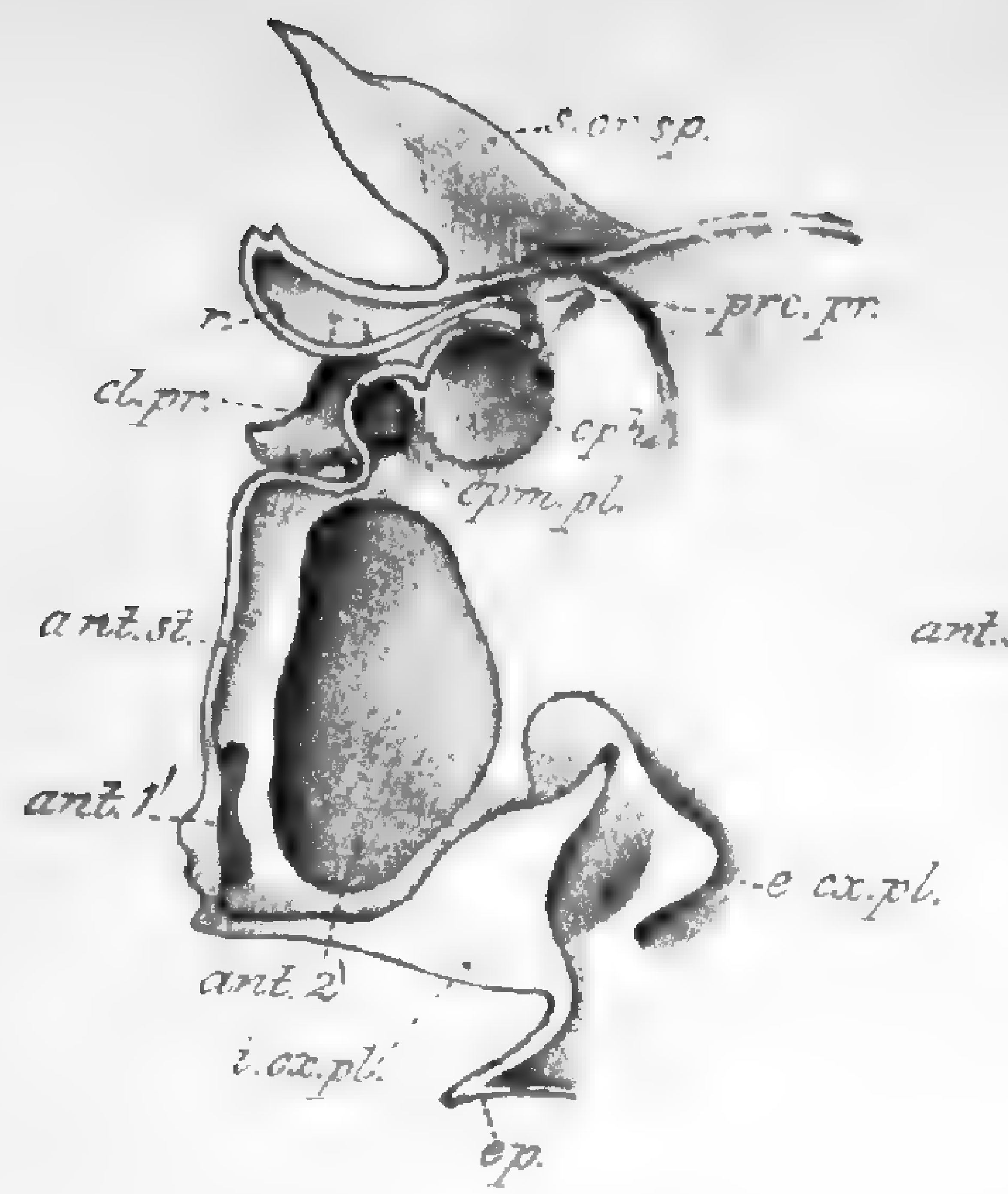
P. vulgaris.

b. Antennulary sternum broad below, causing a wide separation of bases of antennæ; bases of antennules visible in a view from above; rostrum absent; ophthalmic segment uncovered; coxocerites perfectly fused; antennulary flagella long.

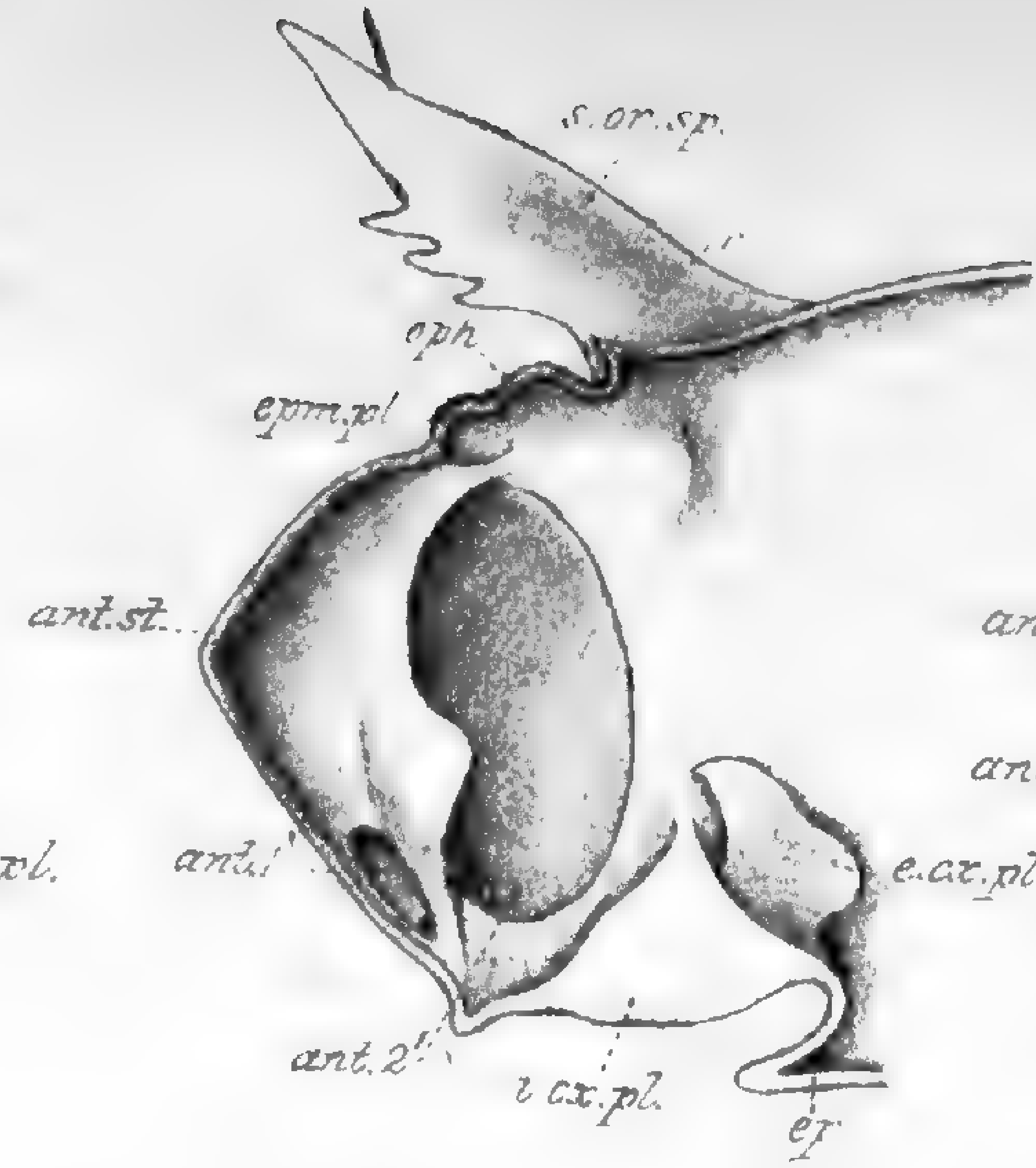
Sub-genus **Panulirus**, Grey, **Senex**, Pfeiffer,

Includes *P. interruptus*, *P. japonicus*, *P. penicillatus*, *P. ornatus*, etc.

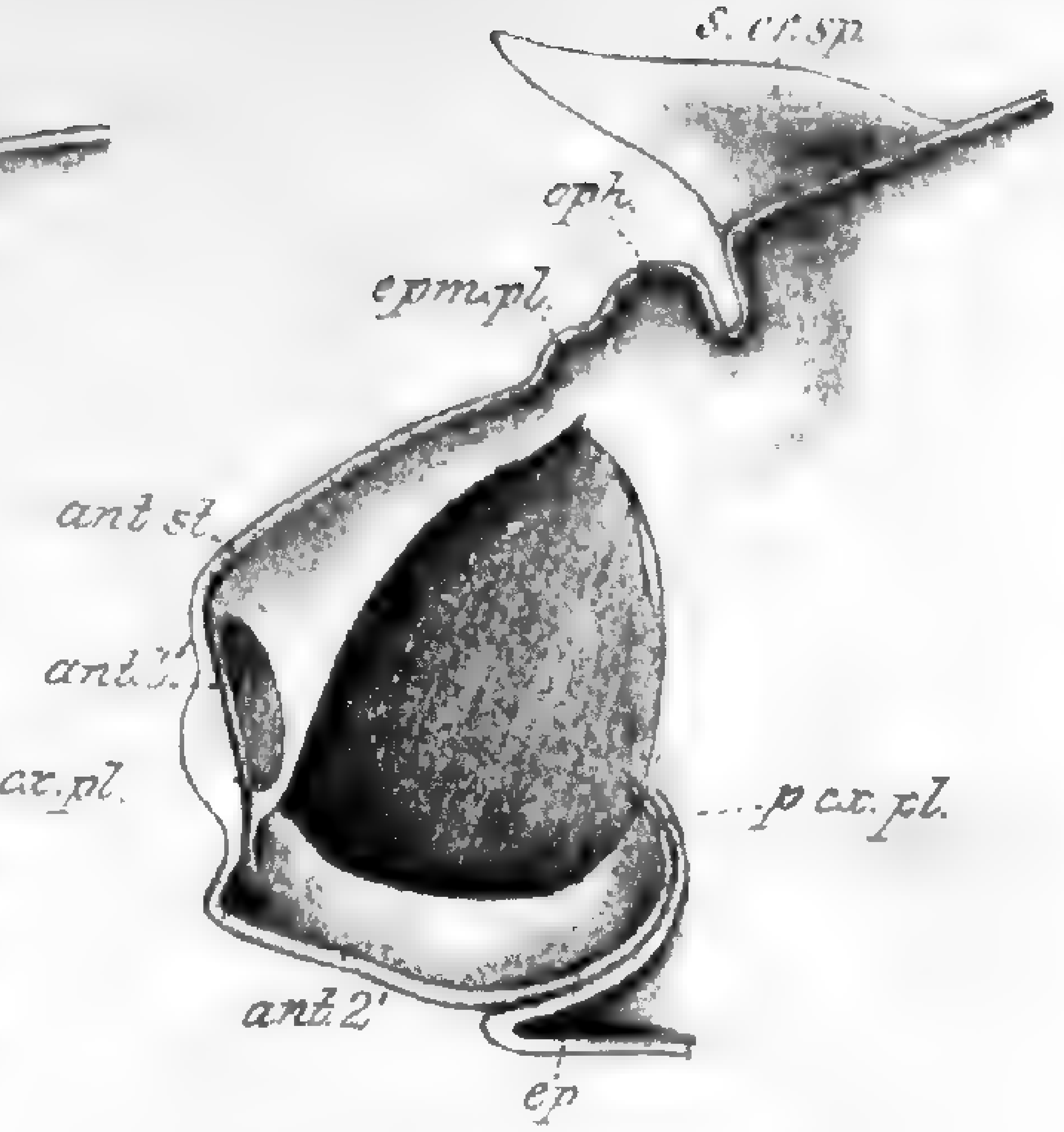
* Jasus, according to Lemprière, was the father of Palinurus.



1. P. EDWARDSII.

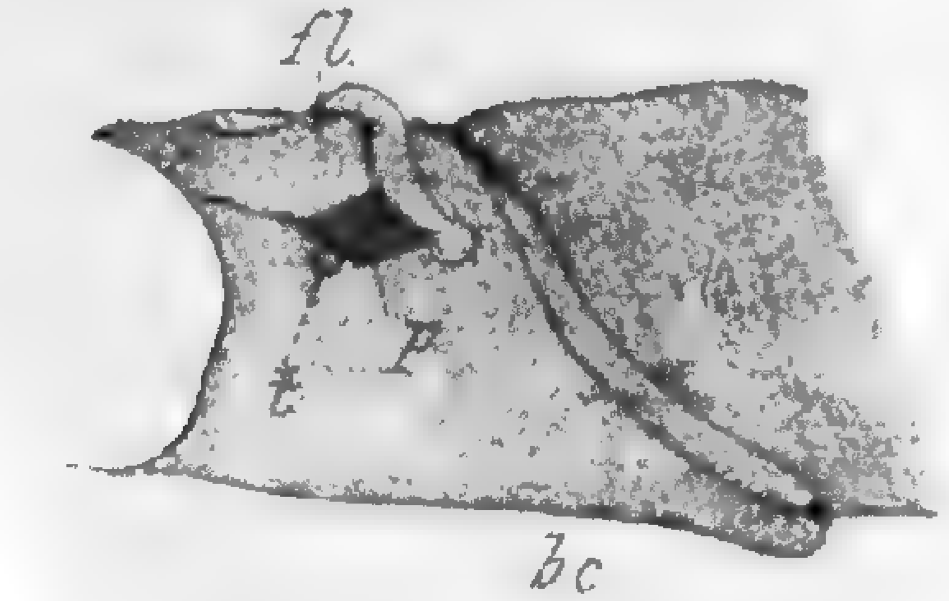


2. P. VULGARIS.



3. P. INTERRUPTUS.

7



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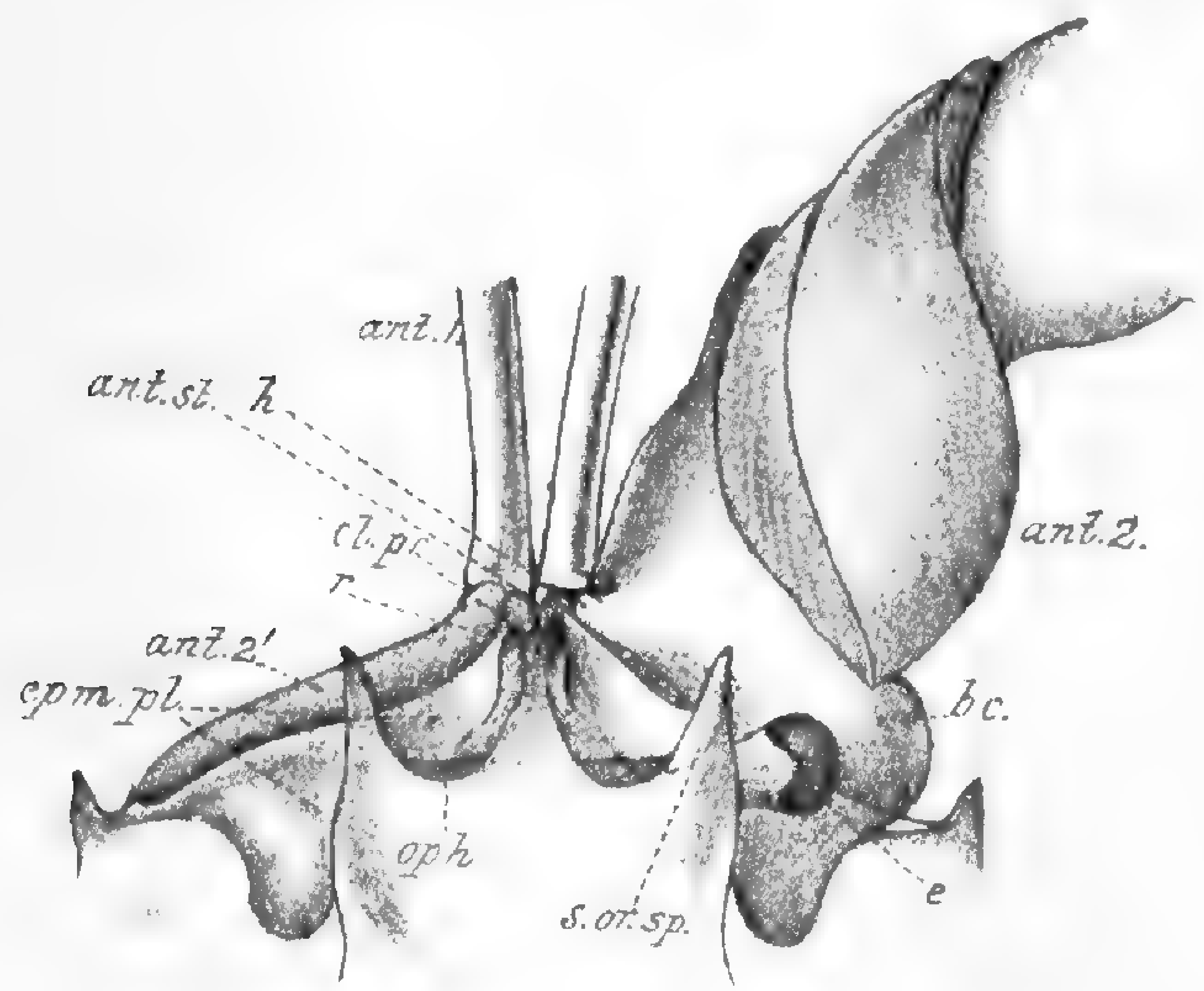
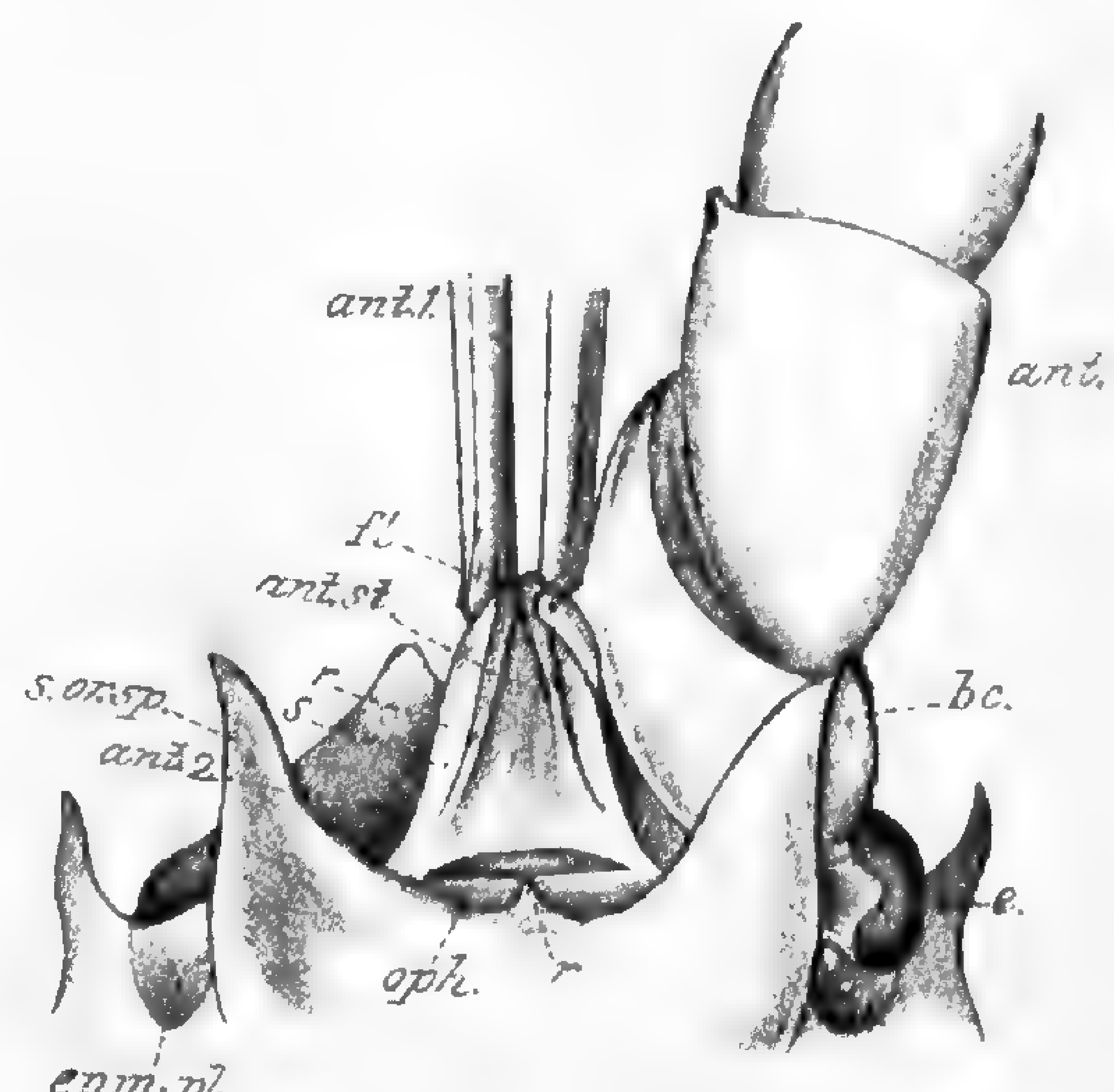
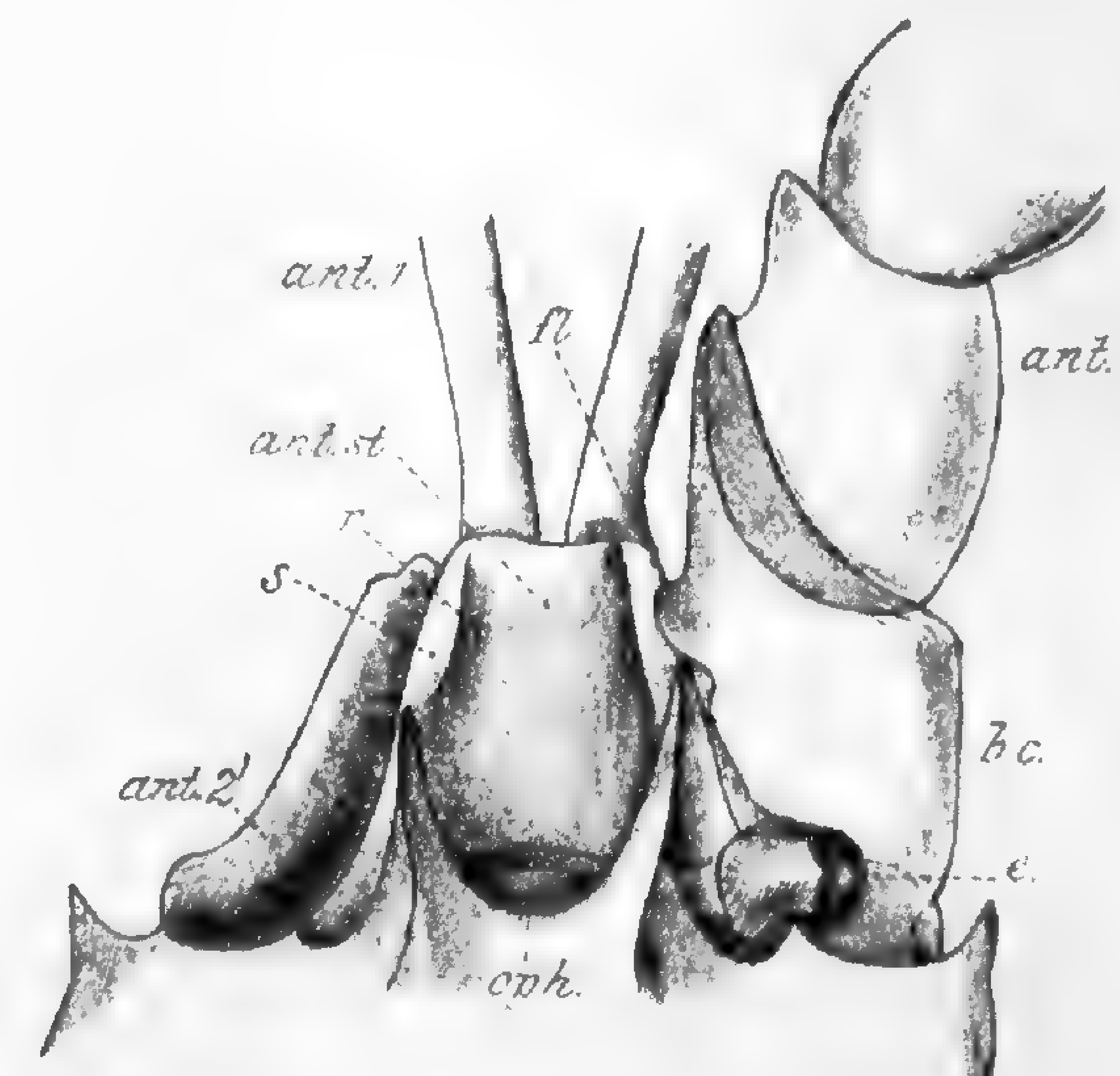
P. VULGARIS.



4. P. EDWARDSII.



5. P. VULGARIS.



6 P. INTERRUPTUS.

T.J.P. del.

PALINURUS

J.B. lith.

There appear to be some interesting facts about the geographical distribution of the *Palinuridæ*, but my information is too scanty to allow of my doing more than glance at this part of the subject. I think there can be no doubt that all the longicorn species (*Panulirus*) agree in essential characters with *P. interruptus*, but I can unfortunately obtain no definite information as to two of the brevicorns, *P. longimanus* and *P. frontalis*, and am, therefore, unable to say whether they should come under *Jasus* or under *Palinurus*, as restricted by me.

Leaving these two species aside, it is worthy of remark that all the species of *Jasus* are confined to the Southern Hemisphere (Ethiopian and Australian Regions), and those of *Palinurus*, as restricted above, to the Northern Hemisphere (Palæarctic Region), while those of *Panulirus* occur in both hemispheres, and, as far as I can make out, in all the zoogeographical regions.

In concluding this paper I wish to offer a few remarks on Mr. C. Chilton's views of the affinities of *Palinurus*, as set forth in his paper on *Paranephrops* in the last volume of these "Transactions."*

Mr. Chilton says:—"The most important result arising from the examination of *Paranephrops setosus* is that its affinity to *Palinurus* now seems to be placed beyond doubt. *Paranephrops* and the *Parastacidæ* generally resemble the *Palinuridæ* in that they have no appendages upon the first abdominal segment; in this they differ from the crayfishes of the Northern Hemisphere, and from *Homarus* and *Nephrops*. The *Palinuridæ* and the *Parastacidæ* also agree in having hooked setæ, while in the *Potamobiidæ* and the lobsters the setæ are not hooked. Moreover the branchial formulæ of *Palinurus* and *Paranephrops* are almost identical. Taking the presence or absence of the first abdominal appendage as the basis of his classification, Professor Huxley placed the *Palinuridæ* and the *Parastacidæ* together as the *Astyla*, while the *Potamobiidæ*, *Homaridæ*, etc., together form the *Stylophora*. This classification is confirmed by the structure of the male reproductive organs in *Paranephrops setosus*, for these agree in every essential particular with those of *Palinurus vulgaris* as described by Brocchi." After quoting Huxley's theory of the origin of *Potamobiidæ* and *Parastacidæ* from a common ancestor, distinguished as *Protastacus*, Chilton goes on to say "I have only to add that the *Protastacus* stock appears to have left *Palinurus*, which has lost the chelate limbs possessed by its ancestors, as its marine representative in the Southern Hemisphere."

* On some Points of Difference between the English Crayfish (*Astacus fluviatilis*), and a New Zealand one (*Paranephrops setosus*), Trans. N.Z. Inst., vol. xv., p. 150.

On re-reading the paper of Professor Huxley's referred to in the foregoing quotation,* it appears to me that Mr. Chilton has been misled by having taken a useful and suggestive table of morphological characters for a natural classification. A very similar table is given in Huxley's paper on *Ceratodus*,† in which the *Ichthyopsida* are divided, according to the mode of attachment of the mandible, into *Autostylica*, *Amphistylica*, and *Hyostylica*, but it is certainly not intended to convey the impression that the *Dipnoi* are more nearly related to the Amphibia than to the Ganoids from the fact that the two former belong to the *Autostylica*, while Ganoids are hyostylic.

It is evident from even a casual examination, and is implied, although not stated explicitly, in the paragraph of Huxley's paper beginning :—"Let it be supposed,"‡ that the *Potamobiidæ* and the *Parastacidæ* are more nearly allied to one another than is either of them to any other family of Crustacea. To say that the *Parastacidæ* are more nearly allied to the *Palinuridæ* than to the *Potamobiidæ*, because they are astylic, is not more reasonable than to say that *Anguis* is more nearly allied to the *Ophidia* than to the *Lacertidæ*, because it is apodal. In the same way, to unite the *Parastacidæ* with *Palinurus*, and to separate them from the *Potamobiidæ*, on the ground that the two former possess a more primitive type of male reproductive apparatus than the latter, is equivalent to grouping Ganoids with Elasmobranchs rather than with Teleosts, because of the abnormal condition of the urino-genital organs in bony fishes.

What Professor Huxley shows clearly enough is that, while the *Homarina* are more closely allied to the *Potamobiidæ* than to the *Parastacidæ*, the reverse is the case with the *Palinuridæ*. He does not discuss the question of the origin of the latter family, nor say whether he considers its affinities to be, on the whole, Astacine or Homarine.|| It is perhaps an open question whether true genetic affinities are more clearly indicated by the loss of the first abdominal appendage, and by the structure of the male organs and the setæ, or by the structure of the gills; but, at any rate, it must not be forgotten that *Palinurus* agrees with the *Homarina* in having the podobranchs completely divided into gill proper and epipodite and thus differs widely, in an important structural peculiarity, from the *Parastacidæ*.

However, this may be, it is certain that the interval separating *Palinurus* from the *Parastacidæ* is far wider not only than that which separates the latter from the *Potamobiidæ*, but than that existing between the *Astacina* and the *Homarina*. To hold otherwise is equivalent to denying the value of both anatomy and embryology as guides to genetic affinity.

* On the Classification and the Distribution of the Crayfishes, Proc. Zool. Soc., 1878, p. 752.

† Proc. Zool. Soc., 1876, p. 24. ‡ Quoted by Chilton, *loc. cit.*, p. 152.

|| Boas, in the paper referred to above, seems to derive *Palinurellus* from a Homarine ancestor.

I am greatly indebted to Mr. T. F. Cheeseman, F.L.S., of the Auckland Museum, for procuring me a spirit specimen of *Palinurus vulgaris*, and to Mr. W. A. Haswell, M.A., and Mr. T. W. Kirk, M.A., for much needed information respecting species of *Palinurus* in the Sydney and Wellington Museums of which I was unable to obtain either specimens or accurate descriptions.

I shall be very grateful to anyone who will furnish me with descriptions of the head in *Palinurus longimanus*, M.-E., *P. frontalis*, M.-E., *Palinurellus*, Boas, and *Palinustus*, Alph. M.-E., or, still better, who will procure me specimens of these forms.

EXPLANATION OF PLATE XXV.

Reference Letters.

ant. 1, antennule.
ant. 1′, articular cavity for antennule.
ant. 2, antenna.
ant. 2′, articular cavity for antenna.
ant. st., antennulary sternum.
bc., basicerite.
cl. pr., clasping processes.
e., eye-stalk.
e. cx. pl., external coxal plates.
ep., epistoma.
epm. pl., epimeral plates.
fl., flap of movable part of stridulating organ.
g., groove on lateral surface of antennulary sternum, for tubercle (*t.*).
h., dorso-internal hinge of antenna.
i. cx. pl., internal coxal plates.
oph., ophthalmic segment.
p., ridged pad of movable part of stridulating organ.
p. cx. pl., posterior coxal plates.
prc. pr., procephalic processes.
r., ridge on antennulary sternum.
s., smooth surface on antennulary sternum forming fixed part of stridulating organ.
s. or. sp., supra-orbital spines.
t., guiding tubercle of movable portion of stridulating organ.

N.B.—All the figures are diagrammatic, unessential details (spines, tubercles, etc.) being omitted.

Fig. 1. Longitudinal vertical section of the head of *Palinurus edwardsii*.
2. " " " " *Palinurus vulgaris*.
3. " " " " *Palinurus interruptus*.
4. Anterior part of head of *Palinurus edwardsii* seen from above.
5. " " *Palinurus vulgaris*. "
6. " " *Palinurus interruptus*. "
7. Antennulary sternum of *Palinurus vulgaris*, from the left side.
8. Proximal end of antenna of *Palinurus vulgaris*, from the inner side.

Art. XXII.—*Observations on the Breeding Habits of the Eastern Golden Plover* (Charadrius fulvus). By C. H. Robson. Communicated by W. L. Buller, C.M.G., Sc.D., F.R.S.

[*Read before the Wellington Philosophical Society, 31st October*, 1883.]

This interesting bird is dismissed by our leading naturalists with so few words that one is induced to think that little is known as to its habits, and that a few remarks on them from personal observation may not be uninteresting. Unlike others of the *Charadriadæ*, the Golden Plover's plumage undergoes little or no change from summer to winter; its habits of flight and feeding are however very similar to those of *C. obscurus* as described by Dr. Buller; its food is of the same kind, and it likewise resembles that bird in the construction of its nest and the locality chosen for making it. On the 9th of January last a Golden Plover was found sitting on three eggs at the northern end of Portland Island. The nest is a very simple affair, composed of a little grass laid in a slight hollow amongst the driftwood a few yards above high water mark; the egg is large for the bird, being about the size of a pullet's, ovoid, a good deal pointed, in colour of a light greenish yellow with irregular blotches of dark rufous brown, almost black in the larger spots, and varying in size from a pin's head to a shilling, the largest being at the more obtuse end of the egg. When disturbed the bird rose with a harsh rattling cry, but did not seem frightened, and returned to the nest after a few minutes. On the 10th the nest was not visited, it being thought best not to disturb the bird again so soon; and on the 11th, on going to it for a specimen egg, the nest was found deserted and the eggs gone, not a particle of shell remaining.

Art. XXIII.—*On some rare Species of New Zealand Birds.* By Walter L. Buller, C.M.G., Sc.D., F.R.S.

[*Read before the Wellington Philosophical Society, 31st October*, 1883.]

Sceloglaux albifacies.

Mr. W. W. Smith, formerly residing on the Albury estate near Timaru, and now settled at the Ashburton, has sent me from time to time very interesting notes on this rare owl. He has not only been exceptionally fortunate in getting specimens, but he has likewise been successful in his endeavours to make them breed in captivity. The following extract from one of his earliest communications on the subject will show what a good observer Mr. Smith is, and how keen his love of natural history. I have received many letters from him since, all replete with interesting facts, chiefly relating to this species; and I am also indebted to him for several fine specimens of the bird, together with eggs and a newly-hatched chick:—

"February 8, 1882. In compliance with your request I have much pleasure in writing a short account of my experience in trying to breed the Laughing Owl. The drawing of the bird made a great impression on me when I saw it for the first time in the "Birds of New Zealand," and since then I had been searching for over five years, trying to procure a specimen; but I was never successful until April of last year I succeeded in finding a very handsome one; in June I found another pair, and again in September I found two more. They have been a great source of pleasure and instruction to me. I found the birds in fissures of the limestone rock on this place (Albury), but they are certainly very difficult to find. I first discovered that they were about the rocks by finding several fresh pellets, and being anxious to secure a specimen, I procured long wires and felt in the crevices, but with no good results. I, however, discovered a plan which proved successful. I collected a quantity of dry tussock grass and burned it in the crevices, filling them with smoke. After trying a few places, I found the hiding-place of one, and, after starting the grass, I soon heard him sniffling. I withdrew the burning grass, and when the smoke had partly cleared away, he walked quietly out, and I secured him. I obtained four birds by this means. I explained in a former letter how very tame they became in a short while after being captured. I also mentioned their call which varies considerably during the year. When I captured the second pair (male and female) their call for a long time, in waking up in the evening, was, as formerly stated, precisely the same as two men cooeying to each other from a distance. The voice of the male is much harsher and stronger than the female, and he is also a much larger and stronger bird. During the period of hatching he is very attentive in supplying her with food, as no sooner had the food been put into the large apartment of their house, than he would regularly carry every morsel into the dark recess; when feeding her she would utter a low peevish twitter and rise off her eggs. I may here correct a mistake which I made in writing to you on a former occasion. I stated that 'The male sits by day, the female by night.' I only saw the male twice on the eggs, and it was at this time I wrote the letter, but I certainly was mistaken, as the female performs most of the duty of hatching. I also ascertained the difference of the sexes by separating them at night until the second egg was laid. The females are much shyer and more timid than the males, as they hide themselves on hearing the least noise. After sitting nine days on her first eggs, the female forsook them, and all efforts to induce her to sit again were unavailing. She laid two more eggs a month afterwards, and had sat seven days, when, I regret to say, I had to leave home for medical treatment at Timaru. When I returned, eight days afterwards, she was still sitting and continued to sit until the 17th November, when she left the eggs without bringing out the young. The eggs must have been allowed to get cold, when eight or nine days sat-on, as when I tried to blow them I found they contained embryo chicks. I am glad, however, that I succeeded in getting the eggs; another season I may succeed in getting young birds. I supplied them with many different articles of food, such as beetles, lizards, mice, rats, rabbits, and mutton, of all of which they partook freely; but they have the greatest preference for young or half-grown rats. They are a little slow and clumsy in capturing living prey, but their want of proper exercise and freedom may account for this; it may be otherwise in their wild state. After what I have pointed out, there can be no doubt that the *Sceloglaux* inhabits the dry warm crevices of rocks. All the birds I captured I found in such places, generally five or six yards from the entrance, perfectly dry, and where no wet could possibly enter. One thing surprised me much—the very narrowness of the entrance to their cranny. In some instances the birds must have forced themselves in. I noticed, however, that the crevices widened as they extended into the rock. The bottoms are covered with soft sand crumbled down from the sides, and affording comfortable resting places.

"Regarding the nidification of this bird, I am no longer surprised that so little is known, and likewise of its natural habits. Considering that it conceals itself in such inaccessible places, and where few would think of searching to find it, as a rule they could lay their eggs and hatch their young unseen and unmolested.

"The breeding season may be said to take place in September and October. I found the bird mentioned in last letter sitting on an egg on the 25th September; but it must have been laid about the beginning of the month, as it contained the chick I sent you. I discovered the bird by reaching a long stick with a lighted taper into the crevice. My captives laid on 23rd, 27th, and 29th September, and again on the 20th and 22nd October. The birds were very restless and noisy for a fortnight before nesting. They begin to moult in December, and are not yet (Feb. 8) in full plumage. When casting their feathers they have a very curious appearance, as they become almost naked. At this stage two of my birds were stung to death a month ago by a swarm of bees passing through the fine wire netting and taking up their quarters on the roof of their dark recess. I was very sorry to lose them, as I cannot now send a living pair. I have one very fine male I will send you in April. I am going to Lyttelton at that time, and I will forward it by the first steamer bound for Wellington. I will likewise send you another owl's egg, but hardly such a fine specimen as any of the two I sent. I intend to search the rocks carefully for more birds, and, if I succeed in finding more, I will not fail in sending you a pair. You may, however, rely on getting a second specimen from me. I should mention that I have collected a quantity of pellets at different times, composed of the hair of rats and mice and the elytra of beetles. Three large species of the latter swarm among the débris beneath the main rock, and certainly constitute part of the bird's food."

HYLOCHELIDON NIGRICANS.

IN a communication which I made to this Society in August, 1878, I quoted a letter I had received from Mr. J. R. W. Cook, of Blenheim, reporting the appearance, on the 9th June, of a swallow hawking in the air on the banks of the Opawa River. From the account which Mr. Cook gave of the bird, I felt no hesitation in identifying it with the Australian Tree Swallow, two occurrences of which in New Zealand had been previously recorded by me. I wrote accordingly to Mr. Cook and begged him to keep a sharp look-out for this rare visitant, and, if possible, to obtain a specimen.

In April last I had the pleasure of receiving from him the specimen which I now exhibit, accompanied by the following letter:—

"Since writing to you in June, 1878, reporting the occurrence here of the Australian swallow, I have not again noticed the bird until the 16th of February last, when I saw another hawking over one of my stubble paddocks. I watched it for some time, and had good opportunities of remarking plumage. The bird appeared to me either immature or weary, the flight being weak and uncertain. I found, too, that the white on the rump was dingy, and the chestnut on the breast faded-looking. There was a stiffish nor'-west breeze blowing at the time, and the bird tried in vain to get past a belt of willow and poplar so long as I was watching.

"On the 20th of last month (March) when duck shooting, I mentioned the occurrence to a party of sportsmen, when one remarked, 'Oh! there have been some birds answering to your description flying about Grovetown for some time back.' Grovetown, I may remark, is situated about four miles from this, and nearly in the centre of the Wairau Valley. After a little talk on the subject it struck me that possibly the birds had been bred there. I said—'The next time you see them, shoot one and send to me.' Yesterday morning one was handed in, but unfortunately I did not see the man who brought it. Fearing that the weather might not allow me to send it to you in the flesh, I have skinned the bird and now send it to you."

Mr. Cook having considerately sent me also the carcase in spirits, I was able to dissect it and to make a preparation of the sternum for Professor Newton's collection at the Cambridge University. It proved to be an adult female, and the stomach contained four large blue-bottle flies almost uninjured and the remains of others in black comminuted matter.

On this point Mr. Cook further remarks in his letter: "Certainly the condition of the specimen is not that of one which has lately made a long aerial trip. In skinning it, although I freely used cotton wool and kept the pepper castor going, I could not help getting the plumage saturated with oil, owing to the excessive fatness of the body."

My correspondent promises to obtain from Mr. Cheeseman, who procured the specimen, full particulars as to when the swallows were first seen, as to whether there seemed to be a family party, and as to when and where this one was shot. In the meantime, he offers the following pertinent remarks: "Do you think that the recent warm weather and the early and frequent nor'-westers have had anything to do with the appearance of the swallows once more? Again, what do you think becomes of the stray birds which find their way to New Zealand? I should say it is very unlikely, judging from the prevalent winds, that they could ever return to Australia or Tasmania, whence, I presume, they come. Are they known in Fiji or South Sea Islands? For, if so, we could imagine them migrating northward to escape our winter. If not, is our New Zealand winter too rigorous for this family of birds? I scarcely fancy so. Even here, there are few winter days when an occasional blink of sunshine does not fetch out dancing myriads of *Ephemeridæ* on the river banks. In olden days, I fancy this was not so much the case. The rapid growth of willows now overhanging the water must afford protection to delicate new-born insects such as mosquito and other gnats which the old fringe of flax and toe never could have given. The temperature of the water in which the larvæ reach their fullest development is scarcely affected by the season. Indeed, in many snow-fed rivers the temperature, far from the source, when the water is at its lowest, must often be higher in winter than in summer when the melting snows are in full swing and the river body too great to be affected materially by sun-heat. I hope you will agreé with me that the natural acclimatization of the Australian swallow is not impossible. One certainly does miss the easy graceful little bird out here."

I received another letter from Mr. Cook, under date June 11th, in which he says:—

"Since I wrote I have seen no further specimens, but note a local in the 'Kaikoura Star,' stating that two swallows had been seen at Kaikoura about the same time as the birds appeared here. I shall try to find out the authority for the statement in the Kaikoura paper, and get, if possible, fuller information than the newspaper paragraph gives.

"I have since seen Mr. Cheeseman who shot the specimen I sent. He tells me there were some six or seven birds in all; that they had been hanging about Grovetown for some weeks before he shot the one; and that he fancied they were young birds, or, at least, that some of them were. He could not, however, say that the party consisted of a pair of old birds with their brood.

"I fear that my idea that they may have been a New Zealand tribe is untenable. The occurrence of birds at Kaikoura and of the one I saw in my paddocks simultaneously with those at Grovetown looks rather like a 'drift' from Australia or Tasmania, I fancy.

"The one interesting question possibly may be why the first notice of occurrence of the swallow is on our East Coast. If the 'drift' is to and through Cook Straits, I can understand it. Otherwise we should expect notice of arrivals on the west coasts of both islands."

Anthochæra carunculata.

In my "Essay on the Ornithology of New Zealand, 1865," I included the above species among our birds, on the authority of a specimen in the Auckland Museum, preserved by Mr. St. John, and said to have been obtained at Matakana, to the north of Auckland. The bird was retained on our lists for many years, but no fresh examples having been heard of, and St. John's specimen being of doubtful authenticity, its name was ultimately expunged.

After a lapse of nearly twenty years, I have once more the pleasure of recording it as a New Zealand bird.

During a visit to Marton last year, I was invited by Mr. Avery, the local bird-stuffer, to examine his novelties. Among these was a bird which he had himself collected when serving with the volunteers in Mr. Bryce's expedition against Parihaka. He met with it in some high scrub at the rear of the camp at Rahotu, when on fatigue duty, and was fortunate enough to shoot it. The bird was new to him and he skinned it, performing the operation very successfully. The skin was in a fresh condition when it came into my hands, and proved on examination to be a well-plumaged specimen of *Anthochæra carunculata*, the well-known wattle-bird of Australia.

Mr. Avery was generous enough to give me this fine bird, which has now an undoubted right to a place in our Avifauna, and I have much pleasure in submitting it to your inspection this evening.

Creadion cinereus, Buller.

In the "Essay," to which I have already referred, I characterized and named what appeared to me then a new species of *Creadion* in the following terms:—"This species is of the size and general form of *C. carunculatus* to which it bears a close affinity, but the colouring of the plumage is altogether different. The common species (the 'Saddleback') is of a deep uniform black, relieved by a band of rufous brown which occupies the whole of the back, and, forming a sharp outline across the shoulders, sweeps over the wing coverts in a broad curve. In the present bird, however, the plumage is of a dark cinereous brown, paler on the under parts and tinted with umber on the wings and scapularies; the upper and lower tail coverts, and a few spots on the smaller wing coverts, bright rufous. The wattles are of the same colour and shape as in *Creadion carunculatus* but somewhat smaller."

My new species was at once fiercely attacked by Dr. Otto Finsch and Captain Hutton, both of whom declared it to be the young of *Creadion carunculatus.* In his paper which appeared in volume v. of our Transactions (p. 208), Dr. Finsch expressed his satisfaction that Captain Hutton's "examination of the types" had "shown *C. cinereus* to be undoubtedly the young of the above-named species."

In my reply, which appeared in vol. vi., p. 116, I explained that an examination of a fine series of specimens in the Canterbury Museum, showing what appeared to be transitional changes of plumage, had forced me to this conclusion, and that I had communicated the result to Captain Hutton long before the appearance of his catalogue. The descriptive notes which I made at the time of this examination will be found at page 149 of my "Birds of New Zealand." I was careful, nevertheless, to add the following qualifying passages:—

"I confess, however, that the subject is still beset with some difficulty in my own mind. Supposing the plumage of *C. cinereus* to be the first year's dress of *C. carunculatus*, it seems to me quite inexplicable that the bird has never been met with in that state in the North Island. Captain Hutton suggests that this is due to the comparative scarcity of the species at the North. But during several years' residence in the Province of Wellington I obtained probably upwards of fifty specimens, at various times, without ever detecting any sign of this immature condition of plumage.

"Admitting the comparative scarcity of the species, one would naturally suppose that the younger birds would be more likely to fall into the collector's hands than the fully adult ones. It may be suggested whether the condition of the Canterbury Museum specimens has not possibly resulted from intercrossing; for we have not heard of any further examples (of the kind) being obtained. At any rate, till a specimen in the supposed immature dress has actually been taken in the North Island, the point cannot, I think, be considered finally set at rest."

Here again, strange to say, after a lapse of nearly twenty years, the required evidence is forthcoming, and my *Creadion cinereus* recovers the specific rank so long denied to it.

In 1881, Mr. A. Reischek, a very ardent collector, wrote to me as follows:—"About *Creadion cinereus*, I have this to state: In December, 1878, when I was on the west coast of the South Island, I shot about twenty of both kinds, and of both sexes. What were supposed to be the young of *C. carunculatus* (your *Creadion cinereus*) I found, on dissection, to be fully adult birds, both male and female. My observations on this point were perfectly reliable. In December, 1880, I stayed on the Hen (an island in the Hauraki Gulf) three weeks, and shot about thirty specimens of *Creadion carunculatus*, all of them being in the common saddle-back plumage. I could only determine the sex in each case by dissection, and what appeared to be the young birds differed only from the adult in having the wattles smaller and lighter in colour. I roamed over the whole island during my stay there, and never saw a bird in the plumage of your *Creadion cinereus*" (which is confined to the South Island, where both species commingle).

In 1882, and again in the early part of the present year, Mr. Reischek revisited the Hen, and on both occasions remained there a considerable time exploring every part of the island, and collecting its productions. On his last visit he saw probably forty examples of this bird, all in the plumage of *C. carunculatus*, and collected many specimens of both sexes and all ages. On the Little Barrier he found the species scarce, and obtained only two specimens; while on the Chickens and Island of Kawau he did not meet with this bird at all. In some which he dissected the testes were almost microscopic, the only external differences between these and the old birds being that the plumage was not so glossy, and the wattles not so large or bright. In the adult male these ornamental appendages, of the size of cucumber seeds, are of a beautiful orange colour, and in the adult female a little lighter. In the young birds they are still lighter and extremely minute in size.

To place the matter, however, beyond all doubt, he found, on one occasion, two adult birds feeding a young one, and was successful enough to secure all three birds, which he carefully preserved and marked. He was loath to part with these specimens, but to enable me to demonstrate the specific value of *Creadion cinereus* he handed all three birds over to me, and I have now the pleasure of submitting them to you, marked respectively male, female, and young.

NESTOR NOTABILIS.

For many years the Kea ranked amongst our rarest species, and it is not very long ago that a specimen fetched £25 in the London market. But all this is changed, and, although still of very rare occurrence in the northern parts of the South Island, and quite unknown in this island, it has become a pest in the middle and southern districts; and, owing to its extraordinary penchant for live mutton, it is now so destructive on the sheep-runs, that the aid of Parliament has lately been invoked to abate the nuisance.

Under these circumstances it is scarcely admissible into a paper treating of rare species, but I am unwilling to lose the opportunity of laying before you a very interesting letter I have received from Mr. John George Shrimpton, of Southbrook, Canterbury:—

"While residing at the Wanaka Lake, I received a letter from my brother Walter (of Matapiro) to the effect that you would like a specimen of the Kea or mountain parrot, and any notes of their habits which I might be able to afford you. My time there was so short after receipt of his letter that, although many Keas were killed, I only succeeded in getting one fair skin, which I forwarded to you by mail a few days ago, and trust has reached you safely. By this mail I forward a water-colour sketch of some young ones drawn from nature by Mr. Huddleston. In the rocky cavern, high up on the mountain, whence these were obtained, were several broods of young ones of various ages and sizes.

"I believe the Kea does not come farther north than the Rakaia River, Canterbury, and is strictly confined to the central range and its spurs as a rule, but may occasionally and will probably be more seen on those hills adjacent to the main range, which attain an elevation of five thousand feet and upwards. There is no doubt that, in spite of the war waged against them, they are increasing very rapidly, probably owing to the plentiful supply of food in the shape of mutton, which they can get, and to which they help themselves most liberally. Fifteen years ago, when I first knew the Lake country, it was a rare thing to see these birds on the hills even in their chosen home among the snow; but now you meet them in flocks of fifty even, and so bold have they become that they will attack sheep under the shepherd's immediate care. Not that they were ever very wild; on the contrary, I think they are the tamest birds in New Zealand; and it is their insatiable curiosity that has probably led them to find out the taste of mutton. At first, they contented themselves with tearing up tents, blankets, and sheepskins, the usual impedimenta of a musterer's camp. They have now so improved upon that, that nothing less than the primest mutton will suit their fastidious tastes. Though so tame that you can often knock them down with a stick, and apparently so inoffensive, a single Kea will swoop down on the strongest fat wether or hoggett, fix himself firmly on its back, generally facing the sheep's tail, and commence digging his daily meal. Sometimes the sheep runs till exhausted, sometimes contents itself by trying to dislodge its adversary by a series of contortions only, but the Kea troubles himself very little about either: he hangs on till the sheep gives in. He then digs away, carefully avoiding the backbone, till he reaches the kidney fat. This is his choicest relish. His cries soon attract others, and between them the poor sheep is soon fitted for a museum. Sometimes a sheep gets away from a timid or perhaps less experienced workman; but he carries with him an indelible scar. On some stations about 5 per cent. of the whole flock are mustered in at shearing-time more or less marked in this manner, and the death-rate is almost incredible. I have no hesitation in saying that, on the runs bordering the Wanaka and Hawea Lakes, the loss from Keas alone is nothing short of from fifteen to twenty thousand sheep annually, and these the primest of the flocks. Although Keas are seen openly enough in the day-time, there is no doubt they work their mischief mostly at night, a bright moonlight one preferred. A severe winter, with sheep snowed in, is their great opportunity; and this they avail themselves of to the uttermost. Although like other parrots, they are given to anything in the shape of fun or mischief (and, on one occasion they killed a young kaka, tethered), I have never known them to *seriously* attack any animal other than a sheep. But as a moiety of them have advanced so far in the course of the last eight or ten years, it is impossible to say to what lengths they may aspire in the future.

"I cannot state for certainty that there are no Keas north of the limits I have here assigned as their habitat: I can only say that I have travelled over a considerable portion of that country without either seeing or hearing of them. But as to their habits and destructiveness in the neighbourhood of the great lakes south, I can speak from a long and painful experience."

As some of those present may not have had an opportunity of examining this carnivorous parrot, I beg to exhibit this evening the bird sent by Mr. Shrimpton, and, at the same time, for purposes of comparison, its well-known congener, the *Nestor meridionalis* or common kaka. Both species are by nature vegetable-feeders; and it is a most remarkable fact in natural history that, with the changed condition of its surroundings, this mountain parrot has so rapidly developed a taste for flesh that the instinct has become one of the first habits of life, and almost necessary to the existence of the species.

Platycercus alpinus, Buller.

Mr. Reischek met with this little parakeet in the scrub on the summit of Mount Alexander (above Lake Brunner on the West Coast); and he met with the species again on the Hen, where he shot two, and on the Little Barrier, where he observed another pair, and killed the male.

While on this subject I may be permitted to refer to a passage in the paper read by Mr. Travers last year, "On the Distribution of New Zealand Birds."* He explains that, in making his analysis of genera and species, he has "assumed that Dr. Buller has seen good reasons for reaffirming *Platycercus alpinus* as a species in the Manual, notwithstanding the remarks on the subject in his larger work."

It is true that I yielded to the arguments of Dr. Finsch and agreed to sink my *Platycercus alpinus*, as a species, and treated it in the text of my work as the young of *Platycercus auriceps*. In the Introduction, however, to the book, I gave my reasons for reinstating this form. I there explained that more than twenty living examples of this bird had recently been brought to England; that it was to be seen alive in the Gardens of the Zoological Society of London; and that the validity of the species had thus been established beyond all doubt.

Charadrius fulvus.

In April, 1881, Mr. T. F. Cheeseman, the Curator of the Auckland Museum, wrote informing me that he had obtained two specimens (male and female) of the Golden Plover, both shot on the Manukau Harbour; and he afterwards made an interesting communication on the subject to the Auckland Institute (Trans. N.Z. Inst., vol. xiv., p. 264).

Of this rare visitant, Mr. C. H. Robson, with his usual activity in the cause of science, has obtained and forwarded to me a fine pair from Portland Island. I take this opportunity of exhibiting them, and also of communicating to the society some notes on this bird by my correspondent who was fortunate enough to discover its breeding place and to obtain its eggs.

Art. XXIV.—*On* Hieracidea novæ-zealandiæ, *and* H. brunnea. By W. W. Smith. Communicated by Dr. Buller, C.M.G., F.R.S.

[*Read before the Wellington Philosophical Society, 31st October, 1883.*]

In the summer and autumn of 1876 I shot several specimens of "Sparrow Hawk," varying so much in size that I was often surprised at the extraordinary difference in the specimens I obtained. Taking as I did at the time

* See Trans. N.Z. Inst., xv., art. xiv.

a great delight in the study of birds, but only a beginner, and knowing practically nothing of the birds of New Zealand—I had heard of Dr. Buller's work, but had not seen it—and being particularly anxious to see the article on the "Sparrow Hawk" (as I called it then in common with others), I went the following June to Christchurch where I spent two days with this work in the Public Library. After studying the articles well, I was of course a little surprised to find that two species of Falcon nearly alike in plumage, but differing considerably in size, existed in New Zealand. I also at this time read the critical notes by Professor Hutton, published in the Ibis, and those by Mr. Potts in the Trans. N.Z. Inst. My mind being thus set at rest, or partly so, I determined when I returned home to procure as many specimens as possible and work out the subject for myself; and my experience since that time is decidedly in favour of the existence of two species.

HIERACIDEA NOVÆ-ZEALANDIÆ.

The first specimen I will mention (a female) was one I shot in September 1876 on the Rangitata River. Being then in the employment of the Hon. J. B. A. Acland, and it being a busy season of the year with me, I was unable to stuff and mount the specimen. I sent it to a friend in Christchurch, who was well acquainted with the late Mr. Fuller, taxidermist at the Canterbury Museum, who stuffed the bird. When Mr. Fuller had finished it he remarked that it was one of the finest he had seen. When I visited the Canterbury Museum I examined all the specimens, but none, as near as I could judge on looking into the case, are equal in size or so distinctly or beautifully marked. On the 28th October, 1874, Dr. Buller read a paper on the two species before the Philosophical Institute of Canterbury. The measurements he then gave are as near as I can make out a few lines short of mine. I copied the whole of the article in pencil, and am therefore able to compare his measurements with mine. I am not an expert at describing the different parts of a bird's plumage, but this bird has what I have never seen in any other individual, namely, nine distinct bars on the tail.

One of the shepherds at Mount Peel brought me in from the back country a very handsome pair of eggs of this species. They also are larger and much darker in colour than those in the Canterbury Museum.

On the 23rd October, 1879, I found a nest of this species in the rocks at the Rangitata Gorge. The nest contained three young ones, one female and two males. They were covered with a light bluish wool. They must have been about three weeks old, but were very quiet. I brought them home and prepared a large box for them. I fed them on birds, rats, mice, mutton, &c., which they devoured in large quantities. On the 16th

November following they had cast off all their woolly covering, and were of a uniform dark brown colour. In two months they assumed a lighter shade, but by this time they were so noisy and fought so savagely that I was obliged to kill them, not having a proper place to keep them in. I have the skins still in my possession, and intend the first opportunity I have to present them, with several others, to the Colonial Museum at Wellington. I have found several other nests, but all containing eggs, some of which are really beautiful specimens. I was careful every season in searching for nests to carry a gun, and was always certain when I found one to procure both parents. The rocks around the Rangitata Gorge are a favourite nesting place of the quail-hawk, and a locality I can confidently recommend to any one who wishes to procure the eggs, young, or adult specimens of this bird. I found the nests every year in October and November.

A farmer living near Peel Forest shot three specimens, and sent them to me. They proved on dissection to be two females and one male: one of the females was a young bird, but very large, and heavily made; it had the thickest tarsus and talons I have seen in any bird of its kind. I afterwards gave the three birds to C. G. Tripp, Esq., Orari Gorge Station, who sent them to his son at the University of Cambridge.

Besides the nest mentioned above I have kept other young ones of this species; one in particular (a male) I had very tame, but one day he accidentally got away from me, much to my sorrow.

I may here remark that I have had several other specimens but all in my opinion easily distinguishable from *Hieracidea brunnea*.

Hieracidea brunnea.

This "spirited little hunter" has been an object of great interest to me for several years, not only because I have studied the bird closely for the purpose of determining the two species, but likewise on account of its bold and intrepid habits, particularly during the breeding season.

On November 9, 1876, I found a nest of this species in a bush of "Wild Irishman" (*Discaria toumatou*). The nest was nearly on the ground among the dead leaves in a wooded gully four miles from the Rangitata Gorge. When I approached the nest the parent birds were extremely fierce and assailed me all the time. When looking for the nest it was rather difficult to find, being almost out of sight under the bush; but I succeeded. The nest contained two young birds and one egg. The young were only hatched the previous day, and were exceedingly small. When I lifted the egg the young bird chirped within the shell. Being the first nest of the species I had found, I was reluctant to leave it, thinking some of the shepherds might come along and destroy the nest. I shot the two parent birds and brought home the two young ones in the hope of rearing them by hand, but they died next day, notwithstanding all the care I bestowed on them in keeping them warm, giving them good food, etc. The female was very plain in plumage. Her measurements agree nearly with those given in Dr. Buller's paper already alluded to. Since I first read Dr. Buller's fine work in June, 1876, I have always adopted his mode of measuring a bird ; and am also very exact in doing so with this bird, as the measurements and "sexing" alone must determine the species. I should have stated that the male of the above-mentioned nest was a very small bird. It had the smallest head of any specimen I have seen, very little larger than the *Falco æsalon* of Europe and North America.

I will speak of one more nest and I have done, as I do not desire to trespass too far. On 3rd November, 1878, I found a nest in Chapman's Gully, a mile from the homestead, Mount Peel. The nest was situated under a large plant of snow-grass (*Danthonia*), and contained three beautiful young birds. I arrived at the nest as the male came with a native pipit in his talons. When he saw me lying on the ground near the nest, he dropped the bird and dashed at me, knocking off my hat. I rose and approached the nest, when the female likewise assailed me ; but it would have been almost impossible for me to remove the young, as the parent birds were so violent. I then secured the two birds and brought the three young ones home, reared them, and kept them six months ; but I need not here give their history for that time, the rearing of the young of this species being ably described in the work already referred to.

The measurements of the parent birds are as near as possible the same as those of the first-mentioned pair, except that the male was a little larger.

I have possessed, from time to time, nearly thirty specimens of this bird, some varying a little in their markings and measurements.

I have one beautiful female, the smallest that I have seen, and the most distinctly marked.

Such is a little of my experience with the two species. I could relate many other facts proving or tending to prove that the species are distinct. The habits and general colouring of the plumage are almost indistinguishable ; but in all the specimens of *H. novæ-zealandiæ* I have seen the plumage was much brighter, more glossy, and certainly more beautifully marked than in *H. brunnea*.

Comparing the nestlings of *H. novæ-zealandiæ* with nestlings of *H. brunnea*, the latter never attained near the size of the former, although I kept them four months longer. They were more lively, fiercer, and appeared to me more untameable than *H. novæ-zealandiæ*. I, however, never tried much to tame them.

With regard to the food of the species, in all my experience I have found *H. novæ-zealandiæ* to subsist on larger game than *H. brunnea*. When the three young birds of *H. novæ-zealandiæ* were two months old, I put a living weka into the cage. They were kept without food for one day to try their courage. The weka walked around the cage twice, when the female sprang upon it and seized it by the neck. I noticed that the hawk tried to bear down the weka by keeping on its back, but the weka succeeded in getting clear. This was repeated several times, and being then evening I left the four birds together in the cage. In the morning I found the weka killed, and the female and one male feeding on its remains.

I tried the same experiment with the smaller species but they never made any attempt to kill the weka.

I should have liked to add a few more experiments I made with the two species. I should also have liked to make a few remarks on the eggs, etc.; but I may have an opportunity of doing so on some other occasion.

Art. XXV.—*Notes on New Zealand Ichthyology.* By Dr. Hector.

[*Read before the Wellington Philosophical Society, 13th February*, 1884.]

Lampris luna, Risso.
Gunth., ii., 415.

A specimen, measuring 3 feet 6 inches in length, of this superb fish was cast on the beach near the Manawatu River in December, 1882, and presented to the Museum by Mr. James Jones, of Foxton.

Unfortunately it had been partly eviscerated so that the chief characters which are relied on by the Rev. Mr. Lowe (Fishes of Madeira, p. 27), for his species *L. lauta* could not be observed, viz., the absence of lingual teeth, having six instead of seven branchiostegal rays.

Thyrsites prometheus, Webb and Berthel.
vel *T. prometheoides*, Bleeker.
Gunth., ii., 351.

A single specimen of this fish was captured in September, 1883, along with the commoner species of barracoota, at Nelson, and presented to the Museum by Mr. J. H. Thomas.

The specimen was slightly mutilated, so that there is a doubt as to which of the above species it should be referred to.

Cossyphus unimaculatus, Gunth.

Gunth., iv., 109.

Collected by Mr. S. Sandeyer.

Loc. Tiritiri Island, Auckland.

Scorpæna bynoensis, Rich.

Gunth., ii., 113.

Collected by Mr. S. Sandeyer.

Loc. Tiritiri Island, Auckland.

Labrichthys laticlavius, Rich.

Gunth., iv., 115.

Collected by Mr. S. Sandeyer.

Loc. Tiritiri Island, Auckland.

Cymolutes sandeyeri, sp. nov.

D. 9–12. A. $^3/_{12}$. L.L. $\frac{90}{60}$. L.T. 8–36.

(For genus, see Gunth., iv., 207.)

Head and cheek smooth, greenish white above and below, orange patch on shoulder. Fins and body orange with broad dark vertical bands. Tail truncate, operculum with a flexible appendage. Tongue smooth, teeth strong. Canines $\frac{2}{2}$. Lips fleshy and turned.

Length of head and height equals one-fourth the total length.

Collected by Mr. S. Sandeyer.

Loc. Tiritiri Island, Auckland.

II.—BOTANY.

Art. XXVI.—*A further Contribution towards making known the Botany of New Zealand.* By W. Colenso, F.L.S.

[*Read before the Hawke's Bay Philosophical Institute, 12th November*, 1883.]

In bringing before you this evening my usual annual basket of "simples," or botanical contribution, I would beg permission to offer a few brief remarks by way of introduction and explanation. This seems almost necessary, seeing that my basket is bigger, or my paper is much longer than any of my former ones on this subject, owing to the large number of new species I have been enabled to obtain and describe.

Species, too, illustrative of many Orders of all the Botanical Classes, particularly of the Class *Cryptogamia*, and of the elegant though lowly Order *Hepaticæ*; having fortunately discovered several new ones, especially of the curious and little-known genus *Symphyogyna*. Of this, I have determined no less than 11 new species, which, with 2 others, formerly discovered and described by me in my recent Botanical papers read here before you, and also those 5 species described in the "Handbook of the New Zealand Flora," make no less than 18 distinct species of *Symphyogyna* indigenous to this country alone! which may now, I think, be fairly considered as the head-quarters of this genus.

According to the celebrated cryptogamic authors of the *Synopsis Hepaticarum*, only 25 species of *Symphyogyna* were known to them at the date of the publication of their work (1847); of those none were European; yet the genus seems to be a widely scattered one, viz.: In N. America 2, in S. America and the West Indies 8, S. Africa, including the neighbouring isles, 6, Asia (Java) 1, Australia 4, Tasmania 2, New Zealand* 2 = 25. I have good reasons for believing that additional species will yet be found in New Zealand; indeed I have at present two others not yet determined, being in an imperfect state.

And here I may also observe that, to the elucidation of this genus in particular I devoted a very large amount of time—labour in seeking and collecting at various seasons, and close microscopical study and examination; having been also cheerfully and zealously aided by some of our members, especially Mr. A. Hamilton, Mr. D. P. Balfour, and Mr. C. P. Winkelmann, to all of whom (as well as to others) my best thanks are due.

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* Two of those 5 species found in New Zealand (as given in the "Handbook") are also found in other countries, and are so classed by the authors of the *Syn. Hep.*; and one other (*S. sub-simplex*) was new and not known to them at the time of its publication.

I should also inform you that several of the plants I have now described in my present paper, and also bring specimens of, to show you this evening, were not first detected by me during this past year. A few have been long known to me; others I first knew of two or three years ago, but wanted time to examine them and work them up. Of others I required better or more complete specimens, while, for a few, I am wholly indebted to my botanical friends.

Still I have been very fortunate during the past year. I have spent a much longer time in patient research in our woods, and deep-secluded glens, and quiet far-off hill-tops and sides, both in winter and in summer, in frost and in heat; and nature has bounteously rewarded her patient plodding disciple and faithful follower, as she always does all such who serve her heartily and simply, and not for pecuniary gain.

Among the principal or first-class prizes with which I have been honoured, and which I wish to bring prominently to your notice, are a handsome white-flowering standard *Metrosideros*, a curious small-leaved *Panax*, a large-leaved *Tupeia*, and a fine *Fagus*; 4 Orchids (one being a new and rare *Bolbophyllum*, two others of the beautiful gem-like genus *Corysanthes*, and one a very fine and handsome *Thelymitra*); of *Liliaceæ*, a *Dianella*, and an *Astelia* (the *male* flower—another single specimen—of the one *female* flower I discovered three years ago); and a few of *Cyperaceæ*, among them a most peculiar *Carex*, having slender trailing culms more than two yards long. Of *Cryptogams* a few ferns, among them a neat little *Polypodium* and a pretty *Lindsæa*, which latter will serve to fill up a gap or natural sequence in our known species; several other curious *Hepaticæ*, besides the *Symphyogyna* already mentioned, particularly of the genera *Petalophyllum*, *Aneura*, *Fimbriaria*, and *Anthoceros*; a handsome *Lichen*, giving another distinct species to a small natural genus; and a few highly curious *Fungi*.

Specimens of all of them, both dry and in spirits, some of them being also mounted on cardboard, will be severally laid before you; and may you all have as much pleasure in going over and examining them as I have had, over and over, in the finding and gathering, examining and describing them.

Class I. Dicotyledons.

Order IV.* VIOLARIEÆ.

Genus I. **Viola**, Linn.

Viola perexigua, sp. nov.

A very small tufted perennial *herb*, its crown of leaves and flowers springing from a thick woody root having many fine and long fibres, without branches or stolons. *Leaves*, 8–12, broadly cordate-orbicular, $\frac{1}{4}$–$\frac{1}{2}$ inch long, glabrous, regularly and deeply crenate, obtuse and rounded at

* The numbers in this paper attached to both Orders and Genera are those of the "Handbook of the New Zealand Flora."

apex, almost truncate at base, *petioles* ½–1 inch long, channelled above and closely ciliate on the edges with 2 rows of short white erect hairs, *bracts* at base diverging, long, linear, very acuminate and acute, with a few (2–4) fine teeth or laciniations that are obtuse and knobbed. *Peduncles*, ½–1½ inches long, quadrangular, succulent, purple-striped, *bracts* linear-acuminate acute, usually not opposite; *flowers* small, 3 lines diameter, white, occasionally one having a few narrow faint-blue stripes; the two lateral *petals* woolly inside in a small circular patch just opposite the anthers; *spur* short, gibbous; *sepals* rather large, oblong-ovate, acute, scarious at edges.

Hab. On dry open upland heaths between Matamau and Danneverke, Waipawa county; also, in adjoining "scrub," among *Leptospermum* and other shrubs, 1880–1883: *W.C.*

Obs. I have long known this pretty little plant, but have hitherto delayed describing it, thinking it (without close examination) to be a variety of the well-known and common species *V. cunninghamii*, and not wishing to add another species to this extensive and cosmopolitan genus. This spring, however, having again visited its habitat, and fully examined it in its fresh and living state, I am satisfied of its distinctness from *V. cunninghamii* and its other congeners. It is a very lowly plant, and although common there, and bearing a great profusion of flowers, it is scarcely perceptible among the numerous small heath plants and mosses that grow thickly with it.

ORDER XXVIII. MYRTACEÆ.

Genus 2. **Metrosideros**, Br.

Metrosideros vesiculata, sp. nov.

Plant small, "a bushy *shrub* 2–3 feet high," of erect fastigiate growth and very leafy; *branches* densely tomentose and hairy. *Leaves* decussate, broadly elliptic or ovate-elliptic, 5 lines long, 3–3½ lines broad, obtuse, pellucid-dotted, glabrous, coriaceous, 3-nerved, sub-revolute, petiolate, *petioles* short, stout, pubescent, paler green and sub-muricated below with small raised black spots; *young leaves* very tomentose and sub-strigosely hairy below. *Flowers* sub-terminal, axillary, white, single or ternate; *peduncle* 1–1½ lines long, stout, hairy; *pedicels* jointed, glabrous, very short. *Calyx* glabrous with a few scattered weak hairs, tube broadly campanulate, vesicular, 5-lobed; *lobes* elliptic or sub-rotund at top, persistent, margins thin and slightly ciliate. *Corolla* white, *petals* small, sessile, broadly oblong or sub-orbicular, sinuate and slightly toothed at edges, concave, crowded at centre with raised orbicular vesicles, 1-nerved, coloured in the centre (dry specimens). *Stamens* numerous, spreading, 4 lines long. *Style* very stout, simple, 6 lines long, persistent. *Capsule* sub-rotund, 1½ lines diameter, glabrous, vesicular, rather thin, 4-loculicidal, girt below the middle.

Hab. Hills, forests on the east coast between Wainui and Akitio rivers, "900 feet elevation;" January, 1883: *Mr. Horace Baker, in lit.*

Obs. I.—A species near to *M. perforata*, A. Richard, as described at length by him;* his specimens were also obtained from Cook Straits, but differing largely in its vesicular capsule calyx and corolla, which plain and constant characters, even in dried specimens, could never, I think, have been overlooked by Richard.

II.—Sir J. D. Hooker has also made but one species of the above-mentioned plant (*M. perforata*) and A. Cunningham's *M. buxifolia*: I, however, have ever believed (with A. Cunningham) their being distinct; although I have never seen specimens of Richard's (and Forster's) *Southern* New Zealand plant, which is, also, *not* a climber (*apud* Richard, *loc. cit.*): this "erect" character, however, does not belong to A. Cunningham's *M. buxifolia*, which is a climbing species, and is as common in the forests here (Hawke's Bay) as it is at the north.

III.—This species, from its short bushy size, small neat leaves, and very numerous flowers, is likely to become a favourite garden shrub. Although I have never seen it living, I have received several good specimens from Mr. Baker, and they are very uniform.

Order XXXIV. ARALIACEÆ.

Genus 2. **Panax**, Linn.

Panax microphylla, sp. nov.

Plant a small hard-wooded *shrub* of diffuse growth, 4–5 feet high; *branches* few, long, slender, straggling, and irregular; *branchlets* brachiate, roughish, sub-muricated with minute tubercles, and occasionally on the younger branchlets a few scattered very small linear-ovate obtuse scales. *Leaves* small, sub-membranaceous, glabrous, alternate, sometimes in pairs, scattered rather distant, compound and simple, flat, spreading, usually sub-orbicular, 4–5 lines diameter, rounded and very obtuse at apex—sometimes rhombic and apiculate, sometimes lanceolate and very small, sometimes trifoliolate on long slender petiolules, the middle leaflet being the largest, and sometimes a simple leaf having a pair of minute leaflets just below its base—the upper half of the leaf being slightly crenulate, each crenature generally bearing a small incurved sharp tooth,—the lower portion cuneate, decurrent, margins conniving, jointed to petiole with 4–6 minute linear acute stipellæ at junction, and several similar stipules at base of petiole; *colour* bright green with minute white dots on the upper surface, paler green below; *margins* coloured purple; *veins* indistinct; *petioles* purple-brown, deeply channelled, slender, glabrous, 1–2 lines long. *Fruit* axillary orbicular, about 1½ lines diameter, sub-compressed, smooth, on

* "Voyage de l'Astrolabe, Botanique," p. 334.

short slender bracteolated stalks (peduncles or pedicels), having many small bracts at their bases, white or pinkish-white, with sculptured dark (black) effigurate spots or blotches, having a peculiar sunken or burnt appearance, and bearing a calycine crown of 5 teeth; *styles* 2 persistent, long, slender, divergent and recurved; sometimes 2 or 3 fruits spring together; *carpels* lunate, gibbous, flattish, rugulose without longitudinal ridges; *seed* with plain sides. *Flowers* not seen.

Hab. In shady open forests near Norsewood (S.), Waipawa County, 1882–3: *W.C.*

Obs.—A species having pretty close affinity with *P. anomalum*, Hook., but differing from that species in its smaller and variously shaped leaves with glabrous (not pubescent) and deeply channelled petioles—in its smaller and differently coloured fruit bearing plain-surfaced carpels and seeds—and particularly in its branches not being densely hairy (" setoso-squamulatis ") as in *P. anomalum*. *P. anomalum* is also a much larger shrub; and I have never once met with it in these southern parts, nor, indeed, anywhere else besides the forests in the Waikato, where I discovered it, 1842 ("Tasmanian Journal of Natural Science," vol. ii., p. 277).

Order XXXVI. LORANTHACEÆ.

Genus 2. **Tupeia**, Chamisso and Schlechtendal.

Tupeia undulata, sp. nov.

Plant a small diœcious parasitical diffuse *shrub*; *branches* long, straight, terete, jointed, 2 feet–2 feet 6 inches long, bark light greenish-grey, somewhat scurfy, not smooth; *branchlets* opposite, sub-compressed, densely covered with light-brown obtuse patent rigid sub-glandular pubescence; young *leaves* and *flowers* enclosed in dark brown scale-like bracts, 2–4 lines long, deltoid and obovate, obtuse with fimbriate margins, 3-nerved, middle nerve long, lateral ones short. *Leaves* (*male* plant) few, opposite, distant, sub-rhomboid and rhomboid-obovate, obtuse, 3 inches long, 2 inches broad; (*female* plant) *leaves* much smaller, sub-rhomboid and broadly oblong-lanceolate, $1\frac{1}{2}$ inches long, $\frac{3}{4}$ inch broad, sub-membranaceous, not thick or fleshy, green, smooth, not shining, undulate, decurrent nearly to base of petiole; *petioles* short, under 2 lines long, and with midrib thickly pubescent, margins sub-sinuate, slightly scaberulous or sub-papillose (of young leaves minutely pubescent-ciliate); *veins* prominent above, veinlets anastomosing. *Flowers* terminal on short axillary branchlets, panicled; *panicles* short, dense, having, in the *female* plant especially, a sub-umbellate appearance, about 1 inch long, each containing 6–12 flowers, peduncles and pedicels pubescent, sub-panicles and pedicels bracteolate at base, bracteoles linear-ovate, about 1 line long, recurved, caducous; *lower sub-panicles* bearing 2–3, sometimes (but rarely) 4 flowers each: *male flower* on much larger and more open panicles than the *fem.*, *petals* 4, spreading, 4 lines diameter, somewhat sub-spathulate or sub-obovate, obsoletely 1-nerved, light yellowish-green, tips sub-cucullate and slightly pubescent-ciliate; *filaments* spreading, rather longer than the anthers; *anthers* broadly-oblong, apiculate; *pedicels* 3 lines long, jointed: *female flower* glabrous, shining, very small, 1 line diameter, petals 4 (sometimes 3 or 5), linear-lanceolate, acute, obscurely 1-nerved, spreading and reflexed, tips obtuse incurved, margins minutely pubescent; light yellowish-green; *style* long, exserted; *stigma* capitate, large, sub-globular, depressed, obscurely lobed, light-yellow. *Fruit* a drupe, broadly-elliptic, smooth, pink thickly spotted or splashed with dark pink, retaining large discoidal scar from style; *pedicels* 1½–2 lines long; *pulp* very viscid; the *panicle* becoming very much elongated when in fruit.

Hab. Parasitical on *Panax arboreum*, Petane Valley, near Napier, 1883: *Mr. A. Hamilton*; flowering in September, and bearing the ripe last year's fruit at the same time.

Obs.—It is not without some considerable amount of hesitation that I announce this plant as a *sp. nov.* of this peculiar and variable genus of (hitherto) only *one* species; but it differs so much in bark and leaf, in flower and fruit, from *T. antarctica*, that I cannot but consider it to be truly distinct. In its general appearance also it widely differs, being a much larger plant of more straggling growth, while the constant and great difference in its dark-coloured and more oblong-shaped fruit, and undulated adult leaves (resembling those of *Myrsine d'urvillei*) is apparent at first sight. I have had plenty of good specimens for examination. The plant emits a peculiarly strong odour in drying (reminding me of that of green figs when peeled), remaining fixed for sometime in the many thicknesses of drying papers.

Order XXXVIII. RUBIACEÆ.

Genus 1. **Coprosma**, Forster.

Coprosma concinna, sp. nov.

A small erect *shrub*, 2–4 feet high, of irregular growth, thickly branched above, *branches* slender, spreading; *bark* smooth, yellowish-brown; *branchlets* short, opposite and decussate, but distant, spreading at right angles, filiform, arcuate, pubescent; *leaves* few, scattered, 3–4 lines diameter, sub-membranaceous, orbicular trowel-shaped and broadly elliptic, very obtuse, sometimes sub-apiculate, slightly sub-crenulate, glabrous, light-green dashed with yellowish spots, margined, foveolate beneath in axils of lower veins and midrib, *blade* abruptly decurrent, *petiole* 1 line long and (with lower half of midrib) hirsutely pubescent, *veins* (and *margins*) red, finely reticulate; *stipules* acuminate acute, pubescent. *Flowers* very small, membranaceous, glabrous, greenish with purple spots: *male, calyx* excessively minute, *corolla* campanulate spreading, *tube* very short, *teeth* rather large, obtuse, minutely pubescent at tips; *filaments* long, scaberulous, *anthers* oblong-ovate, exserted, sub-apiculate, cordate at base; mostly singly, infra-axillary and below, and lateral: *female, flowers* excessively small, minute; *calyx* cup-shaped with 4 short teeth, very hirsutely pubescent, hairs white; *corolla* much smaller than *male*, about ½ line long, *tube* slightly funnel-shaped, *teeth* 4 oblong ovate, revolute, (sometimes only 2) pubescent; *styles*, 2, very long, spreading, flexuose, stout, densely pubescent. *Drupes* underneath on lateral branchlets, always under 2 or 4 leaves, globose, shining, 2 lines diameter, dark port-wine colour, often 4–6, sometimes 10–18, together in a dense semi-cluster; *fruit-stalks* very short, opposite each other on the branchlet. *Stipules* below the fruit, small spreading irregular, pubescent on both sides and ciliate, usually having a long connate pair, sub-spathulate or oblong rounded at tips and 1-nerved, clasping the fruit, like a little involucel; each berry bearing 2 seeds 1½ lines long, largely convex, sub-ovoid, slightly acute.

Hab. Dry woods between Norsewood and Danneverke, Waipawa County, where it is plentiful, 1876–1883: *W.C.*

Obs.—Sometimes a shrub is met with bearing red berries (like small red currants in size and colour); a fully fruited shrub is a pleasing neat-looking object. As a species it will rank naturally near to *C. tenuicaulis, rhamnoides,* and *divaricata.*

Genus 2. **Nertera,** Banks and Solander.

Nertera pusilla, sp. nov.

Plant a very small perennial *herb*, low and prostrate, of densely compact (almost mosssy) growth, closely intermixed with other small plants, setosely-hispid with long white hairs, much branched below and creeping underground; *branches* woody, rooting at nodes; *stems* wiry, 1–2 inches high, erect, tips of branchlets level. *Leaves* sub-orbicular and broadly ovate, spreading, membranous with muricated white dots on upper surface, 1½–2 lines long, obtuse, slightly decurrent, hispid on both surfaces and coarsely ciliate; *hairs* flat with raised bases (glands) on upper surface; *veins* anastomosing; *petioles* slender, 1 line long, connate at base; *Stipules* very minute, linear, acute, entire. *Flowers* lightish-brown or yellowish, longer than the leaves, very few, solitary, scattered, sub-terminal and axillary, fugacious; *corolla* infundibuliform, 3½ lines long, hispid without and densely echinate at top, tube very slender; *hairs* white at first, reddish-brown afterwards; *teeth* rather large, acute; *filaments* very long, wiry, spreading, and twisting, white at first black afterwards; *anthers* large, linear-oblong, much apiculate at tip, cordate at base, auricles acute sagittate; *styles* 2, exserted (but not largely), one-third the length of filaments, very pubescent; *fruit* small, about 1 line long, very hispid, sessile, dry, oval, ribbed, truncate with minute persistent crown of 4–6 calycine teeth, 2 of them being usually much longer and opposite.

Hab. On dry upland heaths between Matamau and Danneverke (with *Viola perexigua* and *Myosotis pygmæa*), 1882–83: *W.C.*

Obs.—A species having close affinity with *N. setulosa*, Hook. fil.

Genus 3. **Galium**, Linn.

Galium erythrocaulon, sp. nov.

Plant small, tender, cæspitose, upright, usually 3–5 inches high, simply branched at base; *stems* below and *rootlets* bright red and naked, stems above membranaceous, ciliated or hairy, with distant, white, acute, recurved hairs. *Leaves* very small in whorls of four, sub-rotund-elliptic, $\frac{1}{2}$–$1\frac{1}{2}$ lines long, 1 line broad or less, mucronate, very membranaceous, light green blotched with yellow, hairy on both sides, largely and distantly ciliate, spreading, sub-sessile, and very shortly petiolate, whorls distant on stalks, veins anastomosing. *Flowers* few, mostly solitary in axils of upper leaves, sometimes two on long divergent pedicels united together near base on a very short peduncle, very rarely three on one peduncle, and, when so, then bracteolated at junction, and the middle pedicel much the longest, simple peduncles and pedicels much longer than leaves, sometimes twice as long, upright; *corolla* rather large, 4-parted, pink, somewhat inflated and concave, segments broadly deltoid-ovate, 3-nerved, with three lines of erect minute pubescence within on the nerves, tips sub-acute incurved; ovarium glabrous. *Fruit* of two globose minute carpels, dark-brown, rugulose and finely muricated with black points.

Hab. Stony declivities, skirts of dry woods between Norsewood and Danneverke, Waipawa County, 1879–1882: *W.C.*

Obs.—When I first detected this plant in 1879, I supposed it to be a small variety of *G. umbrosum*, although its rather large and pink flowers differed considerably from those of that species, which are minute and white; these characters, however, I thought to be abnormal. Subsequently (in 1882), on again meeting with this plant in another and distant locality, I gathered, examined and compared it, and now I believe it to be a distinct species. It is certainly distinct from A. Cunningham's *G. propinquum*, as described by him in his "Prodromus" (a New Zealand and northern species, which I also knew at the North), which Sir J. D. Hooker has united with Forster's *G. umbrosum*, as being identical with that plant. Moreover, Sir J. D. Hooker says (in his "Handbook"), that he doubts if *G. umbrosum* is really different from his Tasmanian species, *G. ciliare*;

however that may be, one thing is certain, that *G. ciliare* (of which Sir J. D. Hooker has given a drawing and dissections in his *Flora Tasmaniæ*) is very distant from this species, *G. erythrocaulon.*

ORDER XXXIX. COMPOSITÆ.

Genus 10. **Craspedia**, Forster.

Craspedia viscosa, sp. nov.

Plant a simple perennial *herb*, bearing a single slender unbranched scape; whole *plant* viscid. *Leaves*, 4–6 at base, flat, spreading, sub-spathulate, entire, sessile, lamina extending to scape, membranous, glabrous with minute raised viscid dots, very slightly ciliate with white floccose hairs, apiculate, olive-green, trinerved; *veinlets* anastomosing. *Scape* erect, 8–16 inches high, bearing 10-12 leaf-like ovate-acuminate sessile bracts, alternate at about equal distances, lowest the largest, 1½ inches long, and gradually decreasing in size upwards. Compound head of *flowers* broadly sub-conical, with hairs as long as (or longer than) florets, ½–¾ inch diameter, upright, greyish; *corollas* slender, usually 3 in a head, each 3 lines long, tube greenish, dilated at base, petals tinged with red; *involucral scales* ovate, acute, 1-nerved, scarious at edges, outermost thickly muricated with minute raised dots, and pubescent in the centre; *pappus* very numerous, main stems of plumose pappus very broad at their bases; *achene* linear-ovate, shining, strigillose, slightly subangular, with a thickened areole at base having a hollow central depression.

Hab. Open spots, and among *Leptospermum* shrubs, dry hills near Matamau (S.), Waipawa County, 1881–1883: *W.C.*

Obs.—This species differs in habit from the two more showy species (N.Z.) already described, in not bearing its compound head of florets globular like a ball; the head is always upright, even after flowering, and confined within its involucral scales.

Genus 14. **Gnaphalium**, Linn.

Gnaphalium parviflorum, sp. nov.

Plant a slender perennial *herb*, prostrate, spreading, sub-ascending, much branched, rooting at joints; forming dense little beds or cushions where undisturbed. Ultimate *branchlets* filiform, 6–9 inches long, very cottony; *leaves* sub-imbricate above and distant on stems below, 3–4 lines long, oval, apiculate with a short stout coloured mucro, entire, sessile, decurrent, very nearly wholly embracing the stem, alternate, regular, white and densely cottony below, very slightly so above, upper surface bright green, floccosely ciliated with white tomentum, midrib prominent and stout below. *Heads of flowers* few, solitary, 2½ lines broad on a filiform peduncle 2 inches long, terminal on branchlets, bearing 1–2 small bracts; *involucral scales* numerous, all green with golden coloured and shining scarious edges and tips, obscurely nerved ; *inner*, linear, glabrous, tips lacerate and ciliate with white cottony tomentum ; *outer*, broadly oval, coloured with a carmine border round the green centre, and very cottony ; *tips of corollas* tinged with red ; *receptacle* concave, deeply and minutely punctured ; *achene* very small, linear, finely scaberulous, truncate at base with an acicular central point.

Hab. With the preceding plant (*Craspedia viscosa*), 1879–1883 : *W.C.*

Obs.—I have long known this plant in its leafing state, and have often sought diligently for its flowers, but failed in securing perfect specimens until this year. In its general appearance at first sight it closely resembles *G. filicaule.* It grows very thickly and luxuriantly where undisturbed, but only produces very few heads of flowers.

Order L. BORAGINEÆ.

Genus 1. **Myosotis,** Linn.

Myosotis pygmæa, sp. nov.

A very small strigose-hispid sparingly branched perennial (and annual) *herb* ; *stems*, 1–3, short, $\frac{3}{4}$–$1\frac{1}{4}$ inches long, prostrate, spreading from root ; *leaves* few, radical petiolate, cauline sessile, obovate-spathulate, $\frac{1}{2}$-inch long, very obtuse, thickish, mostly brownish-liver-coloured, strigose above with large rigid white hairs arising from muricated points, ciliated ; the lower surface of radical *leaves* glabrous, green, midrib very stout ; *flowers* solitary, axillary, sessile, 2–3 only on a branch in the axils of upper leaves ; *calyx* large, inflated, hispid and ciliate with long white hairs, lobes very long, acute, spreading, ciliate ; *corolla* pale yellow, tube cylindric, shorter than calyx, lobes rather large, rounded ; *stamens* included ; *nut* ovoid, convex on the one side and sub-carinated on the other with a slight compressed margin, turgid, obtuse, glabrous, shining, brown-black.

Hab. On dry upland open heaths (with *Viola perexigua, supra*), between Matamau and Danneverke, Waipawa County, 1882–83 : *W.C.*

Obs.—This little plant grows sparingly there, though from its small size and retiring habit it is easily overlooked ; besides it is very early dried up and withered. I think I have also found it nearly 40 years ago, but only as an annual, growing on the pebbly beach, a little above high-water mark, between Napier and the mouth of the river Ngaruroro. It seems to be allied to *M. antarctica*, Hook. fil., but is distinct.

Order LV. LENTIBULARIEÆ.

Genus 1. **Utricularia,** Linn.

Utricularia subsimilis, sp. nov.

A very small slender erect *herb. Roots* rather short, flat, white, semi-transparent, hair-like, with small scattered globular hyaline bladders, much fimbriated on the one side. *Leaves* few (2–3), basal, linear-spathulate, obtuse, 1-nerved, entire, 6–8 lines long ; *lamina* short, about 1 line broad, green; *petioles* white, semi-transparent, flat. *Scape* 2–3½ inches high, simple, filiform; *flowers* 1 (sometimes, but rarely, 2, only one such specimen seen), *pedicels* very slender, about ½ line long, bracts at top of scape 5, ovate-acuminate; *sepals* large, inflated, sub-orbicular in outline, the upper one very slightly sinuate, margins entire; *corolla* purple, strongly-veined, 3–4 lines diameter, upper lip small, cuneate, retuse, the lower one somewhat circular in outline (*i.e.*, presenting the broad segment of a circle), entire.

Hab. "In swampy grounds at Tapuaeharuru," interior (Taupo district), 1880: *Mr. A. Hamilton.*

Obs.—This species seems to have some slight affinity with *U. lateriflora*, Br., a Tasmanian species. Some allowance will have to be made for my description of the corolla of this plant, as I find it almost an impossibility to dissect it satisfactorily when in a dried state, particularly when the specimens have been closely pressed.

ORDER LXX. CUPULIFERÆ.

Genus 1. **Fagus**, Linn.

Fagus apiculata, sp. nov.

A tall handsome *tree*, 40 feet (and more) high, erect, of symmetrical shape; *trunk* 2 feet diameter; *bark* of trunk pale, smoothish; *branches* opposite, regular, horizontal, plane, spreading, bark darkish brown, studded with lighter coloured spots; *branchlets* pubescent. *Leaves* not crowded, rather distant, regularly disposed, sub-membranaceous, glabrous, broadly oblong-lanceolate, 1 inch long, entire, minutely crenulate, finely reticulated, margined, strongly apiculate, the point hard, obtuse, petiolate, slightly and finely pubescent on petioles and beneath; colour light-green; petioles 1–1½ lines long; bracts, *outer* glabrous, brown, shining, ovate-acuminate,—*inner* green, narrower and longer, obtuse, with scarious and ciliate edges. *Male* flowers lateral, on smaller slender branchlets, single, alternate, 2–4 (or more) near each other; *peduncle* slender, 2–2½ lines long, red, glabrous, or with a few weak scattered hairs; *perianth* cup-shaped, inflated, glabrous, whitish with pink margin, semi-pellucid, veined, largely 5-toothed, teeth obtuse; *anthers* 12–14, linear-oblong, apiculate, loosely exserted on long flat slender filaments, nodding. *Female* flowers (immature), small, axillary, sessile in axil of leaf above the male flowers, ovate, downy; *styles* brown, exserted.

Hab. In forests between Matamau and Danneverke, County of Waipawa, 1883: *W.C.*

Obs.—The discovery of this very distinct species of *Fagus* has much pleased me, as it supplies a required link between our known New Zealand species with large serrated leaves (*F. fusca* and *F. menziesii*) and our small entire leaved species (*F. solandri* and *F. cliffortioides*), and also between them and the Tasmanian and S. American species, which all have serrated leaves. The growth, habit and general appearance of this species (*F. apiculata*), with its thin and scattered leaves and flattened spreading branches, is very much like that of the northern variety of *F. fusca*, from Kaitaia near the North Cape, which I have ever supposed to be distinct from the *Fagus* of the East Coast (Poverty Bay), as well as from the plant of Whangarei (Bream Bay);* though at present those three (vars. ?) are all classed under *F. fusca*. I have never, however, seen the northernmost plant in flower or fruit.

Class II. Monocotyledons.

Order I. ORCHIDEÆ.

Genus 8. **Bolbophyllum**, Thouars.

Bolbophyllum tuberculatum, sp. nov.

Plant epiphytal, forming irregular patches on upper forks of large trees (*Dacrydium cupressinum*); *roots* 2–3 inches long, stout; *leaves* linear-oblong, 8 lines long, 2 lines broad, acute, sub-apiculate, entire, glabrous, dark-green on upper surface, of a lighter-green below, and there minutely and closely dotted with round greyish dots, flat or slightly involute, thickish but not fleshy, having 8–10 parallel veins which are transversely netted, keeled; *stipe* stoutish, 1 line long; *bulbs* ovoid, 3–3½ lines long, turgid, ridged; *ovary* oblong, 2 lines long, glabrous, greenish-white, tuberculated in rows, tubercles blunt, reddish; *scape* 6–8 lines long, springing from rhizome below base of bulb, slender, turgid and sub-pyriform at base, reddish, muricated, bearing a short raceme of 2–3 flowers; *flowers* alternate, rather distant on short pedicels, ½ line long, each having a bract at its base; *bracts* sessile rather more than half-clasping, deltoid-acuminate with a produced stout obtuse tip.

Hab. In forests near Petane, Hawke's Bay, 1883: *Mr. A. Hamilton.*

Obs.—A species very distinct from our long known and common *B. pygmæum*, Lindl.; apparently rare, though possibly confounded with that species. It is a much larger plant of similar appearance and habit. I regret that I have not yet seen new and perfect flowers.

Genus 9. **Corysanthes**, Brown.

Corysanthes hypogæa, sp. nov.

Plant very small, terrestrial, tender, succulent; *leaf* single, 5–8 lines diameter, membranous, shining, much veined, veins largely anastomosing with longitudinal dots in the interspaces, cordate-reniform, 3-lobed at tip, middle lobe produced, acute acuminate, side margins sinuate with a single notch on both sides near base, auricles large, distant, subhastate, very blunt; light green above, midrib and marginal spots purple; silvery below

* See "Tasmanian Journal of Science," vol. ii., p. 234.

and sometimes dashed with a purple hue; *petiole* ½–1½ inches long, white, often pinkish, with a sheathing truncate bract at base; *peduncle* short, 1–2 lines long, bibracteate close to base of flower, the front bract much smaller linear, the hind one ovate-oblong, both obtuse; *flowers* 3–4 lines diameter, much veined, dorsal sepal arched, closely clasping, subobovate-spathulate, narrowest at base, rounded and slightly sinuate or subapiculate at apex, green with a purple median line; *lateral sepals* and *petals* linear acuminate, very narrow filiform, upper pair ¾ inch long, lower pair hair-like, 4 lines long; *lip* large, dark blood-red above with darker stripes, greenish below spotted with red, bi-lobed at top, lobes rounded entire, 2–3 deep laciniations or ragged lobes below, with the sides much cut and jagged and incurved, a delicate circular bordered ear-like aperture on both sides immediately behind bases of petals.

Hab. Among mosses, steep cliffy sides of dry hills, *Fagus* forests near Norsewood, Waipawa County; 1880 (plentifully but barren); 1882 (a few capsules long past flowering); and 1883, September, in flower: *W.C.*

Obs.—I have known this plant for some years, but never found it in flower until the spring of 1883, mainly owing to its peculiar manner of growth, and its very early flowering; for while its one small leaf is spread flat on its mossy bed, its delicate flower is 1–2 inches below the surface, and never appears above during its flowering, though afterwards (in a few observed instances) its capsule is shown just above the surface, owing to the elongation of the peduncle after flowering, which habit is also common to the genus. It grows pretty thickly scattered in beds, showing its small glistening leaf just above the mosses and *débris* of fallen *Fagus* leaves (*F. solandri*), but flowering specimens are very scarce, not one plant in twenty bearing a flower. A species possessing close affinity with *C. triloba*, Hook. fil.

Corysanthes papillosa, sp. nov.

Plant small, 2–3½ inches high. *Leaf* ¾–1¼ inches diameter, membranous, finely and regularly papillose on upper surface, orbicular-cordate; *auricles* broad and largely rounded overlapping petiole, slightly retuse and apiculate at tip, much veined; *veins* anastomosing with an intramarginal vein running all round, light-green with (sometimes) a purple midrib and spots near margin; *petiole* ½–2 inches long; *peduncle* short, 3–4 lines long, variously situated—springing from near base of long petiole—from the middle—and from the top near leaf, purple spotted, bibracteate at base of ovarium; *bracts* small, unequal, the front one very minute, white, the back one much larger, ovate-acuminate, green. *Flower* ½ inch diameter, upper sepal suboblong-lanceolate, 2½ lines broad, acuminate, acute, projecting far beyond the lip (sometimes 2½ lines), recurved at tip, very thin, 5-nerved longitudinally, greenish-white spotted with purple-red; *lateral sepals* very filiform, 6–9 lines long, acute, whitish; *lateral petals* about 2 inches long, somewhat filiform but stoutish, obtuse, cylindrical, twisted, minutely spotted and coloured purple-red above for half of their length, white below; *lip* large orbicular, ½ inch (or more) in diameter, deeply bilobed above, spreading, plain, neither recurved nor involute, margins rounded entire above with a single slight notch at top on each lobe, very minutely undulate or finely and slightly toothed, retuse and apiculate below, papillose within, transparent, much veined; *colour*, dark purple-red above, whitish spotted with purple-red below; *ovarium* subangular, sulcated, purple striped.

Hab. In various parts of Hawke's Bay, among mosses in ravines, shaded woods in the interior, 1850–1880: *W.C.* Glenross, near Napier, 1883: *Mr. D. P. Balfour.*

Obs.—A fine species closely allied to *C. macrantha*, Hook. fil., but very distinct. Also, having affinity with *C. fimbriata*, Lindl., an Australian and Tasmanian species.

Thelymitra formosa, sp. nov.

Stem erect, very stout, 12–14 inches high, 3 lines diameter, tinged red with leaf bracts and bracteoles; two sheaths below leaf, scarious, truncate obtuse pointed and 2-nerved; 1–2 foliaceous bracts above leaf, 2½ lines long very acuminate, acute; *leaf* very thick fleshy, linear-ovate, 10 inches long, reaching to lowest flower on scape, 4-nerved, broadly keeled, deeply channelled, edges incurved, 6–8 lines wide near base, purple-brown densely covered with minute red raised dots. *Flowers* 5–10, erect on stout pedicels ½–¾ inch long; a bracteole at base of each, ovate-acuminate very acute, sub-clasping ½–¾ inch long reaching to base of perianth, obscurely 6–8 nerved; *perianth* 1–1¼ inches diameter. *Sepals* ovate-acuminate, nerved, a little longer than the petals, brownish-purple with white margins; *petals* light bluish-purple, broadly oblong-lanceolate, very obtuse, or elliptic with a mucro, obscurely nerved. *Column* with pointed tip; *appendages* (*staminodia*) long, much longer than the column each bifid, anterior arm densely fimbriated with yellow fimbriæ, posterior ditto with long subulate erect points at top, and crenulated fleshy pink edges on back slope running down to a deep notch at the back, exposing top of column. *Ovary* obovate, 9 lines long, 3 lines wide, broadly ribbed. *Tubers* 2, large, sub-obovoid, obtuse, 1 inch long, ½ inch broad.

Hab. In clayey ground, *Fagus* woods, high land between Norsewood and Danneverke, Waipawa County, 1882; flowering in December: *W.C.*

ORDER V. TYPHACEÆ.

Genus 2. **Sparganium,** Linn.

Sparganium angustifolium, R. Brown.

Hab. Hawke's Bay, low watery places, sides of streams, etc.: *W.C.* Petane, near Napier, 1882: *Mr. A. Hamilton.*

Obs.—Agreeing closely with the Australian species; also found in the northern parts of the North Island, and long confounded with *S. simplex*, Huds.

ORDER VII. LILIACEÆ.

Genus 4. **Dianella, Lamarck.**

Dianella nigra, sp. nov.

Plant a diffuse herb; *leaves* drooping, subrigid when old, 3 feet long, 8 lines broad, linear acuminate and very acute, keeled, hooked on margins and keel throughout, glabrous, glossy above, striate below, finely and regularly nerved, margins slightly recurved, light-green, bases pink-red, and so bracts. *Scapes*, 3 feet 9 inches to 4 feet 3 inches long, stem below dark-green, subterete, 1–2 foliaceous bracts below panicle; *panicle* proper, 2 feet to 2 feet 8 inches long, narrow oblong, slender and very loose, black-purple; main *branchlets* few, 4–10 inches long, wiry, filiform, very distant on rhachis, 4–6–10 inches apart, tough, each divided into 2–4 long slender sub-branchlets, all straight and suberect, each sub-branchlet with 4–5 scattered flowers at top on long pedicels; *pedicels* 1–2 inches long, spreading; ultimate *bracts* small, linear, obtuse, 1–2 lines long, generally situated 2–4 lines below junction of subpeduncle. *Perianth* (unfolded) dark-purple almost black, linear-oblong obtuse under 2 lines long, expanded 3½ lines diameter, patent not reflexed, segments with very dark distinct nerves, margins whitish; three outer *segments* 5-nerved, sublinear-ovate, three inner segments 3-nerved, broader and more obtuse at apex. *Anthers* linear-oblong obtuse, light-yellow, scarcely 1 line long; *strumæ* about same length, a little thicker, thickest upwards, dark orange-yellow; *filaments* below much longer, very slender, bent and crumpled, white; *style* a little longer than stamens, slightly curved; *stigma* capitate, papillose. *Ovary* subtriquetrous, rotund at apex, glabrous, ⅓, or so, inferior.

Hab. Dry hillsides among under shrubs, forests near Matamau (S.), Waipawa County, 1882; flowering in December: *W.C.*

Obs.—A peculiar looking species from its tall, large, and lax black panicle and very small star-like flowers, widely differing from our other only known N.Z. species, *D. intermedia*, which species is also said to be generally common in the S. Polynesian Islands, as Fiji, etc. [*see* Seemann, Bentham, etc.] I only detected two bushy diffuse plants or tussocks that had been browsed on by cattle in the past season; they bore, however, a quantity of new leaves, and a great number of scapes.

Genus 5. **Astelia**, Banks and Solander.

Astelia spicata, Col. (*male* plant).*

Plant much the same as the female one in size, leafing, and general appearance. *Scape* erect, 3 inches high, including spike; *spike* 1½ inches long, bearing 12 flowers, the lower ones distant, alternate and pedicelled, each one of these having a long leaf-like broadly-lanceolate-acuminate and ciliate bract, the lowermost being 3½ inches long, acute and pubescent at tips; the upper *flowers* are sessile, clustered in a dense obtuse spike, each one having a fine long linear silky bracteole; lobes of *perianth* white, large, hyaline, linear-oblong, obtuse, 1-nerved, at first cohering at tips and covering anthers, etc., in a conical form, afterwards wholly reflexed; *filaments* white, 1½ inches long, flat, spreading, succulent; *anthers* linear, light brown; *pollen* numerous, issuing in large white grains, possessing a sugary appearance.

Hab. Epiphytical on living trees, in forests near Norsewood (same locality as that of the *fem.* plant), 1883: *W.C.*

Obs.—It is rather a curious incident that, after two years research (and always seeing scores of barren (?) plants high up on the neighbouring trees around), I found only this *one* plant in flower, growing in the low fork of a tree, just as in the case of the *one fem.* plant two years before.

Order XI. CYPERACEÆ.

Genus 9. **Cladium**, Linn.

Cladium (*Vincentia*) *gahnoides*, sp. nov.

Plant growing in large bushy tufts; *culms* 2 feet high, compressed, smooth, leafy; *leaves* flat vertically without a midrib, 2–3 feet long, 4–7 lines broad, linear-acuminate, acute, margins entire, smooth, not cutting, sub-membranaceous, softish, finely striate, equitant at bases, pale green; *panicle* 6–8 inches long, much branched, nodding; *bracts* sheathing glabrous, dark-brown, lower ones very acuminate, minutely scabrid only at tips; *branchlets* drooping, springing from smaller bracts; *peduncles* flat, or tetragonous, compressed, striate, glabrous; *sub-peduncles* and *pedicels*, flat, ciliate-scaberulous; *spikelets* small, fascicled, rich dark red-brown; *lower glumes* and *bracts* awned, glabrous, very slightly and minutely scaberulous on mid-nerve at back; *stamens* 3, 1 inch long, flat, colour light-brown, twisted, dilated and truncate at apex, elongated and persistent after flowering; *style* 1 line long, persistent; *stigmas* 3, linear, longer than style, densely papillose; *nut* very small, less than 1 line long, spindle-shaped, turgid, triquetrous throughout and ribbed at margins, beak minutely barbed, base thickened, often hanging by the persistent filaments as in several *Gahniæ*; colour pale light-brown.

* *See* "Transactions N.Z. Institute," vol. xiv., p. 335, for a description of the *female* plant.

Hab. Cliffy banks of the upper part of the Petane River, near Napier, on high and dry stony ridges, and on similar spots inland between Hawke's Bay and Taupo, 1846–1852: *W.C.* Petane Valley, 1881: *Mr. A. Hamilton.*

Obs.—A species closely allied to *C. sinclairii*, Hook. fil., but smaller in all its parts.

Genus 13. **Uncinia,** Persoon.

Uncinia bractata, sp. nov.

Plant perennial, erect, growing in large bushy tufts. *Culms* 12–18 inches high, stout, smooth. *Leaves* numerous, shorter than the culms, 10–14 inches long, 2 lines broad, flat, membranous, many nerved, keeled, slightly scaberulous, more so at tips which are obtuse. *Spikelet* 3–4½ inches long, ⅛th of an inch broad, trigonous; upper 6–12 lines male; *bracts* 2 sometimes 3, very long, longest and lowermost 6–10 inches and more, foliaceous, very narrow, channelled, scaberulous above, slightly so below; *glumes* closely imbricate, linear, acute, 2 lines long, glabrous, obscurely nerved, keeled, dark-brown; *utricle* shorter than glume, subrhomboidal, glabrous, nerved, subtriquetrous, compressed, dark-brown at top light-coloured below; *bristle* slender, as long as the utricle.

Hab. Woods, dry hills, between Norsewood and Danneverke, Waipawa County, 1882–3: *W.C.*

Obs.—A species having affinity with *U. australis*; from its much softer foliage often browsed on by cattle.

Uncinia obtusata, sp. nov.

Plant thickly cæspitose in rather small tufts. *Culms* 12–21 inches high, sub-erect, rigid, smooth, but finely scaberulous at top for about 1 inch below spikelet, triquetrous. *Leaves* much shorter than culms, 6–9 inches long, linear, $\frac{1}{9}$th of an inch wide, flat, membranaceous, grassy, sub-erect, smooth, finely and closely scabrous towards top, obtuse, nerved, slightly keeled. *Spikelet* 1–1½ inches long, loose, spreading, few-flowered, flowers distant; upper 4–5 lines male, very slender; *bract* 3–4 inches long, filiform, obtuse, scabrous, and densely so at top; *glumes* closely imbricating, shorter than utricle, 1½ lines long, deltoid-acuminate; 1-nerved, obtuse, lowest (one or two) trifid and awned, awn long barbed obtuse; *utricle* longer than glume, 2 lines long, broadly lanceolate, glabrous, produced and tumid at base, triquetrous, turgid, 3-nerved, at first green, afterwards when old dark-brown; *bristle* slender, ½ a line longer than utricle; *stigmas* long, spreading.

Hab. Open woods near Norsewood, County of Waipawa, 1882–3: *W.C.*

Obs.—Sometimes the culm is entirely smooth throughout, and without a bract.

Genus 14. **Carex**, Linn.

Carex flagellifera, sp. nov.

A flaccid diffuse largely tufted *species*. *Culms* slender, 7–8 feet long, 1 line diameter below, much less above in middle and long panicle, smooth, subcylindric, hollow in the centre, striate, prostrate, extended, bearing a single leaf about the middle. *Leaves* drooping and spreading, much shorter than the culms, 2 feet 6 inches long, 1 line wide, stout, smooth, channelled, finely scabrous at edges, and still more slightly so on midrib at back, above but not below, green, regularly striate, with a broad filmy margin at the extreme base. *Spikelets* 4–6 (usually 5), very distant on panicle, cylindrical $2\frac{1}{2}$ inches long, peduncled, pendulous; *peduncles* 2–3 inches long, compressed, lowermost pair 1–2 feet apart, sometimes the lowermost one is compound trifid or shortly tripedicelled, the uppermost one is *male* and very slender, $1\frac{1}{2}$ inches long; *bracts* very long, narrow and foliaceous, finely scabrid at edges; *glume* ovate-acuminate, $1\frac{1}{2}$ lines long, stoutly 1-nerved, awned, awn barbed; *utricle* as long as the glume, broadly lanceolate, bifid, turgid shining, light-brown; *stigmas* 2.

Hab. On sides of abrupt clayey declivities, woods, between Norsewood and Danneverke, Waipawa County, 1881–1883: *W.C.*

Obs.—A very remarkable species, owing to its very long weak and prostrate culms, which stream away together like long wisps or bands, and so get entangled among the low herbage and common fern—*Pteris esculenta.*

Carex sex-spicata, sp. nov.

Culms 2 feet–2 ft. 3 in. high, erect, stout, trigonous, smooth, more than 1 line in diameter, leafy, culm leaves with a sharply acute triangular hairy ligule; *leaves* as long as culms, $\frac{1}{4}$ inch wide, sub-rigid, rather harsh, flat, many nerved, the 2 principal lateral nerves white and strong on the upper surface, very acuminate, expanding below into wide filmy sheaths, keeled, closely and finely scabrid at edges, and slightly so on the two white nerves above and on the midrib below, striated; *spikelets* 6, approximate, each about 2 inches long, stout, shortly peduncled, erect, light brown, panicle short, $\frac{2}{3}$ below of upper spikelet male, and the next two with a very few males below, the other 3 wholly female; *bracts* wide, foliaceous; *glume* linear-ovate-acuminate, bifid, sub-awned, less than 2 lines long, shorter and much narrower than the utricle, 1-nerved, longitudinally and numerously marked with fine short red lines, persistent; *utricle* ovate-acuminate, 1-nerved, turgid, spreading, smooth, bifid, tips acute, long-produced; *anthers* $1\frac{1}{2}$ lines long, linear, apiculate, twisted, light brown; *filaments* longer than anthers, flat, much flexuose; *stigmas* 3.

Hab. Edges of River Mangatawhainui, near Norsewood, 1883: *W.C.*

ORDER XII. GRAMINEÆ.

Genus 16. **Danthonia**, DeCandolle.

Danthonia pentaflora, sp. nov.

Plant tufted, but not in dense tussocks. *Culms* 2–3 feet high, glabrous, stout. *Leaves* flat, 3–3½ feet long, 2–3 lines wide, pale green, strongly nerved, glabrous and shining above, pilose below with long scattered white hairs, margins thickened bearing a double row of fine sharp cutting spiny recurved teeth, midrib scabrid above; *sheaths* ⅓ of an inch broad, subcoriaceous, glabrous and keeled below, pilose above and ciliated with long straggling hairs, margins towards top slightly scabrid, densely and silky pilose with compressed hairs above mouth of sheath, and a transverse line of thickly set shortish white hairs almost disposed in little regular pencilled tufts forming a ligule. *Panicle* large, erect, broadly obovate, 12–14 inches long, open, diffuse, very thin; *branches* alternate, distant, 4–8 inches long, 5 springing nearly together from a node, glabrous; *branchlets* very slender, filiform, few flowered, scaberulous. *Spikelets* distant, ½ inch long, 5-flowered; *peduncles* ¼–1 inch long, hairy under spikelet; *florets* sessile on rhachis; *rhachis* below florets densely hairy; *hairs* long. *Empty glumes* margins entire, subacute, lower one much the smaller, strongly 1-nerved, upper one slightly ciliated near base; *flowering glume* ciliate with long white hairs at margins near base, the 2 lobes much elongated but not awned, very finely and closely villously-ciliate, 1-nerved, awn much longer than glume, acicular, flat at base, 2-nerved, spreading, deflexed; *pale* nearly as long as the glume, broadest near top, almost subobovate retuse, minutely and closely pilose-ciliate and subpencilled at apex, largely ciliated with long hairs on the back near base, margins pale-green. *Anthers* (immature) very long, nearly 2 lines, linear, light-brown, not exserted.

Hab. Slopes of Ruahine mountain range (immature), 1846, etc.: *W.C.* Near same localities, 1882: *Mr. A. Hamilton.*

Obs.—A species very near to *D. cunninghamii* in its general appearance but smaller, of tufted growth but not largely so, and more restricted as to locality. I have closely examined several specimens, gathered at various seasons and in separate localities, and have invariably found a spikelet to consist of 5 florets, the upper one being often smaller and abortive. Unfortunately all my specimens, though gathered at different times in early summer, were rather immature; and those collected by Mr. Hamilton in December are much the same. This species ripens its seeds late in the autumn. I have hitherto refrained from describing it in the hope of obtaining more complete specimens.

Class III. Cryptogamia.

Order I. FILICES.

Genus 1. **Gleichenia**, Smith.

Gleichenia littoralis, mihi.

Plant gregarious; *rhizome* creeping, stoutish, thickly clothed with shining brown laciniate scales; *stipes* erect, glabrous, 6–8 inches high, sub-cylindrical below, flattish above, deeply channelled on upper surface, olive-green, sometimes light-brown; *fronds* sub-flabelliform, 2-branched, each main branch once or twice forked, or sometimes with 3 single branchlets; *branchlet* ovate-acuminate, 4–6 inches long, 1–1¼ inches broad near base, pinnate below, deeply pinnatifid quite to midrib above, extending also to apex which is not caudate; *colour* reddish-green, rhachis and veins red; *segments* linear, glabrous, sub-membranaceous, opposite and occasionally alternate, plane, patent, sub-erect, broadest at base, decurrent, ½–¾ inch long, 1 line wide, pinnate, distant and sub-adnate, not decurrent, (those on branchlets below the upper forkings are generally the longest—there are none below the first or lowest fork), margins entire (slightly recurved in age), sometimes a few segments are irregularly and very finely and distantly serrulate; *apices* very obtuse incurved and adpressed and finely woolly on both surfaces; *midrib* and veins woolly below with shining silky spreading hairs; *capsules* reddish, usually 4 together (sometimes 5 or 3), biserial on upper veinlets of middle of segments, exposed; *veins* prominent, forked.

Hab. Wooded cliffy shores of Whangaruru Bay S., 1836–41: *W.C.* Owana, E. coast Great Barrier Islet, Thames, 1883: *Mr. C. P. Winkelmann.*

Obs.—This species is allied to our *G. flabellata*, Br. (but is very distinct from it, though often, I think, confounded with it), and, possibly, more so to the Cape Horn species, *G. acutifolia*, Hook., particularly in its being a small pedate, erect, non-proliferous species, and like that species also a seaside plant. It seems to have a narrow range, at least I never met with it anywhere else than in that one habitat at Whangaruru, though there it grew plentifully and thickly in one spot, which I visited year after year from the time of its first detection, but could only find short barren yellowish fronds, which both A. Cunningham and Sir W. J. Hooker supposed to be those of *G. flabellata* in its young state; this, however, I always doubted. Now, then, after more than 45 years! it has been rediscovered by Mr. Winkelmann as above, from whom I have had for examination several specimens in full fruit, and pretty uniform.

Gleichenia punctulata, mihi.

Fronds erect, slender, 1½–2½ feet high, repeatedly dichotomously branched, very regular; *stipe* and *rhachises* slender, brown, densely scaly, woolly, and hairy; *branches* deltoid-acuminate, 5–7 inches long, 2 inches broad at base, pinnate; *pinnæ* petiolate, alternate, very distant, 1 inch long, 1½ lines broad, deeply pinnatifid to midrib, glabrous and shining and dull dark green above, wholly glabrous below, except towards base of midrib, and there slightly woolly and scaly, but not hairy, whole plant, however, densely woolly and scaly below when young, the lowest pair of lobes (or sometimes two) larger, distinctly free and pinnate, lobules adnate, broadly elliptic, almost sub-quadrangular, very obtuse and slightly recurved at tips, glaucous almost blue beneath, and minutely and regularly punctulate (stippled) with light fawn-coloured shining dots; *veins* usually 1–3 branched, obscure; *capsules* 1–2 together, large, white, exposed, submarginal on upper inner corner of lobule; *hairs* short, rigid, dark red, fascicled in small scattered bundles; *scales* large, triangular, acuminate, netted and thickly ciliated.

Hab. Near Hot Springs, centre Great Barrier Islet, Thames, 1882: *Mr. C. P. Winkelmann.* I have also seen barren specimens collected earlier, from the west coast, South Island

Obs.—A species having pretty close natural affinity with *G. G. microphylla*, Brown; *semivestita*, Lab.; and *hecistophylla*, A. Cunn.; but differing from them all, and possessing characters which those species have not—that are better seen than described in words.

NOTE.—I have ever believed in the specific distinctness of those three ferns I have just mentioned; in which I also wholly agree with Mr. J. Smith (who had so long successfully cultivated them at Kew), in his last two works on ferns, viz., "Historia Filicum," p. 339, and "Ferns, British and Foreign," p. 248; as well as with Sir W. J. Hooker in his "Species Filicum." Those eminent practical botanists, R. Brown and A. Cunningham, who had ample opportunities throughout many years of observing those three ferns they had described in their native habitats, could not possibly have been mistaken about them.

Genus 10. **Lindsæa**, Dryander.

Lindsæa trilobata, sp. nov.

Rhizome creeping densely scaly; *scales* ramentaceous, largely reticulated and transversely barred. *Plant* erect, cæspitose, 7–10 inches high, sublinear-lanceolate acuminate, pinnate, glabrous, dull green, but when young of a graceful delicate light green, sub-membranaceous. *Stipes* 4–6 inches long, very flexuous and tough below, obscurely triquetrous, compressed at base, deeply channelled and shining (together with rhachis) on the upper surface, slightly and sparsely roughish and muricated with little round knobs; *colour* light chesnut-brown. *Fronds* 3–5 inches long, 6–9 lines broad, fertile ones usually the longest and about 20–22-jugate; *pinnules*

2–4 lines long, 1½–3 lines deep, opposite and sometimes alternate, petiolate, obliquely-flabelliform, sub-rhomboidal, and broadly cuneate, spreading, distant, lower very remote, upper approximate; *petioles* slender; the larger pinnules of the barren fronds and frequently of the fertile ones deeply 2–4 (mostly 3-) lobed on upper convex margin; *lobes* laciniate and irregularly crenate and toothed, the lower and inner margins of pinnules entire; *veins* radiate, free, forked, clavate at apices, prominent, dark-coloured, not extending to margin. *Involucres*, the inner valve green, broad, extending quite to margin of the outer one; *margins* of both closely and deeply laciniate-toothed; *teeth* sub-rigid, very obtuse; *margins* (with petioles and upper rhachis) bright red, and revolute when young. *Sori*, straw-coloured, but reddish with age.

Hab. In hollows on high land, tops of hills near the north head of Wellington Harbour (but not plentiful), 1846–7: *W.C.* Whangaparapara, west coast Great Barrier Islet, Thames, 1883: *Mr. C. P. Winkelmann.*

Obs.—A species having affinity with *L. linearis*, Sw., and probably with *L. incisa*, Prentice, another Australian species (judging from Bentham's description of this latter, as I have not seen any specimens of this plant), and with *L. lobbiana*, Hook. (also from his description). Differing, however, from *L. linearis* (a species found plentifully in New Zealand—Bay of Islands, and elsewhere) in size—in its larger and lobed pinnæ, which are also on slender petioles—in form and colour of stipes and rhachis, and in the stout obtuse toothing of its involucres. Here I might very well adopt Sir W. J. Hooker's remark in describing the fern above mentioned, *L. lobbiana*:—"Without a figure I should despair of making its character intelligible, so difficult is it to define in words the forms of the pinnæ of these plants."—*Sp. Filicum.*

Genus 16. **Lomaria**, Willdenow.

Lomaria oligoneuron, sp. nov.

Plant under a foot high, tufted, 6–12 fronds to a plant, glabrous, sub-erect and spreading, with a short, stout, woody caudex about 1 inch long. *Roots* stoutish, long, spreading, densely clothed with light brown, shining, shaggy hairs; *stipes* short, usually under 1 inch (sometimes of sterile fronds extending to 2 inches or more, and of fertile fronds still longer), slender, dark purple-brown, slightly roughish below, sub-cylindrical, channelled (with rhachis) on the upper surface; *scales* long at base and for some distance upwards; *fronds* pinnate; *sterile* ones sub-lanceolate, broadest near tips, flat, 7–9 inches long, 10–14 lines broad, pinnæ numerous, rather distant, sub-opposite, adnate and decurrent, coarsely and prominently veined, membranaceous and puckered, deeply and coarsely crenate-serrate, almost sub-laciniate or pinnatifid-serrate, the most prominent teeth or laciniations usually bearing a minute hard white recurved tooth (sometimes two) on their tips; *colour* pale greyish-green; upper and largest pinnæ broadly linear-oblong, very obtuse and truncate, 6–8 lines long, 3–4 lines broad, suberect, confluent at top, terminal lobe deltoid very obtuse; lower *pinnæ* occupying considerably more than half of the frond, much smaller than upper, orbicular and gradually decreasing in size downwards; *fertile fronds* longer than barren ones, but more slender with fewer and more distant pinnæ; *pinnæ* opposite and alternate, distant, ligulate, largest ½ inch long, 1 line broad, apiculate, upper and larger ones slightly petiolate, terminal one subcaudate, lower ones excessively small; *involucre* finely reticulated, margins entire; *scales* on stipes 2 lines long, flat, deltoid-linear acuminate, nerved longitudinally and much dilated at base. *Veins* conspicuous, simple and forked, extending quite to margin, clavate, very few and distant, usually only 4-jugate in the largest pinnæ, the lowermost one or two pairs not springing from the midrib (this character is also found in the smallest orbicular pinnæ), midrib usually forked at apex.

Hab. Great Barrier Islet, Thames, 1883: *Mr. C. P. Winkelmann.*

Obs. I.—A species having close affinity with *L. lanceolata* and *membranacea*, particularly the latter, but differing in several important particulars:—*e.g.*, in its large normal sterile pinnæ being fewer in number and decurrent, and much more coarsely serrate, and fewer veined, with veins extending to margins and the lowermost not springing from the midrib; in its small orbicular and deeply crenate-serrate pinnæ occupying nearly two-thirds of the frond; and in all being more distant from each other on the rhachis; and in its upper fertile pinnæ being petiolate, and their involucres finely reticulate with entire margins.

Obs. II.—I have had several fully fronded plants containing together more than fifty specimens of barren and fertile fronds to look over, and their uniformity in habit and character is great; the plants differing only in size.

Genus 22. **Polypodium**, Linn.

Polypodium rufobarbatum, sp. nov.

Plant terrestrial, sub-erect, wholly covered with long and stout red and shining jointed and moniliform hairs; *rhizome* creeping, densely hairy; *fronds* ½–1 inch distant on rhizome. *Stipes* 1–3 inches long, and rhachis, slender, subflexuose, dry, channelled above, red, shining; *frond* 4–6 inches long, sublinear-ovate, acuminate, bipinnate, membranaceous, light green; *pinnæ* petiolate, distant and subopposite, deltoid-acuminate, ¾–1 inch long, 3–6 lines broad, spreading; *pinnules* sessile, distant, pinnate below, pinnatifid above, cut down quite to midrib of pinnæ, decurrent, linear-oblong, obtuse, flat, 6–7 lobed, very uniform, ciliated all round with stout red hairs extending far beyond margin; *lobes* slightly crenate-toothed, never recurved over sori; *sori* large, round, reddish, bifariously disposed, one on each lobe on middle of veins, within margin, mostly three pairs on a pinnule; *veins* few, simple, and once forked, extending quite to margin, clavate at tips.

Hab. Skirts of woods, hills, between Norsewood and Danneverke, Waipawa County, 1882; *W.C.*

Obs.—A very graceful little fern of uniform growth and appearance, allied to *Polypodium rugulosum* and *Hypolepis distans*, but distinct from both.

Order II. LYCOPODIACEÆ.

Genus 2. **Lycopodium**, Linn.

Lycopodium consimilis, sp. nov.

Plant gregarious; *rhizome* creeping, stout, white, glabrous; *stems* slender, erect, leafy from the base, 7–10 inches long, simple and branched; *branches* often again forked from near their bases; *leaves* nearly 3 lines long, squarrose, flat, linear-acuminate (occasionally forked), broadest at base and coadunato-decurrent, finely striate and shining, obsoletely nerved, margins revolute, slightly lacerate and jagged at tips, tips obtuse; green when young, yellowish-green when mature, often purple-tipped; *spikes* 5–6 on a branch, lateral and sub-terminal, cylindrical, peduncled, 5–8 lines long, lowermost longest, narrow, acute; *bracts* large, spreading, finely striate and shining, deltoid-acuminate, sub-awned, slightly keeled towards apex, margins serrate and jagged and sub-revolute, apices jagged (after the manner of the leaves but stronger); yellow-brown; *capsules* 3-lobed, turgid, with a small linear inner bracteole arising from base of capsule and embracing it.

Hab. Stony ground, White Cliffs, Great Barrier Islet, 1883: *Mr. C. P. Winkelmann.*

Obs.—A species having pretty close affinity with *L. laterale*, Brown.

Order IV. MUSCI.

Genus 21. **Encalypta**, Schreber.

C. novæ-zealandiæ, sp. nov.

Stems closely tufted, very short, about ½ an inch high. *Leaves* green, sub-erect, oblong, obtuse, margin entire, midrib very stout below, not excurrent, glabrous; *perichætial leaves* broadly ovate. *Fruit stalk* 3–4 lines long, red; *capsule* linear-ovate, compressed, smooth, shining, reddish; *calyptra* large, nearly 3 lines long, shining (satiny), finely striated, entire at the base (and, sometimes, finely toothed), tips smooth.

Hab. On ground, dry hills at Pohue, and at Petane, near Napier, 1882: *Mr. A. Hamilton.*

Obs.—A species near to our only (hitherto) known New Zealand species *E. australis*, Mitten); and also, and nearer, to *E. vulgaris*, Hedw., a British and common European species, found also in Tasmania; but differing from both, and from all others known to me.

Order V. HEPATICÆ.

Genus 7. **Gottschea,** Nees.

Gottschea compacta, sp. nov.

Plant of densely compact dwarf growth under 1 inch high, erect, closely imbricate, forming little patches, whole plant very tender and brittle. *Stems* rather stout, prostrate, dark claret colour, 1–1½ inches long, with many fine dark pink rootlets below, sometimes two-branched near the tops, tops of branches decumbent, spreading, and then 4–6 lines broad, with leaves laxly imbricate. *Leaves* light green, pink at junction with the stem, very much waved and crisped, smooth, shining, semicircular, broadly elliptic and sub-quadrate in outline, margins entire, decurrent, sometimes very sparingly toothed towards base. *Involucral leaves* smaller, narrower, entire, conniving; *fruit stalk* 1 inch long, rather slender; *capsule* small, globose, black, minutely pitted; *stipule* 0.

Hab. On wet perpendicular clay cuttings among mosses, etc., near bridge of River Mangatawhainui, Norsewood, 1883: *W.C.*

Genus 30. **Symphyogyna,** Mont. and Nees.

This, hitherto, small and little-known genus having lately largely increased in additional and new species, I give a classification of them:—

I. Fronds stipitate, erect.

1. Margins serrate.

1. *S. rubricaulis.*
2. *S. pellucida.*
3. *S. melanoneuron.*
4. *S. vulgaris.*

2. Margins entire.

5. *S. simplex.*
6. *S. megalolepis.*
7. *S. fœtida.*
8. *S. longistipa.*

II. Fronds prostrate, creeping.

1. Margins serrate.

9. *S. prolifera.*

2. Margins entire.

10. *S. undulata.*
11. *S. marchantioides.*

S. rubricaulis, sp. nov.

Plant terrestrial, gregarious, diœcious, each plant simple, suberect, stipitate, the largest from ¾–1 inch long including stipe, roots short succulent and hairy; *stipe* mostly 3–4 lines long (sometimes 9–10), flexuose, obsoletely angled, rosy-red, 1-nerved from base of frond to root (sometimes 2-nerved above), succulent, semi-transparent; *frond* (largest and fruit-bearing) broadly deltoid or fan-shaped in outline, ½ inch long, ½ inch broad at top, mostly 4-parted or sub-digitate, sometimes simply once-forked, 1½–2 lines broad, and very truncate and undulate at base, not decurrent on stipe; *segments* under 1 line broad, nearly linear but broadest at base and narrowest at tips, margins serrate, serratures few, small, and irregular, none at tips which are obtuse and retuse, glabrous, transparent, minutely reticulated, areolæ oblong-pentangular regular; colour bright light green; *fructification* on upper surface of frond, single, on one side below forking of veins of forked fronds; *involucre* a narrow linear-oblong laciniate scale; *peduncle* 10–11 lines long, slender; *calyptra* tubular, 2½–3 lines long, whitish, reddish at base, slighly roughish, mouth truncate, laciniate, with rather long fimbriæ; *fimbriæ* brown; *capsule* 1–1½ lines long, linear, cylindric, finely striate, sub-acute and pointed, shining, black; *antheridia* on separate and much smaller fronds, closely placed on midrib and veins on the upper surface.

Hab. On shaded clayey banks, Seventy-mile Bush, near Norsewood, County of Waipawa, 1880–3: *W.C.* Glenross, near Napier, 1883: *Mr. D. P. Balfour*; fruiting in September.

Obs.—A species having affinity with *S. biflora*, mihi, and *S. hymenophyllum*, Hook., but very distinct from both. *S. biflora* bears its fructification on the lower surface and this species on the upper. This species grows thickly together in little beds or patches, with its fronds always inclining one way, half-nodding and overlapping, with its coloured fructification erect and some distance above them. Some fronds have three segments, others only two, and some a single one, which is then oblong-lanceolate. It is a very pretty neat little species.

2. *S. pellucida*, sp. nov.

Plant gregarious stipitate erect, usually single, though sometimes two, or even three, are found united by a very short rhizome, 1–1½ inches high, 1½–2½ lines broad, commonly once-forked, sometimes single, and occasionally (though rarely) 3-branched, single fronds and segments generally linear-oblong and broader near tips, pagina of frond broadly decurrent to near base, slightly sinuate and waved, particularly below, transparent, margins very finely serrate, apices rounded, obtuse or slightly emarginate, nerve single, strong, and extending to tips, colour very light green; *stipes* very short, 1–1½ lines long, with small fine rootlets at base ; *fructification* on the upper side, scattered, mostly on nerve near the middle of the frond, sometimes near the base, and sometimes at the forking but above it, and not unfrequently two on a frond ; *involucre* broad, subplicate, deeply and finely laciniate, sometimes three occur on a branchlet ; *calyptra* cylindric, two lines long, whitish, glabrous, slightly rugulose, with delicate small fimbriæ at the mouth ; *peduncle* slender, 8–12 lines long ; *capsule* linear, obtuse, 1 line long, glossy dark brown, valves not cohering at tips ; *spores* circular, presenting a ringed appearance ; *cellules* very minute, chain-like, irregular in shape and size, mostly pentagonal.

Hab. On clay banks, sides of streamlets near Norsewood, 1878–83 (but barren) : *W.C.* Petane, near Napier, September, 1883 : *Mr. A. Hamilton* ; profusely in fruit.

Obs.—A species having alliance with *S. subsimplex*, Mitten, and *S. prolifera*, mihi (*infra*), but very distinct from both. Occasionally, however, a frond is met with slightly rooting from its centre, below the fruit-point, or from becoming recumbent, and sometimes, though rarely, by throwing out lateral fronds from its base. A few young fronds are also found intermixed, very narrow long and pointed ; these, I am inclined to believe, enlarge their pagina afterwards.

3. *S. melanoneuron*, sp. nov.

Plant small, single (?), stipitate, erect ; *frond* reniform in outline, 7–8 lines broad, 4–5 lines long, forked, once or twice divided, stoutish, wavy, colour dark olive, cellules small, oblong ; *segments* few, sublinear-oblong, short, about 1½ lines or more wide, not divided deeply, not decurrent on stipe, very slightly and distantly serrulated towards bases not above, tips largely emarginate ; *midrib* stout, almost black, not extending to tips, in some segments midrib forked at tips ; *stipe* 6–9 lines long, stoutish, black-brown ; *involucre* small, simply 2–3 times notched, on upper surface at second forkings above, 2–3 on a frond ; *antheridia* on lower surface, under minute ovate leaf-like scales, scattered on both sides of the midrib.

Hab.—On clay banks under ferns, &c., dark forests near Norsewood, 1879–83 : *W.C.* ; and at Great Barrier Islet, 1883 : *Mr. C. P. Winkelmann.*

Obs.—This is another peculiar-looking species, of which I should have liked to have had better fruiting specimens. It is a rather scarce species and generally barren. I have long known it in this state, and I should not care now to describe it had I not been engaged lately in studying and working-up the several species I have described in this paper—besides my well-knowing all the other published N.Z. species of this genus. I have, therefore, no doubt of its being quite distinct as a species from all of them, although I find it hard to describe plainly in a few words its characteristic differences. The ultimate segments of the fronds are remarkably wide and short, indeed, on some fronds, might more properly be termed lobes. The few specimens brought away by Mr. Winkelmann this year (1883) from the Great Barrier Islet, were also barren, and very similar.

4. *S. vulgaris*, sp. nov.

Plant terrestrial, gregarious, diœcious, stipitate, erect, arising from a short stout rhizome, 2–3 springing together, or nearly so, 1¼–2 inches high including stipe; *fronds* variously shaped, but mostly broadly fan-shaped in outline, 6–8 lines long, 9–10 lines broad at top, divided into two main branches, each being dichotomous and sub-imbricate, angles of sinuses very obtuse, spreading; *segments* 1 line broad, mostly dilated with very large margins above forks, and deeply emarginate at tips, margins finely serrated extending down the decurrent wings of stipe, nerves thick throughout, not percurrent to tips; *colour* a light reddish- or lurid-green, cellules large oblong; *stipe* 1–1¼ inches long, stout, sub-flexuose, broad and compressed and winged above, sub-cylindrical below, stoutly 2-nerved, sometimes 3-nerved above; *fructification* on upper surface of frond in the main forks; *involucre* a rather broad trifid or deeply 3-laciniate scale with jagged margins; sometimes 3–4 observed on a frond, but invariably only one bearing a calyptra; *calyptra* large, tubular, 3–3½ lines long, slightly contracted at base, dilated and fimbriate at mouth, of a similar dirty-reddish hue as the frond; *antheridia* on separate and narrower fronds, rather loosely scattered in lines on both sides of main nerves under broad acuminate jagged scales.

Hab. Clay banks lower sides of deep water-courses, shaded forests, Seventy-mile Bush, Waipawa County, 1878–1881: *W.C.*

Obs.—This species is one of the largest and the coarsest-looking of all our known stipitate New Zealand species. I have long known it, but hitherto I have refrained from describing it in hopes of getting better specimens,—*i.e.*, more perfect in fruit. The calyptræ of this plant often seem as if gnawed by some small insect. It appears to be pretty closely allied to *S. hymenophyllum*, Mont., and also to *S. rugulosa*, mihi, in its general appearance, but this latter species has entire margins, etc.

5. *S. simplex*, sp. nov.

Plant diœcious; *frond* stipitate, erect, with no indication of a rhizome, simple, of varied outline mostly linear and sublinear-ovate, sometimes broadest at base and then deltoid-acuminate and subtruncate, 1–2¼ inches long including stipe, 1½–2 lines broad in the broadest part, slightly repand and waved, very thin, pale green, margins entire, emarginate at apices, mostly narrowly and very gradually decurrent half-way down stipe, midrib narrow, very prominent and keeled on both surfaces, light yellow-brown, not continued to tip, but continued downwards as a nerve within to the base of the stipe; *stipe* 3–6 lines long, slender, rosy-red; *fructification* on midrib upper surface, nearer the apex than the base; *involucre* small, trifid, laciniate, laciniations acuminate sharp; *calyptra* substipitate, stout, 1½ lines long, much fimbriated at top, dilated and laciniate at mouth; *peduncle* slender, short, 3–4 lines long; *capsule* large, nearly 2 lines long, linear, obtuse, truncate at base, light-brown; *cellules* pretty regular, suborbicular-pentagonal; *antheridia* under small deltoid jagged scales, in short linear masses on the midrib near the top of separate fronds, that are usually narrower and longer.

Hab. High and dry woods near Norsewood, 1878–1882: *W.C.* Pohue, high lands near Petane, Hawke's Bay, 1883: *Mr. A. Hamilton.*

Obs.—This small and simple species very much resembles some of the linear unbranched fronds of *S. subsimplex*, to which species it is closely allied; and indeed it was for some time by me taken for it, but on close examination and dissection I found several differences: *e.g.*, this species is never branched or forked, has generally much more attenuated fronds with a keeled and coloured midrib, and longer stipes that are rosy red, its involucral scale is sharply laciniate, and, beyond all, it differs greatly in the form of its cellules, which, in *S. subsimplex*, are distinctly "hexagonal." It has caused me much study to determine its specific difference, for, though I have collected plenty of specimens, there are but few among them in full fruit.

6. *S. megalolepis*, sp. nov.

Plant terrestrial, gregarious, stipitate, erect, rising from a slender and long rhizome, roots stoutish, white, closely intermixed, each frond about 1 inch apart on rhizome; *frond* fan-shaped, flat, slightly waved, 6–8 lines long, 4–7 lines broad at top, divided into two main branches that are generally again once or twice divided; *segments* broadly linear, sub-imbricate, broadly decurrent on upper part of stipe, margins entire, apices sub-rotund and emarginate; *stipe* 6–9 lines long, slender, sub-flexuose; whole *plant* very pale green, delicate and highly transparent, cellules orbicular; *involucre* on under surface, immediately above lowest fork of veins, very large, apparently double (?)—the outer scale being more than 2 lines broad at top, extending quite across lower forkings, orbicular-reniform, loose and slightly waved, margin quite entire, the inner scale, as seen through the outer, small, green, and much laciniate, with a tumid swelling at the base—sometimes two involucral scales on a frond, the upper one smaller and above the upper fork, nerves throughout strong and extending quite to tips, and biserial in the upper part of stipe; *antheridia* under minute jagged scales, in scattered circular spots and tubercles, at forkings of veins and on both sides of the lower rhachis. A peculiar abnormal very narrow stout linear segment (nearly all nerve) arises vertically from forking of nerves in some fronds.

Hab. On rotten logs, forests, between Norsewood and Danneverke, Waipawa County, 1880–1882: *W.C.*; also young and barren, Great Barrier Islet, 1883: *Mr. C. P. Winkelmann.*

Obs.—Not yet detected bearing fruit; the supposed "inner scale," as seen through the clear outer one, may prove to be the laciniate tips of the undeveloped calyptra, but if so it is very large and coloured. I know of no New Zealand species bearing a large and plain outer scale like this; although that of *S. longistipa*, mihi, (*sp. nov.*, *infra*) approached it; it is a striking characteristic. Some immature fronds have been noticed more strongly forked, the fronds beginning at 2–3 lines above the branching stipe.

7. *Symphyogyna fœtida*, sp. nov.

Plant (? monœcious) gregarious; rhizome stout, succulent, creeping under soil; *fronds* stipitate, erect, mostly 2 inches high, and about 1 inch apart on rhizome. *Stipe*, 1½ inch long, stout, green, succulent, sub-cylindrical, compressed and dilated at top, with sometimes small warted tubercles (? antheridia) beneath on upper part. *Frond*, orbicular in outline when expanded, symmetrical, generally of a reniform appearance, 4–5 lines broad, 10–12 lines wide, multifid, divided into 2 (sometimes 3) main branches, each subdivided into 3 branchlets, and each branchlet again divided into 2–4 portions; *segments* numerous, usually 20–40, linear, entire, imbricate, slightly sinuate and waved, obtuse and emarginate; *colour* (adult) dark green. *Fructification* on the under surface (sometimes several on a frond), on the main stipe below first forking, and also on the branches above secondary forkings, arising from a gibbous tubercle; *involucre* a large sub-plicate scale, slightly laciniate; *calyptra* greenish white, cylindrical, broad, smooth, membranaceous, truncate and dilated at apex; *mouth* very minutely and regularly toothed—sometimes 3 calyptras on a single frond; *capsule* (immature within), oblong, blackish.

Hab. In damp spots in dark woods, growing in large patches in rich soil near Matamau, Seventy-mile Bush, Waipawa County, 1883: *W.C.*

Obs.—A very distinct and fine species, possessing a most disagreeable smell, its strong *Algæ*-like odour resembling that of *Chara fetida*; this strong smell is retained by long-dried specimens and emitted on their being soaked, filling the room with its stink. The single fructification on the main stem is surrounded by several largish scales, some longer than the others, reminding of those of *Steetzia lyellii*. The natural affinities of this species are with *S. flabellata*, *rugulosa*, and *longistipa* (*sp. nov.*, *infra*), though largely differing from them all.

8. *S. longistipa*, sp. nov.

Plant terrestrial, gregarious, stipitate, erect, rising from a slender and long rhizome, roots wiry, fronds generally 3–4 near each other, of irregular shapes and sizes, usually broadly sub-flabellate in outline, 6–9 lines broad, 4–8 lines long, forked, sometimes trifid and almost pinnate-pinnatifid, pinnæ on long slender branchlets or petioles, segments short, flat, broadly sub-lanceolate-linear, sinuses round, margins entire, rounded at tips and deeply emarginate, not decurrent on stipe nor on branchlets; *stipes* 1¼–1¾ inches long, slender, subflexuose; whole *plant* darkish green; *involucre* on lower surface immediately above forkings, double—the outer scale being very large, loose and flabellate, margins entire, the inner scale much smaller and laciniate—several fruiting involucres on a frond, often four on a small frond all bearing fructification; *calyptra* white, cylindrical, transparent, 3 lines long, glabrous, mouth dilated, slightly laciniated or bifid, and finely and regularly toothed; *seta* 1–1½ inches long, slender; *capsule* large, cylindrical, linear, abounding after bursting in dark-brown elaters, which often remain hanging in pencilled masses; *valves* long, linear ovate, bordered; *spores* green; *antheridia* scattered beneath on the stipe, midrib and veins, under rather large open jagged scales.

Hab. On soil, margins of water-courses, deep ravines, shady woods, near Norsewood, 1883: *W.C.*

Obs.—A plant having close natural affinity with the preceding (*S. megalolepis*), but differing from it in several characters.

9. *S. prolifera*, sp. nov.

Plant terrestrial, prostrate creeping, cæspitose, imbricated in growth, rooting at middle and tip of fronds, and thence sending forth other fronds; *fronds* very irregular of various shapes and lengths, but flat, mostly linear and very narrow, 1–3 inches long, 1–3 lines broad, obtuse, sometimes ovate-acuminate, 2–3 leaf-like fronds issuing from near base of the short stipe, fragile, irregularly sinuate and serrate, very thin, transparent and pale green, midrib stout with fine short hair-like rootlets scattered below: fructification arising from midrib on upper surface, 1–2 on a frond, pretty close together or scattered; *involucres* very small, narrow, jagged, sometimes 2 scales or bifid; *calyptra* cylindric, 2–3 lines long, whitish, lacerate at mouth and slightly fimbriate; *peduncle* slender, weak, 1 inch long; *capsule* linear, cylindric, 1 line long, brown; *valves* cohering at tips; *elaters* and spores numerous, rich red-brown; *spores* circular, plain; *cellules* very small, oblong and irregular in size.

Hab. In rich black mould, wet shady woods, Seventy-mile Bush, near Norsewood, 1879–1882 (rarely in fruit): *W.C.*; and at Glenross, 1883 (fruiting plentifully): *Mr. D. P. Balfour.*

Obs.—A species pretty closely allied to *S. rhizobola*, Nees, but differing considerably.

10. *S. undulata*, sp. nov.

Plant diœcious, of densely compact growth, procumbent, creeping, rooting from midrib below its whole length, apices free, branches frondose, 1–1½ inches long, 2–3½ lines wide, forked, linear, crisp, translucent, brittle, much undulated and sub-sinuate, margins entire, sub-involute, apices orbicular and emarginate; *colour* light green, *midrib* broad, dark, nerve indistinct with long brown hairy rootlets below; *fructification* from the midrib on the upper surface, 2–3 on a branchlet at a short distance from each other; *involucre* large, sub-flabellate, trifid and laciniate, sometimes surrounding calyptra, front and sides; *calyptra* cylindric, 1½–2 lines long, whitish, largely tuberculate and fimbriate, particularly at apex; *tubercles* at first white, succulent, soon becoming reddish-brown; *mouth* laciniate; *peduncle* 1–1½ inches long, rather stout; *capsule* $\frac{1}{10}$th of an inch long, cylindric, linear-oblong, obtuse, sub-apiculate, shining, dark purple-brown; *valves* cohering at apex; *spores* minute, orbicular, black and tuberculated; *elaters* geminal; *antheridia* in dense brownish linear masses, with minute fimbriated perigonial leaves on the midrib upper surface, running nearly the whole length of their branchlets.

Hab. On shady sides and hollows of decomposing and damp limestone rocks and cliffs, hills, at Petane, near Napier, September, 1883: *Mr. A. Hamilton*; most profusely bearing fruit.

Obs. This plant differs much in appearance from all other known indigenous species of this genus; it often presents a very peculiar appearance from its densely-clustered and regular manner of puckered contracted growth, a patch of it extending a few inches each way without break; at such times its regular form reminds one of the thickly-compacted small involute petals of a double *Dahlia*—and of the leaves of a small variety of our *Dichondra repens* closely compacted in growth, sometimes met with in patches on our dry upland heaths. It also grows over and on other frondose and larger *Hepaticæ* (as *Marchantia*), while minute *Hepaticæ* (*Jungermannia*, sps.) often grow over it. It bears fruit plentifully—some plants, or patches, bristling with capsules, while others alongside are wholly barren. Some of the larger specimens resemble in habit *Steetzia lyellii*. A smaller and still more densely-compacted variety has also been noticed, which is similar though reduced in all its parts.

11. *S. marchantioides*, sp. nov.

Plant procumbent, creeping, of irregular shape and growth, but somewhat spreading out into a circular form from a centre, adhering strongly to the soil; *fronds* pale green with a very broad and dark midrib, 1–1½ inches long, $1\frac{1}{2}$–$2\frac{1}{2}$ lines broad, simple, and branched once twice forked, linear, much sinuate and waved, brittle, margins entire, densely clothed below with brown rootlets, dilated at apices, which are round emarginate, and sometimes 3-lobed through extension of midrib; *fructification* on the upper surface; *involucre* usually trifid and sharply laciniate, sometimes 2–3 involucral scales scattered on a frond; *calyptra* large 2–$2\frac{1}{2}$ lines long, sub-stipitate, tubular, sub-infundibuliform, slightly rugulose with large and stout tuberculated fimbriæ; *mouth* oblique or bifid, sometimes 1–2–3 on a frond both below and above forks; *peduncle* 6–12 lines long, stout; *capsule* 1 line long, cylindric, obtuse, black, bursting in a round mass; *valves* narrow, slightly cohering at tips; *spores* black, circular, and muricated; *elaters* red-brown, geminate, twisted very closely, pointed at tips; *cellules* large, broadly-oblong, usually sub-quadrangular, but irregular in shape and size.

Hab. On clayey soil, damp shaded sides of watercourses, near Norsewood, 1880: *W.C.* Also at Petane, near Napier, 1883: *Mr. A. Hamilton*; sometimes creeping over stems of the larger mosses.

Obs.—This is a very peculiar-looking species, and one that, in its barren state, I should scarcely have deemed to belong to this genus, looking more like a *Marchantia* in habit, or even an *Aneura* (especially *A. imbricata*, *sp. nov.*, mihi, *infra*), in the almost total absence of any central nerve. It serves, however, in its frond and habit as a natural approach towards those two allied genera. It is very distinct from all our other known species of *Symphyogyna.* When creeping over the stems of mosses it adheres but loosely and at intervals. It is so extremely brittle in texture that it is difficult to preserve or procure a good specimen. It is also a scarce species.

Genus 32. **Aneura**, Dumort.

1. *Aneura alba*, sp. nov.

Plant small, erect, densely compact, of dwarf moss- or scale-like growth, much resembling the small horizontal scales of some species of *Cladonia*; *frond* whitish or greenish-white, 3–4 lines long, main stems creeping, flattened, thickish, shining, under a lens microscopically bullate, sub-orbicular and cuneate in outline, sub-palmate, digitate and irregularly laciniate, lobes obtuse and retuse, abounding in fruit, sometimes a capsule to each lacinia, margins entire; *areolæ* rather large, confused not clear; *involucre* small, subovate, jagged, roughish; *calyptra* 2 lines long, much tuberculated especially at tip before bursting; *tubercles* in little lumps or fascicles; *mouth* nearly entire; *peduncle* 2–3 lines long, stout, striate; *capsule* $\frac{1}{2}$ line long, narrow-oblong, purple-black, shining, striate.

Hab. Growing with mosses among grasses and other small herbage, shaded banks, Scinde Island, Napier, 1883: *W.C.*

2. *A. bipinnatifida*, sp. nov.

Plant prostrate and sub-ascending, straight and sub-flexuose, somewhat crisp, very brittle, 1–2 inches long, flat, linear, simple and 2-branched at base, bipinnatifid, main stem 1 line wide, margins entire, lobes or sub-branchlets opposite, sometimes sub-opposite or alternate, 1–3 lines long, ½ line wide, linear, pinnatifid sometimes simple, ultimate lobules very obtuse, retuse emarginate or slightly crenulate, tips sub-incurved; *colour* green; *involucre* springing from upper part of plant, large, irregular, torn; *calyptra* 3–4 lines long, cylindrical, white, clavate, papillose and finely pilose; *mouth* deeply toothed with 4–5 triangular teeth; *peduncle* 1 inch or more long; capsule cylindrical, oblong, finely striate, purple before bursting, rich chestnut-brown after; *valves* oblong-lanceolate, acute, 1-nerved; *elaters* and *spores* adhering in long pencilled masses at tips.

Hab. Among small herbage, mosses, etc., wet shady grounds, Scinde Island, Napier, August, 1883: *W.C.*

Obs.—A species near *A. palmata*, Nees; but still nearer to a Cape Horn species, *A. alcicornis*, Hook. fil.

A. filicina, sp nov.

Plant terrestrial, gregarious in small compact patches, dark green. *Frond* stipitate, erect, arising from a dark, creeping, rooting, rhizome, sub-coriaceous, somewhat rigid, brittle, broadly obovate, sub-tripinnate, 1½–2 inches high, ¾–1 inch broad, pinnæ opposite, rather distant, sub-bipinnate, sub-flabellate, much cut, lobes linear, narrow, truncate, laciniate, recurved, main rhachis nearly 1 line wide, apex truncate, branched nearly to base, stipe very short; *cellules* large, pentangular-orbicular, evidently two series or strata in the middle of lobes; *involucres* numerous, scattered underneath, mostly below axils of upper laciniæ, and on main rhachis near top, composed of small sub-quadrangular whitish scales, each having a minute spur-like projection at its outer upper corners, truncate at top very minutely incised; *calyptra* near top of frond, 2–2¼ lines long, cylindrical, whitish, minutely pubescent in transverse rings or lines, pubescence brown, a minute contracted brownish pencilled tuft at apex before opening, mouth (open) truncate and bifid; 2–3 calyptræ often very close together; mature fruit not seen, but only within calyptræ, capsule linear-oblong, blackish.

Hab. On wet clayey banks near watercourses, shaded forests, Norsewood, 1879–1883: *W.C.*

Obs.—A pretty species, evidently allied to *A. prehensilis*, Mitt.; hitherto only met with in a few detached spots, and there not plentiful, and rarely in fruit. The involucres have a sub-lunate appearance, reminding me of the outline (in miniature) of the cauline leaves of *Drosera lunata*.

Aneura orbiculata, sp. nov.

Plant large, spreading, growing flat on rotten logs and over small mosses and *Hepaticæ*, in irregular oblong patches of 8–10 inches, adhering strongly; thickish, glabrous, light green, branches short effigurate, loosely imbricate, lobes 4–8 lines wide, orbiculate in outline, deeply crenate, hyaline at edges, spongy underneath with numerous short obtuse semi-rootlets. *Calyptra* ½ inch long, stout, cylindric, fleshy, greenish-white, lacerate at top, top and edges disposed in minute tuberculated lumps, sparingly setose, hairs light-brown, more thickly set at top, some 3–5 together subfasciculate but diverging (as in prickly pear). *Fruit stalk* (seta) 1¼ inches long, white, shining, finely striated, striæ twisted. *Capsule* large, 2 lines long, brown, oblong-lanceolate, splitting crosswise; *valves* spreading, pencilled at tips; *elaters* cohering.

Hab. In wet shady woods, between Norsewood and Danneverke, Waipawa County, 1876, etc.; in fruit, April, 1883: *W.C.*

Obs.—A very handsome plant, but rarely found in fruit; without fructification it might well be taken for an *Anthoceros.*

Aneura imbricata, sp. nov.

Plant spreading, flat, in patches of 4–6 inches, effuse, adhering pretty closely, sub-membranous, brittle, glabrous, green; *branchlets* or compound sub-foliaceous scales very numerous, irregular, laciniate, semi-convex, imbricated, ultimately much overlapping, lobes 3–4 lines broad, sub-orbicular in outline, margins sinuate, waved, and crisped, largely crenate, translucent, with very many short whitish-brown filiform rootlets issuing in pencils beneath, from middle of scales, and strongly adhering to those below; *calyptra* whitish-brown, erect, 4–6 lines long, cylindrical, stout, 1 line diameter, glabrous, having a broadly gibbous base; *mouth* bifid, slightly toothed and tuberculated with a few small scattered tubercles; *capsule* not seen.

Hab. On soil and on rotten logs, on the immediate low sides of deep water-courses, ravines, dark shaded woods, near Norsewood, October, 1883: *W.C.*

Obs.—A species having pretty close natural affinity with *A. orbiculata*, mihi (*supra*), but very distinct; their differences, however, are better and far easier seen in comparing the two plants while fresh, than can be described in words. Some allowance must be made for description of calyptra, as those seen (several specimens) were more or less slightly damaged through recent heavy rains flooding the channels where they grew.

Genus 37. **Fimbriaria**, Nees.

Fimbriaria gracilis, sp. nov.

Plant gregarious; *frond* single, procumbent, 3–7 lines long, 1¼ lines wide, linear-oblong or linear-obovate, sinuate, incurved, edges thin and finely crenulate, apex obtuse, sometimes (though rarely) emarginate and trifid, when trifid bearing 2 peduncles, light green, minutely and regularly papillose, with a continuous conspicuous purple band-like margin; *midrib* below stout, turgid, with diverging purple crescent scale-like markings, and a few fine hairy rootlets. *Female* receptacle sub-conical obtuse, 2–3–4-lobed, purplish-brown dotted with whitish spots, scarcely subpapillose, naked below except a few long white straggling hairs within perianths and immediately around apex of peduncle; *perianths* white, elliptic-conical, sometimes orbicular in outline and much depressed at tips, 12–14-fid; *segments* linear, flat and wrinkled, cohering at apex, hyaline and shining, netted, cellules irregular, sub-oblong-quadrangular; *peduncle* $\frac{3}{4}$–$1\frac{1}{2}$ inches long, subflexuose, finely striated, shining, tetrangular and purple below, cylindrical and white above; *spores* deltoid- and rhombic-orbicular with netted intra-margins, edges entire.

Hab. On pebbly (conglomerate) and limestone strata, shaded banks, hills, various localities, Hawke's Bay 1870–83: *W.C.* At Petane, near Napier, September, 1883: *Mr. A. Hamilton.*

Obs.—An elegant little species, pretty closely allied to the other described N.Z. species of the genus, particularly *F. drummondii*, from which, however, it is quite distinct.

Fimbriaria pallide-virens, sp. nov.

A very small *plant* of densely compact growth and habit. *Fronds* much branched, tender and sub-succulent, undulate, very slightly papillose, light green above, whitish-green below, midrib stout with numerous fine rootlets, cellules appearing (when held between the eye and the light) as if disposed in feathery falcate lines diverging from midrib; *branches* 1–$1\frac{1}{2}$ inches long, dichotomous, sub-imbricate; *branchlets* $\frac{1}{2}$–$\frac{3}{4}$ inches long, 3–4 lines wide, oblong and broadly obovate, bi-tri-fid at tips, margins finely crenulate and hyaline. *Female* receptacle small, convex, smooth, pale green, with minute and faint white dots, 2–3–4-lobed, lobes broad, spreading, obtuse and retuse, margins entire or slightly sinuate, naked below; *perianths* globose, 6–9-fid, segments small, distant, deltoid-acuminate, sometimes two are joined together from base slightly diverging at tips, scarious, soon expanding; *capsule* large, early exserted, brown-black, bursting circumcissilely; *spores* rather large, orbicular and sub-stelliform, muricated; *peduncles* 1–$1\frac{1}{4}$ inches high, rather stout, purple below, greenish-white above, sub-erect, flexuous.

Hab. Among and creeping over mosses, Hawke's Bay; Glenross, *Mr. D. P. Balfour*, growing densely: Petane, *Mr. A. Hamilton.*

Obs.—A strikingly pretty little species, nearly allied to *F. tenera*, Mitt.

Genus 39. **Anthoceros,** Micheli.

Anthoceros muscoides, sp. nov.

Plant forming small dense moss-like patches, often circular, 2–3 inches diameter; light-green above, whitish-green below possessing there a blanched appearance; *branchlets* or *fronds* all erect, very compact and crisp, ½ inch high, narrow below, very much dilated above, much laciniate and jagged at margins, each branchlet usually incurved sub-cyathiform with involucre arising from the central lacinia, sometimes two on a branchlet; *involucre* cylindric, margin of mouth slightly scarious and slightly erose; *capsules* numerous, 2–2¼ inches long, at first erect acute and coloured green, brown at tips, black flaccid and drooping when mature; *valves* 1½ inches long, obtuse; *columella* exceedingly filiform, and, with spores, black; *gemmæ* circular, scattered, immersed in substance of frond; *rootlets* numerous, fine light brown.

Hab. On damp shady sides of cuttings in white indurated clay hills, road, Seventy-mile Bush, Waipawa County, 1883: *W.C.*

Obs.—A well-defined and truly elegant little species.

ORDER VII. LICHENES.

Genus 5. **Sphærophoron,** Pers.

Sphærophoron polycarpum, sp. nov.

Thallus foliaceous attached at base, sub-erect, branched, effuse, under 1 inch high, loosely imbricate in growth like large irregular scales, light green above white below, branches and lobes broad dilated or narrow, laciniate and crenately toothed. *Apothecia* at the edges of laciniæ or teeth, or sub-marginal below, many (8–00) on a frond, circular, light brown at first, with a narrow flat thalline border, afterwards black and hemispherical, becoming oblong and sub-confluent in age, capitulum girt by a narrow entire rim.

Hab. On trunks of aged *Fagus* trees in large patches, projecting horizontally, sub-alpine forests Ruahine mountain range, 1846–1852; always barren; but near Norsewood, bearing fruit plentifully, 1883: *W.C.*

ORDER VIII. FUNGI.

Genus 10. **Polyporus,** Fries.

Polyporus (*Mesopus*) *nivicolor*, sp. nov.

Plant glabrous, wholly pure white including stem, shortly pendulous, growing closely together, sometimes 3 or more springing from the same root and subimbricate. *Pileus* fleshy, thickest in centre thin at edges, suborbicular, oblong or reniform, 1–1½ inches diameter, concave and subcup-shaped below, convex and obsoletely zoned and veined above, margin distinct, delicately thin, irregularly but neatly crenate and subincised, revolute; *stem* a continuation of pileus, short, thick, obconical, nearly central; *pores* rather large, subrotund and angular.

Hab. On decaying logs, in dense forests between Norsewood and Danneverke, Waipawa County, 1883: *W.C.* Only observed in two spots, yet there plentiful.

Obs.—A beautifully white species, graceful bivalve-shell-like; naturally allied to *P. phlebophorus*, Berkeley; a plant also discovered in forest 60 miles further south by *W.C.*

Genus 23. **Aseroe,** Labill.

Aseroe corrugata, sp. nov.

Stipes sub-cylindrical, stout, 1½ inches long, obconical, 1 inch wide at top, ½ inch wide at base, smoothish or slightly rugulose, sub-translucent, nerves reticulated, a rectangular hole at centre of base, 2 lines long and 1 line wide; colour white. *Rays of pileus* 6, of a brilliant red colour, darker within, conniving, 1¾ inches long, 2 lines broad at base, deeply transversely and irregularly rugose and wrinkled on both surfaces, but more so on the upper side, the outer lower margins angled and broad as if ribbed, each ray continuous with stipe on the outside and forked at ½ inch from its base, and thence bearing a deep central groove downwards to stipe, very acuminate, subulate towards tips which are twisted, a tolerably large irregularly shaped hole at the base of each bifurcation on the upper side; the large *central aperture* above in the pileus at the bases of the rays is 6-angled with small papillose portions of the rays projecting into the centre. *Volva* small, globular or broadly obovate, about an inch in diameter, rugulose, sessile, dark umber-coloured on the outside, white within; *roots* central, long, white, spreading and much branched.

Hab. In forests, Te Aute, Hawke's Bay, April, 1883: *Mr. C. P. Winkelmann.* Woodville, from settlers there: *W.C.*

Obs.—Among several good specimens, one has 7 double rays; another has two stipes, united near to the base of the pileus, thence diverging and bearing together 8 double rays, one of them being very broad and divided into 4 single rays. According to the Woodville settlers, this species is fatal to their cats; they say that their cats eat it, being fond of it, and die soon after. This plant is evidently allied to our two other New Zealand species, *A. rubra* and *A. hookeri* (as well as to the few known foreign species), but is abundantly distinct from them all.

Genus 27. **Geaster,** Micheli.

Geaster coronatus, sp. nov.

Outer peridium about two inches diameter, expanded, flattened at base, thickish, divided half-way down into 7 pretty equal broadly triangular obtuse sub-erect segments, semi-papillate and dark brown on the outside, blackish-brown and densely pubescent on the inside, with a continuous raised border at their inner bases; *inner peridium* ¾ inch diameter, globular and smooth, sessile, perfectly free all round, reddish-brown, darker towards the top, and there thickly covered with minute black dots, having a depressed orbicular coronula 2 lines diameter, roughish, slightly rising in the centre with a small plain ostiole.

Hab. On ground, forests near Norsewood, 1883 : *W.C.*

Obs.—A species having some affinity with *G. archeri,* Berk., a Tasmanian species.

Geaster affinis, sp. nov.

Outer peridium sessile, 3¼ inches diameter expanded, flat on the ground, marked with 2–3 concentric rings on outside near base, thin, light brown and smooth outside, divided into 8 narrow deltoid-acuminate acute segments, cut down nearly to the base, segments roughish and darker-brown inside ; *inner peridium* 1¼ inches diameter, globular, light tawny, sessile, free to base, with a ridge running round the inside, about 3 lines below bases of segments, at top a small coronula, 3 lines diameter, subplicate, mouth elevated, large, conical, more than 1 line diameter, laciniated.

Hab. On ground, elevated woods, at Glenross, 1883 : *Mr. D. P. Balfour* ; and other places near Napier, 1883 : *W.C.*

Obs.—A species near to *G. tenuipes,* Berk.,—also a Tasmanian species.

ART. XXVII.—*On the Occurrence of the Fern* Botrychium lunaria, *Sw., (Moonwort) in New Zealand.* By J. D. ENYS.

[*Read before the Philosophical Institute of Canterbury, 3rd May,* 1883.]

ON 15th November, 1882, I was engaged laying out the line of a wire fence across a piece of ground of a peaty nature resting on a stiff clay about 2,600 feet above the sea, when I detected the first specimen of this well-known fern. After a close search I failed in finding a second, indeed the first specimen had only just shown up. About a week later I found a number more showing up in two spots in the same neighbourhood ; a month or so later not one remained, this may partly be owing to the dry season.

I have copied out the description from Hooker and Baker's "Synopsis Filicum" (1868), as New Zealand fern collectors may not have access to a description of this fern.

"*B. lunaria*, Sw., st. stout, 1–4 inches ; sterile segm. sessile or nearly so, 1–3 inches long, ½–1 inch broad, not much broader at the base than the middle, cut down to a flattened rhachis into several distinct, close, entire, or notched cuneate-flabellate pinnæ on both sides; fertile peduncle equalling or exceeding the sterile segm. when fully developed; panicle close, 1–2 inches long, lanceolate-deltoid, bipinnate, Hk.Br.F. t. 48.

"*Hab.* Arctic Europe and Iceland to Spain, Italy, Kamscatka, and the Himalayas, South Australia, Tasmania, North-West America, Greenland."

Art. XXVIII.—*A Bird-killing Tree.* By R. H. Govett.

[*Read before the Wellington Philosophical Society, 26th September*, 1883.]

About a month ago my brother mentioned that in a shrub growing in my father's garden at New Plymouth, two Silver-eyes (*Zosterops*) and an English Sparrow had been found with their wings so glued by the sticky seed-vessels that they were unable to move, and could only fly away after having been carefully washed.

Never having heard before of such an occurrence, and being anxious to learn more about this curious plant, I asked him to keep an eye upon it and let me know anything further he might observe. The following mail brought me some of the sticky seed-vessels and a few leaves, which I showed to Mr. Buchanan, who at once identified the shrub as *Pisonia brunoniana*, or *sinclairii*, a native of Whangarei Bay and a very rare plant, called by the Maoris *Parapara*. In a letter which accompanied the leaves, my sister told me that on the previous day she had rescued two more birds from the plant, and, to use her own words,—"Thinking I was doing a merciful act, I collected all the branches with seed on them I could lay hands on, and threw them into the ashpit. To-day the servant comes in to say that about a dozen 'silver-eyes' are glued to these branches, and a pretty piece of work we had to get them clear, for four or five of the sticky pods, at the lowest average, were clinging to each bird. When you look at the tree you can see tufts of feathers and legs where the birds have died, and I really don't think they could possibly get away without help. The black cat just lives under the tree, so that a good many fall to her share; but in revenge many pods get into her fur and she has to come and get them dragged out."

This particular shrub is 10 or 11 feet high, and perhaps 20 in circumference. I am not aware what the usual height of the tree is when full grown, but probably not much more, as this one is in a sheltered position, in rich soil, and is, I should think, at least fifteen years old. The gum which causes the mischief is secreted by the seed-vessels when they attain full size, and is nearly as plentiful on them in their green state as when they become ripe. The seeds remain long in the sticky condition; but the gum does not exude from either the stem or leaves.

My first idea was that the birds were perhaps attracted by some sweetness in the gum, but my sister tells me that it does not appear to have any taste, and it certainly is not sweet.

My next impression was, that insects must be caught in the gum, and that the birds in seeking for them fell into the same trap. Upon inquiry, I learned that there *were* a number of insects sticking to the berries. My brother noticed mosquitos, spiders, house-flies, blue-bottle-flies, and the big brown blow-flies. He states, however, that he does not himself think the birds are attracted by the tree in any way more than that they find shelter there, and he adds that he is quite sure that no importance should be attached to the fact that the blight-birds were caught in the berries when thrown into the open ashpit, as he has frequently observed these birds in large flocks in an ashpit in his own garden in quest of scraps of potatoes, etc.

A friend to whom I mentioned the circumstance just told, remembers a shrub in Mr. James Russell's garden, at Auckland, being pointed out as remarkable for the same behaviour. There were tufts of feathers adhering to *it* also, and the shrub, if not of the same species, closely resembled the one at New Plymouth.* Mr. Buchanan, too, tells me that he and Dr. Hector recollect that when travelling to the north of Auckland, they were told of a tree which captured birds; but they did not pay any heed to what they regarded as a bit of Maori romance. It is clear, then, that *Pisonia brunoniana* is a confirmed bird-slayer, and that the specimen at Taranaki is not a depraved individual of a harmless species.†

I may, perhaps, also mention that Mr. Buchanan, after considerable search for this shrub, believes, or at least thinks, it probable that it is in its native state extinct, and is now only to be found cultivated in gardens.

The question of course arises,—Does the plant derive any, and, if so, what advantage from its sticky seed-vessels? As the leaves and stems do not exude gum, it surely cannot extract nourishment from its captives as does *Dionæa* and other carnivorous plants, for it is difficult to understand that any nutriment can be absorbed through full-grown seeds, which spring from the ends of the branches. If the flowers were viscid, fertilization might be promoted by the entangled insects; but it is the seeds alone which generate the viscid matter. Can it be that the seeds are sticky to ensure their being widely disseminated by means of the bird to whose plumage they attach themselves? If so, the plant has not been successful in its

* It is a *Pisonia* of the same species.

† Since writing this, I find that Hooker, in his Flora of New Zealand, describes *Pisonia* as a "small genus, chiefly of littoral tropical shrubs or trees with viscid cymes of fruit, sometimes armed with hooked spines in which small birds get entangled." *P. brunoniana* has certainly no spines.

object, for, as just stated, it is nearly, if not quite, extinct in its original habitat. But I am too ignorant to give an opinion on this interesting point, and must leave it to others to decide. My part consists merely in calling attention to a curious fact in connection with *Pisonia brunoniana* which, so far as I am aware, has not been noticed in the Transactions of the New Zealand Institute.

Art. XXIX.—*Notes on* Botrychium lunaria. By T. Kirk, F.L.S.

[*Read before the Philosophical Institute of Canterbury, 6th September,* 1883.]

In November last I had the pleasure of examining a specimen of the Moonwort (*Botrychium lunaria*, Sw.), which had been recently discovered by my friend, Mr. J. D. Enys, and a few days later received several specimens collected by him. In New Zealand, however, the species is of a remarkably fugacious character, as on visiting the habitat on 3rd January not a trace of the plant could be found; all had disappeared.

The habitat is a gently undulating turfy depression on the south-western flank of Mount Torlesse, at an elevation of 2,800 feet. The Moonwort was growing in somewhat boggy situations, but not where it would be constantly moist. The situation is not one of the most favourable character, and it is not surprising that the specimens are of small size, closely resembling examples from the highest known habitats in the Highlands of Scotland.

The Mount Torlesse specimens do not exceed 3 inches in height, the roots are of a wiry character and the base of the stem is furnished with a membranous sheath; the sterile portion of the frond is pinnate and consists of from two to four pairs of flabellate sessile pinnules and a deeply cleft terminal pinnule; the fertile frond is sparingly branched and does not exceed one inch in length; the sporangia are bright yellow in colour. In the British Islands the plant varies from 3–7 inches in height.

The brief period of duration above ground may have prevented the detection of this plant in other parts of New Zealand, but in any case it can scarcely be expected to be of frequent occurrence. It may be searched for in cool grassy places from sea-level to 3,000 feet. In Europe it exhibits a predilection for limestone pastures at a low elevation, but is by no means restricted to calcareous soils.

In Australia it is somewhat rare, having only been observed in Victoria and Tasmania, where it ascends to 4,000 feet. It occurs also in Terra del Fuego. In the northern hemisphere it is generally distributed through the cool temperate regions; Labrador, Canada, the Rocky Mountains, Colorado, etc., in America; nearly all European countries, and in the cooler parts of Asia. It is generally distributed through the British Islands, where it ascends to 2,700 feet.

A remarkable fact in the life-history of this species is the great length of time which is required for the development of the frond before it rises above the surface of the soil. On making a longitudinal section of a mature stem the embryo frond for the ensuing year is seen to be sufficiently advanced to allow of the sterile and fertile portions being easily distinguished, the former being already coloured green at the tip, even the pinnules can be recognized notwithstanding their rudimentary condition.

Enclosed in the basal portion of this embryonic frond we find the embryo for the second following year, and this again encloses the embryo for the third year following. The embryo for the second year is differentiated into sterile and fertile parts; but the component parts of the frond for the third year can scarcely be made out. It is only in the fourth year that the fronds appear above ground.

It should be added that the embryo fronds are arranged in an alternating position so that if the frond destined to rise above ground next year has the fertile portion directed to the right, the frond for the second following year will have the panicle directed to the left.

Attention was first directed to the lengthened period required for the development of the fronds rather more than fifty years ago by the late W. Wilson of Warrington, the well-known bryologist.

Art. XXX.—*Botanical Notes.** By T. Kirk, F.L.S

[*Read before the Wellington Philosophical Society, 16th November,* 1883.]

The Parapara.

Pisonia umbellifera, Seeman.

(*Ceodes umbellifera*, Forst.)

(*P. sinclairii*, Hook. f.)

This plant is found in several localities north of Whangarei, both on the east and west coasts; also on the Taranga Islands, Arid Island, Little Barrier Island, and on the East Cape: in the last-named locality, possibly planted by the Maoris.

It attains its greatest luxuriance on the west coast, north of Hokianga, where it forms a tree; in other localities it forms a shrub, rarely more than 10 feet high,—usually from 4–7 feet. When growing entirely in the

* These notes accompanied specimens in illustration of art. xxviii.

shade, the leaves are often from 14–16 inches long, of a deep glossy green; but in situations of this kind it rarely developes flowers. In exposed situations the leaves are much torn by the wind.

The fruiting pericarp is remarkable for its viscidity, which is usually retained for a considerable period after the fruit is fully matured. This renders it difficult to press fruiting specimens for the herbarium, as they adhere to the drying papers with remarkable tenacity. It can be readily imagined that small birds tempted to feed on the seeds might easily become glued to a cluster of fruits.

The Puka.

Meryta sinclairii, Seem.

(*Botryodendrum sinclairii*, Hook. f.)

This rare plant was originally discovered by Mr. Colenso, who found a solitary specimen planted by the natives at the head of Whangururu Bay. Mr. William Mair with great trouble procured leaves from this plant, which he sent to the late Dr. Sinclair, who forwarded them to Kew, and the plant was described as *Botryodendrum sinclairii* from these leaves alone. The natives had strictly tapued the tree, and resented the removal of leaves to such an extent that the tree was cut down by them.

The first specimens observed by Europeans in a wild state were found by the writer on the Taranga Islands* in the early part of 1869. Only eight plants were found, and as it has not been discovered elsewhere it must be considered one of the rarest plants known.

Although at best but a small tree, rarely more than 20 feet high, and frequently much less, it produces by far the largest leaves of any New Zealand plant. Some of the leaves measured from the base of the petiole to the tip of the blade fully 30 inches by 10 in breadth, the petiole being from 8–12 inches in length. Notwithstanding the large size of the leaf, the blade is never torn by the wind, owing to the stout marginal nerve by which it is strengthened.

The plant is not in any way viscid, so that birds could not possibly become adherent either to the leaves or fruit. When the branches are wounded a peculiar resin is exuded, but not in large quantities.

The plant was introduced into Auckland gardens by means of cuttings which required considerable care and attention before they developed roots. Since then ripe seeds have been obtained, so that notwithstanding its extreme rarity the plant is not likely to be lost.

* See Trans. N.Z. Inst., ii., p. 100.

ART. XXXI.—*Notice of the Occurrence of a Species of* Rhagodia *at Port Nicholson.* By T. KIRK, F.L.S.

[*Read before the Wellington Philosophical Society, 14th November, 1883.*]

THE genus *Rhagodia* has long been supposed peculiar to Australia, its addition to the New Zealand Flora is therefore a matter of considerable interest as it increases the number of important genera common to both countries.

In this district a species belonging to the genus occurs in rocky places by the sea on the Miramar Peninsula, and in other localities on the coast. It closely resembles *Chenopodium triandrum* in external characters, and it is to this cause that we must attribute the fact of its having so long escaped notice. It may, however, be distinguished from any species of *Chenopodium* by its succulent bright crimson fruits.

Our plant was originally added to the Flora and identified as *Rhagodia nutans*, R. Br., *var.*, by Mr. T. F. Cheeseman, of Auckland, who discovered it on an island in the Hauraki Gulf, and kindly favoured me with specimens in May last. On a recent examination of a collection of plants formed by my youngest son, H. B. Kirk, I was agreeably surprised to find the plant represented by specimens collected at Miramar, in the vicinity of Wellington, and have but little doubt that most of the littoral stations recorded for *Chenopodium triandrum* will prove to belong to the New Zealand form of *Rhagodia nutans*.

The Wellington plant appears to be more robust than the Auckland plant; the leaves of the latter also are green and membranous, while those of the former are mealy-white beneath.

Our plant is characterized by slender branches one to two feet long or more, trailing amongst rocks or supporting themselves amongst the lower branches of shrubs. The stems are woody at the base, and sometimes of considerable thickness; leaves usually mealy-white, opposite or rarely alternate, about ½″ long, on slender petioles, broadly lanceolate with an angular base (never hastate in the specimens examined), not unfrequently the points turned inwards, acute. Inflorescence in axillary fascicles, near the extremity of the branches, or in slender, shortly-branched terminal panicles. Fruit succulent, bright crimson.

Further acquaintance with the plant will probably show that it is worthy of permanent distinction as a variety, in which case it might be appropriately designated:—

Rhagodia nutans, R. Br., var. *novæ-zealandiæ*.

Apparently it was first observed in this colony by Dr. Hector, who supposed it to be a form of *Chenopodium triandrum* with succulent fruits. Sir Joseph Hooker, in the supplemental reference to *C. triandrum* in the Handbook of the New Zealand Flora, writes,—"Hector observes that the utricle is fleshy." It is somewhat remarkable that this statement did not suggest the possibility of the plant in question being a *Rhagodia* since the fruits of all our *Chenopodia* are dry.

On examining the specimens of *Chenopodium triandrum* in the herbarium of the Colonial Museum, I observed specimens of *Rhagodia* from The Brothers rocks, and other localities not stated, but probably in the vicinity of Wellington.

It is worthy of remark that no fewer than nine genera formerly supposed endemic in Australia have been added to our flora since the publication of the "Handbook." They are:—

Actinotus.
Rhagodia.
Poranthera.
Calochilus.
Epiblema.
Amphibromus.
Liparophyllum.
Lepilaena.
Iphigenia.

Art. XXXII.—*Description of a new Pine.* By T. Kirk, F.L.S.

[*Read before the Wellington Philosophical Society, 14th November*, 1883.]

Plate XXVI.

Podocarpus acutifolius, n. s.

A low growing shrub, 2–5 feet high; branches lax, slender. Leaves scattered, green, coriaceous, spreading, straight, linear, acuminate, pungent; midrib prominent beneath. Peduncles of male catkins $\frac{1}{2}''$–$1''$ long or more, naked or with one or two short pungent leaves: catkins solitary, or in fascicles of from two to five, extremely slender. Involucre at the base of each catkin consisting of four scarious acuminate bracts. Female flowers solitary, axillary, on short peduncles, which in the young state are invested with a loose membranous sheath. Drupe (immature), small, ovoid.

Hab. South Island—Upper part of the Buller Valley: *T. Kirk*, 1875.

Our plant belongs to the section *Eupodocarpus*, its nearest allies being *P. totara*, A. Cunn., and *P. nivalis*, Hook. f. From the former it is distinguished by its low stature, lax habit, narrow linear leaves, and slender catkins with uniseriate involucres; it differs from the latter in the slender habit and acute spreading leaves, which are never imbricated.

PODOCARPUS ACUTIFOLIUS, n. s.

I. M. Kirk, del.

It varies to some extent in the size of the leaves and in habit, but is easily recognized in all its forms. Sometimes the leaves are shorter than in the specimens figured and more closely arranged.

My specimens were obtained in the vicinity of Rotoiti, not far from the outflow of the lake. I have to acknowledge my indebtedness to Mr. Cheeseman for specimens collected in another habitat lower down the valley.

Art. XXXIII.—*Description of new Plants collected on Stewart Island.*

By T. Kirk, F.L.S.

[*Read before the Wellington Philosophical Society, 13th February,* 1884.]

Plate XXVII.

Umbelliferæ.

Aciphylla traillii, n. s.

Tufted, glabrous, 3″–6″ high, flaccid when fresh. Leaves 2″–4″ long, spreading, 3-foliolate or quite simple; leaflets linear, $\frac{1}{12}$″ broad, acute or pungent with a stout marginal nerve on each side, slightly canaliculate, entire: petiole and sheath rather broad, membranous. Flowers diœcious: scape more or less flexuous, bracts simple, linear, or with one or two short segments at its junction with the short inflated base. Male umbels 5–7, pedicellate, slender, lax, calyx-lobes reduced to points, flowers on slender pedicels, minute. Female scape stouter, umbels 5–10, crowded, bracts shorter and broader, more rigid, slightly pungent, sheaths broad tumid, enclosing the umbel, umbel simple or with a solitary branch, involucral leaves extremely minute, flowers shortly pedicelled; carpels (immature) narrowly 5-winged.

Hab. Near the summit of Mount Anglem, Stewart Island, 2,800 to 3,200 feet.

I have named this distinct little species in compliment to Mr. A. W. Traill who accompanied me during the ascent, and to whom I am indebted for valuable assistance in elucidating the Flora of Stewart Island.

It is allied to *A. lyallii*, from which it is distinguished by its smaller size, excessively tufted habit, flaccid leaves and prominent marginal nerves. A single specimen of an *Aciphylla* collected on Rakiahua by Mr. P. Goyen may be identical with *A. traillii*, but this could only be determined by the examination of specimens in a more advanced state: the leaves are 5-foliolate, with strict rigid pungent segments and are longer than the scape: the marginal nerves are much stouter.

Compositæ.

Olearia traillii, n. s.

A shrub or small tree 5–12 feet high or more; young shoots very stout, tomentose. Leaves crowded near the tips of the branches, narrow obovate-lanceolate, or lanceolate, 4″–6″ long, 1″–1¼″ broad, narrowed into a short broad petiole, acute, coriaceous, closely serrate, clothed with appressed white tomentum beneath. Panicles terminal, 4″–9″ long, rhachis clothed with leafy, tomentose, deciduous bracts; heads 6–8 pedicellate, 1″–1¼″ diameter, involucral scales linear, acute, tomentose; ray florets female, white, obtuse; disc florets perfect, tubular, limb companulate, segments reflexed, achenes silky, pappus pale, 1-seriate.

Hab. In places near the sea, Stewart Island; also on Puyseygur Point, South Island.

A noble species, one of the most striking plants in the New Zealand Flora. The panicles are terminal when developed, but at length are overtopped by the young shoots, so that they appear to be given off from the base of the new growth. Pedicels 1″–4″ long; disc florets purple, tube silky, achene faintly grooved. I have great pleasure in dedicating this fine plant to my old and valued friend, Mr. C. Traill, who has done so much towards extending our knowledge of the natural history and botany of Stewart Island.

Our plant is in some respects intermediate between *O. angustifolia*, Hook. f., on one side, and *O. colensoi* and *O. lyallii* on the other. *O. angustifolia* has smaller leaves, and the flower heads are solitary, carried on stout peduncles clothed with imbricating, persistent, foliaceous bracts. *O. colensoi* has broader shorter leaves, with the principal nerves diverging at a wider angle, and the flower heads are usually destitute of radiating florets. *O. lyallii* has broader more obtuse crenulate leaves, with widely diverging veins; and flower heads similar to those of *O. colensoi*.

Brachycome thomsonii, n. s.

Plate XXVII.

A coarse, pubescent, glandular herb, 4″–12″ high or more: stems stout, branched, erect or spreading, leafy. Leaves 1″–1½″ long, oblong-spathulate, narrowed into broad petioles, lobulate or dentate, lobes or teeth obtuse. Flower heads ½″ diameter, solitary, on terminal peduncles 3″–6″ long or more, naked or with a solitary bract. Involucral scales ovate with purple margins; receptacle convex: ray florets numerous, female, white, obtuse, spreading: disc florets perfect, tubular. Achenes clavate, with a slightly thickened margin, excessively glandular, pappus minute, bristly, more conspicuous in the achenes of the disc than in those of the ray.

β. minima.

Flower heads smaller, ray florets wanting.

BRACHYCOME THOMSONII, T. Kirk.

L. M. Kirk, del.

Hab. Stewart Island; *β*. Dog Island.

Strong smelling and excessively glandular in all its parts. It is most nearly allied to *B. odorata*, Hook. f., but Professor Oliver, who at my request kindly compared it with Colenso's original specimens of that species, informs me that it closely approaches some forms of *B. diversifolia*, Fisch. and Mey.

B. thomsonii was discovered by Mr. G. M. Thomson, who favoured me with one or two small specimens in 1877. Having had the opportunity of examining the recent plant in its original habitat, I have pleasure in confirming his opinion as to its specific validity and connecting his name with it.

(?) *Raoulia goyeni*, n. s.

Stems forming hard compact masses 1″–2″ high, much branched and with the leaves fully ¼″ diameter, woody below. Leaves densely imbricated, sessile by a broad base, oblong, with erose, purple margins, slightly emarginate, with close set whitish hairs on the apical half of the upper surface. Flowers not seen.

Hab. Summit of Rakiahua, *P. Goyen*! Peaks of Mount Anglem, 3,200 feet, *T.K.*

Originally discovered by Mr. Goyen, to whom I am indebted for specimens. The branches are very short, sometimes no longer than broad, and the plant presents a green appearance not common in this genus. It bears considerable resemblance to the recently discovered *Haastia greenii*, Hook. f., and its generic position must be considered uncertain until the flowers have been discovered.

My apology for publishing this imperfect description must be based upon the fact that the leaves of our plant are remarkably different from those of any recorded *Raoulia* or *Haastia*, while it grows only in habitats extremely difficult of access.

Myosotis antarctica, Hook. f.

Subspecies, *traillii*.

Radical leaves forming a rosette in the centre of the plant, flowering branches 3″–6″ long, procumbent, given off from beneath the rosette. Stems and leaves reddish coloured, rather succulent.

Radical leaves ¾″–1½″ long, oblong-spathulate, or ovate-spathulate, narrowed into slender petioles, clothed with appressed hairs especially on the upper surface. Cauline leaves ¼″ long, ovate, narrowed at the base, usually sessile. Fl. minute, solitary in the axils of the cauline leaves; calyx segments acute, hairy, closed in fruit; limb of corolla flat, minute; stamens shorter than the corolla tube. Nut ovate, shining, dark brown with compressed edges, keeled near the apex.

Hab. Sandy places on the west coast of Stewart Island.

This well-marked form is sufficiently distinguished from the type by the petioled leaves, compressed nuts, and the peculiar habit. In some respects it approaches *M. spathulata*, Forst., but diverges in the long petioled radical leaves, the sessile cauline leaves, broader calyx lobes and sessile flowers which are always axillary, never given off from below the leaves. As with most forms belonging to the genus, it varies considerably in the amount of hairiness; but the hairs, however scattered, are invariably appressed.

EXPLANATION OF PLATE XXVII.

1. *Brachycome thomsonii*, nat. size.
2. Floret of the ray.
3. Floret of the disc.
4. Achene of the disc, all magnified.

Art. XXXIV.—*Notice of the Discovery of* Amphibromus *in New Zealand, with Description of a new Species.* By T. Kirk, F.L.S.

[*Read before the Wellington Philosophical Society, 13th February,* 1884.]

Plate XXVIII.

On my last visit to the Waikato district I had the pleasure of discovering an undescribed species of *Amphibromus*, a genus hitherto supposed to be monotypic and restricted to Australia: my specimens are in a somewhat advanced condition, but after waiting for a lengthened period in the futile hope of procuring perfect examples, I deem it advisable to publish a description without further delay.

The nearest allies of *Amphibromus* in the New Zealand Flora are *Trisetum* and *Danthonia*: the former is readily distinguished by the spikelets consisting of 2 or 3 flowers only: the latter by the tufted hairs on the back of the flowering glume, and especially by the position of the awn, which is terminal, springing from between the lobes of the glume. In *Amphibromus* the spikelets consist of several flowers, the awn is strictly dorsal, adherent with the flowering glume for the greater part of its length, and the glume is destitute of tufted hairs on the back.

Amphibromus fluitans, n. s.

Culms floating or procumbent, glabrous, 12″–18″ long, rooting at the nodes, leafy; leaves slightly scabrid, flat, ligule laciniate. Panicle 1″–2″ long, partially included in the loose sheath, simple, or with one or two short distant branches, lax, rhachis and pedicels scabrid, slender; spikelets

AMPHIBROMUS FLUITANS. T. Kirk. n.s.

I. M. Kirk. del.

pedicellate 5–7 flowered, faintly pubescent; outer glumes unequal, one-third the length of the spikelets; flowering glume more than twice as long as the outer glume, 5-nerved, bifid, awn dorsal springing from near the base of the glume, free at its apex, scabrid, not twisted, palea equalling the flowering glume, with 2 stout ciliated nerves, truncate, the apex and upper margins ciliated; caryopsis free.

Hab. North Island: in shallow waters, margins of the Waihi Lake and Creek.

Stamens 3, lodicules narrow, acute; stigmas 2, minute, ovary loosely invested by the palea. Flowering glume with a few short hairs at the base. Pedicels varying from $\frac{1}{4}''$–$1\frac{1}{2}''$ in length: occasionally two or more pedicels spring from the same point, but in cases of this kind one pedicel is greatly abbreviated.

Our plant is readily distinguished from all other indigenous grasses by its fluitant habit; although in very shallow water it is suberect, yet as a general rule little more than the panicle is elevated above the water. Owing to the rhachis of the spikelet being articulated below each flower, the glumes fall away almost immediately after the extrusion of the panicle from the sheath, leaving only the naked pedicels, so that there is but little to attract attention to the plant, which may easily be passed unnoticed.

Amphibromus fluitans is usually if not invariably cleistogamous, fertilization being effected before the panicle is extruded: in fact extrusion is often delayed until the grain is nearly matured. I suspect that the stamens are not always developed in the uppermost flowers of each spikelet, but the flowers must be collected in an earlier state, before this point can be positively determined.

Our plant differs from the Australian species *A. neesii*, Steudel, in the procumbent habit, shorter leaves, smaller panicle, and straight awn. *A. neesii* is found in all the Australian Colonies except Queensland, and attains its greatest luxuriance in moist situations.

EXPLANATION OF PLATE XXVIII.

1. *Amphibromus fluitans*, natural size.
2. Flowering glume, lateral view.
3. Palea, front view.
4. Caryopsis, all magnified.

Art. XXXV.—*On* Lycopodium varium, *R. Br., and* L. billardieri, *Spring.*, *with Description of a new Form.* By T. Kirk, F.L.S.

[*Read before the Wellington Philosophical Society, 26th September*, 1883.]

Plate XXIX.

It has long been recognized by New Zealand botanists that the plants known as *Lycopodium varium* and *L. billardieri* are not separated by any absolute characters, the differences relied upon to distinguish the two depending chiefly upon the mode of growth and degree of luxuriance exhibited, but up to the present time no attempt has been made either to define the two so-called species by precise and constant characters or to enumerate the chief distinctive peculiarities of the varieties comprised under each. And in truth this is no easy matter, for a complete series may be traced from the short leafy stems, and drooping tetragonous spikes of *L. varium* to the elongated pendulous stems of *L. billardieri*, and from this form again to the slender drooping stems and foliaceous spikes of an elegant variety not hitherto described, so that although the extreme forms may be readily distinguished at sight, they are so closely connected by transitional forms that it is impossible to lay down characters of sufficient value to be available for specific distinction. I am therefore compelled to consider *L. billardieri* as merely one of the varieties of *L. varium*, and propose the following arrangement of the principal forms.

Lycopodium varium, R. Br.

Rhizome short, stems short or elongated, sparingly or excessively branched, erect, drooping or pendulous. Leaves $\frac{1}{4}''$–$\frac{3}{4}''$ long, decurrent, linear, lanceolate, obtuse or rarely acute, patent or closely appressed, gradually passing into the abbreviated bracts of the spike. Spikes simple or branched, sessile, tetragonous or foliaceous.

a. varium.

L. varium, R. Br. in Fl. Prod. Aust.; Hook. f. F. Nov. Zel., Handbk. N.Z. Fl.

Stems 6″–15″ high, erect, sparingly branched, rigid, leaves $\frac{3}{4}''$ long, spreading; spikes short, drooping, compact, tetragonous.

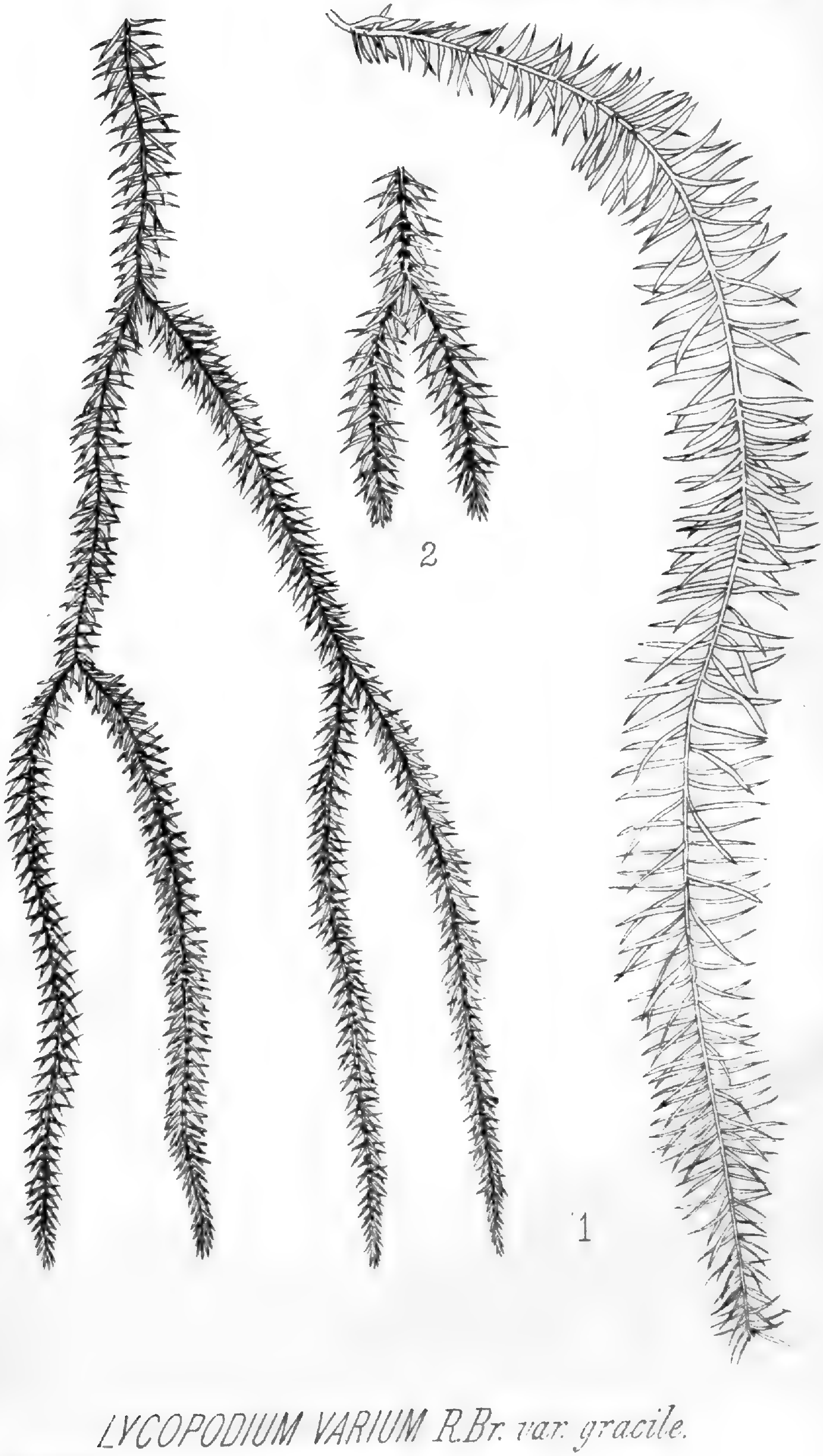
Rupestral, rarely epiphytal. In mountain districts: Great Barrier Island; Cape Colville; South Island; Chatham Island.

The most robust of all the varieties, and usually exhibiting the broadest leaves. The spikes are stouter than in other varieties and rarely become branched; they show no tendency to become foliaceous.

The most characteristic specimens that I have seen were collected by Mr. H. H. Travers on the Chatham Islands and by myself on Mount Young.

β. polaris.

Stems erect, $1\frac{1}{2}'$–$2'$ high, branched from the base, lower leaves spreading, upper appressed and imbricating; spikes drooping, simple or branched.



LYCOPODIUM VARIUM R.Br. var. gracile.

L.M.Kirk, del.

Sub-variety 1. Leaves obtuse, imbricate, keeled.

,, 2. Leaves acute, slender, flat, spreading; spikes slightly foliaceous. *L. umbrosum*, R. Br.

Terrestrial, usually inhabiting mountain woods in the North and South Islands; descends to sea-level in Stewart Island, the Auckland Islands and Campbell Islands.

γ. billardieri.

L. billardieri, Spring. Hook. f. Fl. N.Z., Handbook N.Z. Flora.

Stems loosely tufted, suberect or pendulous, 2–5 feet long, excessively dichotomously branched, midrib indistinct; spikes much branched, tetragonous, slender, compact, flaccid, scales keeled, broad.

In lowland woods. Epiphytal or rupestral. North Cape to Southland, but of rare occurrence on the east coast of the South Island.

The most striking form assumed by this variable plant and in its most highly developed condition not to be mistaken for any other: pendent masses of this plant 5 feet long are often seen in the forests of the North Island, and at a short distance present the appearance of green network.

Under *L. varium*, in "Flora Tasmaniæ," vol. ii., p. 156, Sir Joseph Hooker states—"When it (*L. varium*) inhabits warmer latitudes it grows dependent from trees, is much branched, more slender and flaccid, and becomes *L. billardieri.*"

δ. gracile.

Stems sparingly tufted, sub-erect, 6″–12″ high, very slender, crowded, spreading, linear, acute or obtuse. Spikes lax, simple or sparingly branched, scales foliaceous, linear, three or four times longer than the capsules.

On the stems of tree-ferns. North Island—Wairarapa Valley: *J. Stewart Tandager.* South Island—Maitai Valley: *Dr. Boor* and *T. Kirk.* Westport, etc.

A very graceful flaccid plant of a pale green hue and differing widely in appearance from other forms.

It is worthy of remark that New Zealand specimens of *L. varium* do not exhibit any close approach to *L. selago*, as appears to be the case with the Australian plant.

EXPLANATION OF PLATE XXIX.

1. *Lycopodium varium* var. *gracile.*
2. ,, ,, spikes in a more advanced condition, natural size.

Art. XXXVI.—*Notes on* Carmichælia, *with Descriptions of new Species.*

By T. Kirk, F.L.S.

[*Read before the Wellington Philosophical Society*, 13*th February*. 1884.]

Plates XXX.–XXXIII.

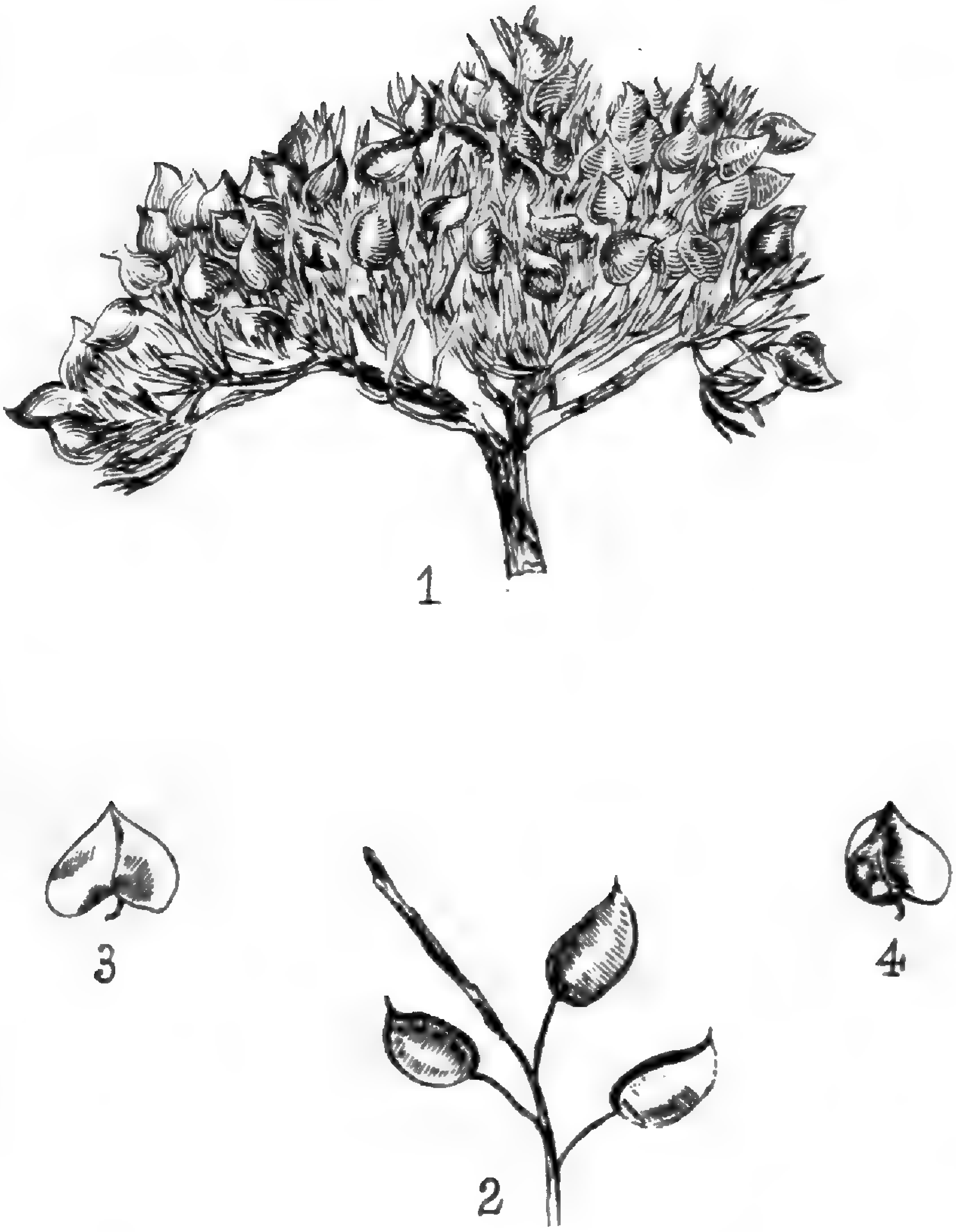
The genus *Carmichælia* comprises certain species which are tolerably constant in their vegetative characters, and can be identified in all states with little difficulty, but on the other hand it contains species of which the individuals exhibit an amount of variation scarcely surpassed by any genus in our variable Flora. The habit of the plant may be lax or compact; the branches and branchlets may be glabrous or more or less pubescent; they may be terete, plano-convex or much compressed, and when compressed may vary from one-twentieth to one-fourth of an inch in breadth; they may be leafless or foliaceous, while unifoliolate and pinnate leaves may be found on the same branch. The inflorescence may consist of two or three few-flowered fascicles, or of fascicles or short racemes crowded into false whorls, or of many-flowered lax racemes, and the pedicels may be glabrous, pubescent, or pilose.

The most constant characters are afforded by the fruit which varies widely in the different species. In the typical form of the pod dehiscence is effected by the separation of the valves from the placenta, leaving the latter as a framework (replum) carrying the seeds, but in some species the replum itself splits down the middle, one-half being attached to each valve; in others one valve becomes partially or completely separated from the replum which remains attached to the opposite valve. The replum varies considerably in the different species, being least developed in *C. crassicaulis*. Dehiscence usually commences from the base, but not invariably.

The form of the pod exhibits marked characters in the different species, and nearly always affords the safest characters for identification, however much the species may vary in its vegetative characteristics. With a few exceptions characters derived from the flowers are less satisfactory.

I do not propose to consider the causes of variation in *Carmichælia* beyond recording the fact that in *C. odorata*, *C. pilosa*, and *C. flagelliformis*—the species in which it is most excessive—it is often caused by soil, situation, age of the plants, etc.

In the following paper I purpose describing two new species, and supplying some omissions in the characters of those with which we are already acquainted, from descriptions in the "Handbook of the New Zealand Flora" and elsewhere.



CARMICHÆLIA ENYSII, T. Kirk, n. s.

L. M. Kirk, del.

Carmichælia crassicaulis, Hook. f.

Branches of young plant much compressed, closely striated, pubescent. Leaves unifoliolate, articulated on short grooved petioles, orbicular, ovate, or oblong, usually emarginate, gradually becoming reduced to sessile deciduous scales. Wings slightly shorter than the keel, ovary 1, rarely 2-ovuled. Pod villous with white silky hairs, obscurely deltoid, rounded beneath, beak reduced to a mere point when fully mature, 1-seeded, seeds brown, slightly mottled with black, placenta not forming a replum, always adherent to one of the valves.

A remarkably local species, restricted to a few habitats in the mountains of Canterbury and Otago.

Carmichælia enysii, n. s. Plate XXX.

Forming dense hard compact patches, scarcely exceeding 1″ above the surface of the ground; 1′–4′ in diameter. Root and lower branches stout, secondary branches 1″ long, branchlets $\frac{1}{2}$″–$\frac{3}{4}$″ long, $\frac{1}{20}$″–$\frac{1}{12}$″ broad, glabrous, compressed. Leaves and flowers not seen. Pods solitary, $\frac{3}{10}$″ long (including beak) on erect or recurved peduncles shorter than the pod, orbicular-ovate with a short curved beak compressed, 1-seeded, seed black, replum rather stout, incomplete.

Hab. South Island, terraces of the Porter River, Waimakariri. *J. D. Enys* and *T. Kirk.*

One of the most remarkable plants in the Flora, the branches are so dense that it is impossible to thrust the finger between them. In dehiscence one valve becomes partially separated from the replum, but remains attached near the apex, and both valves become contorted in such a manner as to give the pod a curious deltoid appearance. Seeds 1, reniform, very rarely 2 or 3. Ovules 2–5.

A seedling plant has developed at this date (February, 1884) small orbicular emarginate leaves on slender petioles; these, in all probability, will be gradually succeeded by scales.

Our plant appears remarkably local, not more than a dozen specimens having been observed at present.

A small barren specimen from the Ashburton kindly given me by Mr. T. H. Potts, F.L.S., may possibly belong to this species.

Carmichælia uniflora, T. Kirk, n. s. Plate XXXI.

Forming large lax patches 1″–2″ high, stems creeping for some distance underground and giving off slender distant branches. Branchlets compressed, glabrous $\frac{3}{4}$″–1″ long, $\frac{1}{25}$″–$\frac{1}{20}$″ broad, notches few, distant. Leaves not seen. Flowers solitary $\frac{1}{4}$″ long on capillary puberulous peduncles, jointed about the middle, minutely bracteolate. Calyx glabrous, teeth acute short, standard slightly reflexed, rounded, wings stouter than the keel, ovary glabrous. Pod (immature) linear oblong, style recurved.

Hab. South Island—Lochnavar, Valley of the Poulter, *J. D. Enys.*

An extremely slender species, allied to *C. nana*, Hook. f. That species however differs in the wider branchlets, more compact, stouter habit, racemed flowers and broader pods.

Carmichælia munroi, Hook. f.

Leaves minute, cuneate or obovate, emarginate, silky, gradually succeeded by minute scales. Pod $\frac{1}{3}''$–$\frac{1}{2}''$ long, slightly falcate, rarely straight, with a short straight or oblique beak, remarkably turgid, valves corrugated. Seeds 4–5 mottled.

I suspect that the leaves described above are preceded by others of larger size.

Carmichælia williamsii, T. Kirk. Plate XXXII.

Trans. N.Z. Inst., xii., p. 394.

A further supply of specimens from Archdeacon W. L. Williams enables me to offer a plate of this fine species, and to add a description of the fruit to the characters already given. None of my pods however are fully mature: the most advanced is a single pod collected by Mr. Buchanan at Hicks Bay, and for which I am indebted to Dr. Hector.

Pods on stout erect pedicels, slightly turgid, oblong or obliquely oblong, with a long straight beak, 1″–1¼″ including beak. Seeds 9–10 red, mottled with black.

Carmichælia kirkii, Hook. f. Plate XXXIII.

Ic. Pl., t. 1332.

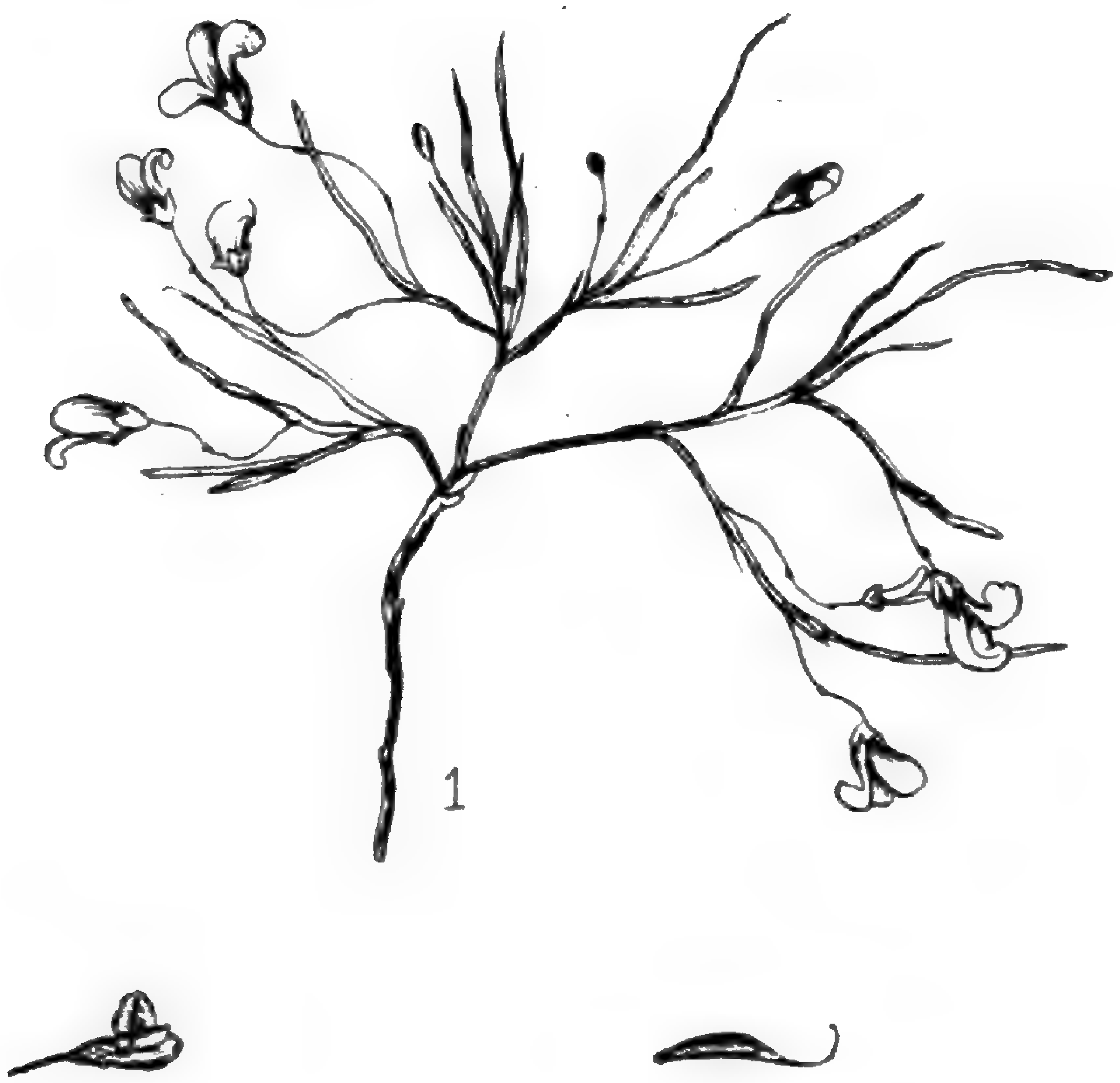
Branches few, distant, extremely slender, 2′–3′ long, or more, terete, grooved. Leaves few, pinnately 3–5-foliolate, $\frac{1}{2}''$–1″ long, leaflets sessile, orbicular, emarginate, $\frac{1}{4}''$ long, glabrous, racemes 3–5-flowered, lax, rhachis and pedicels slender, bracts ciliated. Flowers $\frac{1}{2}''$ long, calyx glabrous, teeth acute, vexillum 2-lobed, orbicular, wings longer than the keel, ovary glabrous. Pod $\frac{1}{2}''$ long, ellipsoidal, with a long perfectly straight subulate beak, valves faintly reticulate, seeds 2, replum stout, broad.

Hab. South Island, Cardrona Valley, *T. Kirk.* Otepopo, *D. Petrie.*

A very distinct species, differing from all others in habit, flowers, and fruit. The long flexuous branches are unable to support their own weight and usually become interlaced with adjacent shrubs.

Carmichælia pilosa, Col.

The branches of the North Island plant are much compressed and usually distichous, but on the Canterbury plains they are frequently plano-convex, or even terete and fastigiate. I can, however, detect no difference in the pods; the ovary varies in the degree of silkiness; the same branch may produce specimens with but few hairs, while others may be villous. In most cases the hairs speedily fall away after fertilization has taken



CARMICHÆLIA UNIFLORA.

L.M. Kirk. del.

CARMICHÆLIA WILLIAMSII, T. Kirk, n.s.

L. M. Kirk. del.

place, although very rarely a few scattered hairs may be found on pods nearly mature. The pod differs very slightly from *C. odorata*, of which it appears to be a variety.

Carmichælia australis.

Easily distinguished by its red seeds. In the "Handbook" it is stated to be "common along the East Coast and interior of the North and South Islands," a statement which requires some qualification. It is the only species found between the Waikato settlements and the North Cape, and is certainly common north of a line drawn from Castle Point to the mouth of the Manawatu river, but it does not occur within many miles of Port Nicholson. In the South Island it has been recorded from the districts of Nelson, Canterbury, and Otago. With regard to Nelson, Mr. Cheeseman informs me that an error was made in identification, the specimens being in bad condition and belonging to *C. flagelliformis.* I have botanized over large portions of Banks Peninsula and other parts of the Canterbury district, but never saw a specimen, and may say the same with regard to Otago and Southland, so that if found in the South Island at all, which I greatly doubt, it cannot be considered common.

Carmichælia odorata, Col.

A species varying to a surprising degree in habit, but remarkably constant in the structure of the flowers and fruit. Sometimes the branches are prostrate and present a close resemblance to *C. juncea*, at others erect or spreading; leafless and foliaceous specimens may be found side by side; the branches may be terete and extremely slender or excessively compressed and broad, while the inflorescence may vary from a few scattered fascicles, to dense whorls—or many-flowered lax racemes; not unfrequently all the variations may be found in the same plant. Pods 2–3-seeded.

It is the most abundant form on many parts of the Canterbury Plains.

Carmichælia flagelliformis, Col.

Leaves pinnately 3–5-foliolate, leaflets emarginate.

On Banks Peninsula the branchlets are sometimes filiform and pendulous, presenting a very elegant appearance; but in this state the flowers are produced sparingly.

The most common species in Southland, and attains the southern limit of the genus in the lower part of the Makarewa Valley.

Carmichælia juncea, Col.

Leaves unifoliolate, or pinnately 3–5-foliolate, silky, terminal leaflet much the longest; leaflets ovate or linear oblong, sometimes produced in profusion at the base of the branches, which are closely appressed to the ground and excessively compressed.

EXPLANATION OF PLATES XXX.—XXXIII.

PLATE XXX.

1. *Carmichælia enysii*, natural size.
2. Branchlets with pods.
3. Dehiscing pod, back view.
4. The same, front view. All enlarged.

PLATE XXXI.

1. *C. uniflora*, T. Kirk, nat. size.
2. Flowers.
3. Ovary enlarged.

PLATE XXXII.

1. *C. williamsii*, T. Kirk.
2. „ with immature pods.
3. „ with pod further advanced.

PLATE XXXIII.

1. *C. kirkii*, natural size.
2. „ fruit natural size.
3. Flower enlarged.
4. Ovary „
5. Wing „

ART. XXXVII.—*Description of a new Roseaceous Plant.* By R. BROWN. Communicated by Professor F. W. Hutton.

[*Read before the Philosophical Institute of Canterbury, 3rd May*, 1883.]

Acæna huttoni.

GROWING from a stout woody perennial rootstock. Leaves impari-pinnate; radical 5–8 inches long; petioles long, slender, triquetrous, woolly; stipules adnate, small, subulate, decurrent, expanding into a membranous, clasping base; leaflets spirate, or alternate, 11–17, enlarging upwards, the lower sub-rotund, the upper oval or obovate, all sub-plicate, incised, or inciso-dentate, midrib woolly on the under side, veinlets with a few hairs, the upper surface smooth. Peduncles erect, or inclined, sometimes decumbent, angular, woolly, leafy to near the apex; upper leaves becoming sessile and exstipulate, from 9–18 inches high; heads sub-globular, florets sessile with a small scarious bract at the base of each, fimbriated on the margin; bracteola two, sub-rotund, very concave, scarious, fimbriated on the margin, attached near the base of the calyx-tube on spirate angles, and in a young state wholly enclosing the flower. Calyx-tube elliptic in outline, 4-angled, the angles produced into wings, each face deeply wrinkled; calyx-lobes four. Corolla either absent or very fugacious. Stamens 2–8, immersed; anthers oval, dehiscence introrse, filaments short, slender. Pistil—style erect, short; stigma dilated at the apex and fimbriated. Achenes two, plano-convex with an oblique ovoid outline, pale and long.

Collected on the Canterbury Plains, near the River Ashburton, in December, 1882.

CARMICHÆLIA KIRKII, Hook. f.

L. M. Kirk, del.

ART. XXXVIII.—*On the natural Spread of the* Eucalyptus *in the Karaka District.* By A. T. URQUHART.

[*Read before the Auckland Institute, 17th September*, 1883.]

MR. WALLACE in summing up his interesting chapter on "The Flora of New Zealand: its affinities and probable origin" (Island Life), points out the remarkable fact that compared with the European, few Australian plants have succeeded in establishing themselves in New Zealand, but it must be borne in mind that there has been a continued stream of imported seed from Europe, affording repeated opportunities for the introduction and establishment of the naturalized plants.

As nearly all the species which are identical and peculiar to New Zealand and Australia, are either temperate or alpine forms, Mr. Wallace fairly concludes that there has been an interchange of species in comparatively recent times.

In accounting for the absence of such characteristic Australian genera as *Eucalyptus*, *Acacia*, *Hakea*, etc., he says:—"In this particular case, however, we have some very remarkable evidence of their non-adaptation." The evidence of their non-adaptability to spread and run wild in New Zealand, consisted in there being no record of the fact. I need hardly point out how local causes—not always apparent—influence the natural spread of most plants; even the hardy *Ulex europæus* is not exempt. In my own district, although there are some old-established hedges, I have only observed two self-sown seedlings of *Hakea acicularis*; yet Mr. T. F. Cheeseman, F.L.S., says that it "has established itself over several miles of open manuka country at the foot of the Waitakerei ranges, and is increasing fast."* In regard to the *Acacias*, several species readily establish themselves in most districts; the allied *Albizzia lophantha* competes successfully against, and in time destroys, almost the strongest vegetation met with in open country.

To have hastily placed on record the apparent naturalization of so important a genus as the *Eucalyptus*, would have been an error; however, now that its adaptability to spread naturally is fairly established, the fact is worth recording. In pastures, or lands where the native vegetation has been almost entirely destroyed, the gum spreads freely; on a neighbouring farm, where they have not been checked, there are about 5,000 self-sown plants from a few inches to 15 or more feet in height—scattered more or less about; the largest of the dense patches—½ acre—contains over 300 young trees.

* Trans. N.Z. Inst., vol. xv., p. 291.

Probably many seeds germinate through being trodden in by the stock; at the same time numbers of seedlings must be annually destroyed from the same cause; many obtain protection from clumps of *Pomaderris* and manuka. On another farm about 500 gum-seedlings have been transplanted from the pastures and waste-lands this season. Compared with the grass-lands, the young gum-trees springing up amongst the indigenous vegetation—as might be expected—are scarce; yet they are sufficiently numerous to make it appear not improbable that, if allowed their freedom, in the course of time they would spread over the more favourable portions of the district. Although the seedlings naturally stand a better chance in the struggle for life amongst the dwarf vegetation, those that germinate amongst the stronger manuka, once they attain the level of their taller rivals, compete successfully with the surrounding vegetation. When not too dense gum-seeds will germinate and grow amongst manuka four feet or more in height. The seeds appear not to be widely disseminated, the furthest plant yet observed, from the supposed parent-tree, being 98 yards to the eastward. In the vicinity of four gum-trees—the remains of two homesteads deserted upwards of 25 years ago—numerous young plants have sprung up amongst the furze and manuka. It would have been interesting to have watched the annual increase, but, unfortunately many of them have been destroyed by fire, or carted away by settlers. In another part of the district, some of the self-sown seedlings, growing amongst the indigenous vegetation, have attained a height of 31 feet. The greater portion of the young plants are seedlings of *Eucalyptus globulus*, this species being the most numerous; but interspersed amongst them are seedlings of *E. piperita*, *rostrata*, *hæmastoma*, etc.

Gum-trees in this country produce fertile seed in less than ten years; some will attain a girth of 9 feet 1 inch, and many a height of about 80 feet in 27 years.

I have not had the opportunity of personally observing to what extent the *Eucalyptus* has spread in other districts, but I am told that at Waiuku the seedlings are "coming up in crowds" near some old trees. In this case, however, the native vegetation has been destroyed by fire. The common *E. globulus* appears to spread most freely; but as it is not improbable that some of the more valuable Australian timber-trees may spread with equal freedom, considering their rapid growth and that they are rarely destroyed by stock, the fact may not be without some value in regard to our future forests.

ART. XXXIX.—*On the Botany of the Thames Goldfields.*

By. J. ADAMS, B.A.

[*Read before the Auckland Institute, 2nd July, 1883.*]

THIS is the title of a valuable paper by Mr. T. Kirk, F.L.S., that appeared in the second volume of the Transactions of the New Zealand Institute, and as the object of the present paper is to supplement what has been there published, the title of Mr. Kirk's paper appears to be the most appropriate.

No cursory examination of the district could add anything to the paper of this distinguished botanist; but a residence of three years in the district, a thorough exploration of the dividing-range, and a careful examination of the vegetation in every season have enabled me to collect the following additional information.

The district examined will be found to differ slightly from that reported on by Mr. Kirk. It is the country intervening between a line drawn on one side from Tapu to Puriri, and on the other side from Mount Wynard (Mamaepuke) to Pakirarahi, which are peaks on the main range between the Thames and Tairua. One visit was made to the east coast, in order that some comparison could be made between the evident zones of vegetation on the west side with those on the east, and also with the hope of finding some of the plants that have not been gathered since the time of the visit of the first botanists to the coasts of New Zealand.

The term "main range" is used to distinguish it from a second range on the Thames side, not very well defined, which rises into peaks at the "Look-out Rocks" and Ipuwhakatara. In the secondary range all the streams flowing west take their rise, with the exception of the Kaueranga, which comes from the very heart of the main range. It is scarcely necessary to say that this range is the most interesting part of the district from a botanical point of view. Wherever the summit is examined, it shows a characteristic vegetation which enables an observer to know at once that he is on the main range.

The plants specially referred to are *Melicytus lanceolatus, Metrosideros albiflora, Panax discolor, Panax simplex, Coprosma fœtidissima, C. colensoi, Gaultheria rupestris, Archeria racemosa, Pimelea buxifolia, Phyllocladus glauca,* and *Dacrydium intermedium.* In the gorges will be found *Senecio myrianthos, Loxsoma cunninghamii, Lomaria elongata,* and *Lindsæa viridis.*

Some of these plants can be found on the peaks of the secondary range, but *Coprosma colensoi, Panax simplex, Pimelea buxifolia,* and *Archeria racemosa* are, according to my observations, only found on the main range. Indeed the abundance of *Archeria racemosa* in this locality induced me to make diligent search for it on the secondary range, but without success.

The highest peaks on this range in the district examined are Mamaepuke, Whakairi, Kaitarakihi, and Pakirarahi.

Each of these deserves special mention, but as Mr. Kirk gives a description of the first, it is only necessary to add to his remarks an observation that appears worthy of attention. One of the approaches to Mamaepuke (Mount Wynard) is by a steep ridge that rises to a height little inferior to that of the mountain itself, and yet the deep gully that separates these ranges also separates the characteristic main range vegetation from that of the taua, hinau, and other common plants, on the lofty ridge that approaches it.

The next high hill on the range in a southerly direction is Whakairi, or Table Mountain; and as it is within an easy day's walk from the Thames, I have been several times on the summit which forms a broad plateau.

The plants peculiar to the mountain are *Celmisia longifolia* and *Epacris sinclairii*. The *Celmisia* is in Mr. Kirk's list, but it differs widely from the South Island plant of the same name. I have seen it only on a bare cliff near the summit of this mountain, and there were not more than a dozen plants.

The *Epacris* was not flowering at the time it was gathered. It probably flowers in November at the same time as *E. pauciflora*.

The other plants found on Whakairi can be also found on the opposite but much lower peak, Atuatumai, and from thence all along the ranges that rise precipitously from the upper course of the Kaueranga. This part of the river is not very well known unless to gum-diggers. Its course is from west to east, and it flows right from the heart of the main range. It bears some resemblance to the head waters of the Canterbury rivers in the water-falls, the masses of rock in the course, and the narrow gorges; but the ruggedness of the precipitous walls of rock on each side of the stream are clothed with an abundant growth of kiekie and *Gahnia*. The whole of this upper course has the characteristic main range vegetation on the summits of the ranges, with abundance of *Loxsoma cunninghamii* and *Lindsæa viridis* near the stream, and of *Lomaria elongata* near the cataracts.

The next peak on the range is Kaitarakihi, which stands near the source of the Piraunui Creek, a tributary of the Kaueranga. Like Whakairi it rises in a series of plateaux, the characteristic trachyte formation. A stiff climb is succeeded by a broad flat, and so on until the summit is reached, which is very unlike that of Table Mountain, as it is very narrow. The view from the top is perhaps more extensive than from any peak on the peninsula.

The plant peculiar to the upper part of the mountain, but not growing near the summit, is *Coprosma fœtidissima*. This is a very rare plant on the Thames side; as I found it in one place only off the main range, and that was on the ridge between the head waters of the Puru and Waiomio Creeks. It was evidently a straggler from Whakairi, although not observed on that mountain. On Kaitarakihi it is very abundant, and it can be found on the wooded sides of all the high peaks to Te Aroha Mountain. The other rare plants abundant on the hill are *Panax simplex*, *Coprosma colensoi*, and *Cordyline indivisa*. The last-mentioned plant I have seen on no other mountain nearer the Thames than Pirongia; but I am informed by the Maoris that it is plentiful on Te Aroha Mountain, and that many a battle was fought between the natives at Te Aroha and other tribes who desired this plant to make from it their war mats.

The most southern peak examined was Pakirarahi, which is a trig. station at the head of a tributary of the Tairua River. It abounds in plants that appear on Kaitarakihi only as stragglers from it. These plants are *Melicytus lanceolatus*, *Olea montana*, *Gaultheria rupestris*, and *Dracophyllum strictum*.

Melicytus lanceolatus is as common on the sides of this mountain as *Coprosma fœtidissima* on the sides of Kaitarakihi.

The rarest plant on the mountain is *Pimelea buxifolia* which was found in one place only, and that was on the summit of some immense rocks that form curious archways and buttresses on a ridge leading to the trig. station.

I traversed every ridge in the neighbourhood of the peak for other plants, but found none.

The Tairua diggings, now deserted, are situated at the foot of this mountain, and there is a plant that grows so plentifully in the clearings and along the pack-track that it deserves notice. I refer to *Cordyline pumilio*, which, mingled with *Gahnia lacera*, covers hundreds of acres. This plant has a sweet root that is roasted and eaten by the natives, and resembles the root of the ti (*Dracæna*) of the Tahitian Islands. The Maori name for the plant is tirauriki.

I mentioned before that I desired to make comparison between the growth of vegetation on the east side with that on the west, and I thought that the succession of plants that obtained on the west side from sea-level to the summit of the dividing range, would also obtain on the east side. It appears to me, however, that there is a great distinction, and that zones of vegetation are more marked on the west than on the east side. In ascending from the west side, the ordinary ericetal plants, growing on bare hills covered chiefly with *Leptospermum scoparium* and *Pteris aquilina*, are succeeded by taua, rata, rimu, hinau, and tawhero, which give place at a height of 1,700 feet to *Quintinia*, *Ixerba*, kauri, and *Gahnia*. But on the east side there is no such well-marked distinction, for the mountain plants descend very much nearer the sea-level, so that some of those that can be found only at elevations of 1,800 or 2,000 feet on the Thames side are found as low down as 500 feet from the sea-level near Tairua sawmills.

The country round the sawmills is a painful scene of widespread desolation; as the large timber is not only cleared away, but the undergrowth is annually burnt. There is, however, one exception along the course of the Pepe Creek, and here I found *Quintinia serrata*, *Panax discolor*, *Panax simplex*, *Phyllocladus glauca*, and *Loxsoma cunninghamii*, at an elevation of not more than 500 feet. Far greater havoc is made of the forests on the Tairua side than on the Thames, which may be partly owing to the nature of the soil; but it is, however, certain that for sixteen miles, along the Tairua River from the sawmills, the desolate appearance of the country is very distressing. This desolation will be much increased when the kauri forests, near the Tairua diggings, are cut down. The traveller will then be able to look from Pakirarahi over all the country to the east coast, which will then be the most ruined and disfigured part of New Zealand. *Faciunt solitudinem et cultum appellant.*

In addition to the exploration of the main range I have paid a good deal of attention to orchids; and as these plants have on the whole very short seasons, it may not be unprofitable to put in a connected form the months in which they bloom in the Thames district.

This is the more easy, as the different species appear from month to month throughout the year with such regularity as to form a kind of floral calendar by their successive appearance in flower.

The botanical year may be said to commence in June, when *Acianthus sinclairii* comes into flower. It first appears on the hill-sides in the bush near tufts of *Astelia*, where there is rich mould. A week later *Pterostylis trullifolia* is in full flower in rocky places on patches of moss. This is a common plant in damp places on the sides of fern hills.

During the last week in June *Corysanthes rivularis* begins to appear in damp places near the foot of forest hills, and later, along the banks of mountain streams. All these orchids continue through the month of July.

In August *Corysanthes macrantha*, *C. oblonga* and *C. triloba* can be found in flower. They affect high ground on the borders of heavy bush-land and grow best in rich black mould. Their purple flowers are warnings that the rarest orchids are about to appear and may disappear also in the same month of September. The rare orchids are *Cyrtostylis oblonga*, *Pterostylis puberula* and *Pterostylis squamata*. They all grow on low hills covered with fern (*Pteris aquilina*) and tea-tree (*Leptospermum scoparium*), but are not equally abundant.

There are at least fifty plants of the two first-mentioned to one of *Pterostylis squamata.* This plant grows amongst tea-tree (*Leptospermum scoparium*) and always near the summit of low hills.

Very few of the flowers come to maturity, as they are destroyed by minute insects before the flowers open. Another enemy to it is fire, as the vegetation is annually burnt off the hills where it grows. This year I could find it only in those places that escaped the fire last year; and as its extinction is not improbable, I enclose a painting of it in full bloom.

Whilst these are in bloom on the bare hills, *Pterostylis graminea* is in flower on the ridges of steep bush-land hills.

In the beginning of October *Pterostylis banksii* begins to flower in the woods whilst *Thelymitra imberbis* and *Caladenia minor* have taken the place of *Pterostylis puberula* and *Cyrtostylis oblonga* on the low hills.

Towards the end of the month *Thelymitra longifolia* is also in flower, and *Chiloglottis cornuta* is found on steep ridges where no bush fires have been.

The commonest orchids appear in November. They are *Microtis porrifolia* and *Orthoceras solandri.* These plants, together with *Thelymitra longifolia,* are so abundant on some hillsides near native settlements that pigs turn over the soil in large patches for the sake of getting at the tubers. *Sarchochilus adversus* that blooms in the same month and grows on the boles of trees is not by any means common.

These plants with *Bolbophyllum pygmæum* flourish through the month of December.

The orchids of January are *Gastrodia cunninghamii* and *Thelymitra pulchella.* The former though a large plant is extremely difficult to see, and the latter I found only once, and that near the summit of Pakirarahi.

Earina autumnalis begins to flower in February, and can be found in flower for a couple of months.

The last orchid of the year that I found was *Prasophyllum pumilum.* It flowers in the middle of March, and is not only rare but also easily overlooked in the low tea-tree where it grows.

My collection of orchids at the Thames numbers twenty-seven, and the whole number peculiar to New Zealand is forty. I do not include in this number *Adenochilus gracilis,* for although it appears in Mr. Kirk's list I have not been able to find it here.

I have been equally unsuccessful in the search for *Dracophyllum traversii, Lomaria vulcanica* and *Dactylanthus* sp. My friend Mr. Cheeseman, F.L.S., who knows the district well, has not been more successful in his search for these plants, although he has made a very large addition to Mr. Kirk's list. I have to thank him for the valuable assistance he has given me in the progress of my researches, and I believe he takes as much interest in my collection as I do myself.

The following are some of the most interesting plants in the list appended to this paper :—

Veronica pubescens.—A shrub 1½–2 feet high, covered in all its parts with a soft white pubescence. It closely resembles *V. salicifolia,* and indeed an intermediate plant grows on Shoe Island, Tairua, and also near Paoraka, Thames. This plant has not been collected since the time of Banks and Solander.

It grows on precipitous rocks on the sea side of Paku at the mouth of the Tairua river.

Rhabdothamnus sp.—This plant differs much in habit from *R. solandri.* It is a straggling shrub, 7–8 feet high, with long, straight, brittle, fastigiate branches. Branches, leaves, and twigs very hirsute. Leaves 1¾–2 inches long and 1½ inches broad, orbicular. Flowers large, peduncles ½ inch, sepals ⅓ inch, corolla 1 inch. Capsule ovoid, *longer* than the calyx. Mr. Cheeseman considers it a variety of *R. solandri,* but I think he admits the distinction as great between the plants named as between *Veronica salicifolia* and *V. macrocarpa.* The plant was found on Shoe Island, Tairua.

Quintinia elliptica.—This plant is found near the summit of Pakirarahi, but I agree with Mr. Cheeseman that there is no specific distinction between it and *Q. serrata.*

Fagus menziesii.—I was surprised to find this plant abundant on the secondary range near Puriri Springs. The leaves differ slightly from the South Island specimens. Flowers and fruit not seen.

Pimelea buxifolia.—This is another plant from Pakirarahi. It agrees exactly with the description in the "Handbook of Zew Zealand Botany," except in the height. The few specimens seen were not more than 2 feet high.

Marattia fraxinea.—It is curious how this plant should have so long escaped observation ; as there is a large number of plants, though local, in the Tararu Creek, near the base of a look-out rock. The Maoris say it is found at Kuitarakihi, and on the Pepe near Tairua. They were accustomed not only to eat the subaerial rhizomes, but also to plant them in suitable places in the bush.

There is no exaggeration in saying that the forests within six miles of Thames are rapidly disappearing, and many plants, formerly common, are now become extinct. As an example I may mention *Fagus fusca* which Mr. Kirk speaks of as plentiful, but at present there is not a specimen nearer than Puru Creek. Several other plants, as *Parietaria debilis* and *Hoheria populnea,* are extremely rare.

The whole number of plants in Mr. Kirk's list is 397, and in the list appended there are 90 additional, so that the number growing in the Thames District is 487. This number of plants makes the district compare favourably in point of variety of vegetation with any other district in New Zealand of like area and elevation.

Additions to Mr. Kirk's Catalogue of Flowering Plants and Ferns in the Thames District.

Clematis hexasepala, DC. Kaueranga Valley.
Ranunculus acaulis, Banks and Sol. Sandy places near brackish water.
Melicytus macrophyllus, A. Cunn. Shoe Island, Tairua.
,, *lanceolatus*, Hook. f. Pakirarahi.
Melicope mantelli. Kerikeri Ranges.
Pennantia corymbosa, Forst. Table Mountain.
Quintinia elliptica, Hook. f. Pakirarahi.
Drosera spathulata, Labill. Kerikeri Swamps.
,, *binata*, Labill. Kerikeri Swamps.
Myriophyllum elatinoides, Gaudichaud. Kopu.
,, *variæfolium*, Hook. f. Kopu.
Epilobium rotundifolium, Forst. Puriri.
Tetragonia expansa, Murray. Sandy places near the sea shore.
Hydrocotyle americana, Linn. Waikiekie Creek.
,, *pterocarpa*, F. Muel. Kerikeri Ranges.
,, *novæ-zealandiæ*, DC. Pakirarahi.
,, *moschata*, Br. Kerikeri Ranges.
Crantzia lineata, Mitt. Piako Towers.
Angelica rosæfolia, Hook. Paku, Tairua.
Panax anomalum, Hook. Look-out Rocks.
,, *simplex*, Forst. Pepe, Tairua.
,, *sinclairii*, Hook. Kaitarakihi.
Loranthus adamsii. Hape Creek.
Coprosma petiolata, Hook. Tairua landing.
,, *rhamnoides*, A. Cunn. Kaueranga.
,, *fœtidissima*, Forst. Kaitarakihi.
,, *colensoi*, Hook. f. ,,
,, *acerosa*, A. Cunn. Tairua.
Galium tenuicaule, A. Cunn. Kopu.
Cassinia leptophylla, Br. Tairua.
Senecio myrianthos. Kaueranga.
Dracophyllum strictum, Hook. f. Main Range.
,, *urvilleanum*, A. Rich. Look-out Rocks.

Sapota costata, A. DC. Paku, Tairua.
Olea montana, Hook. f. Pakirarahi.
Parsonsia rosea, Raoul. Look-out Rocks.
Mimulus repens, Br. Piako Towers.
Mazus pumilis, Br.
Gratiola peruviana, A. Cunn. Kopu.
Veronica pubescens, Banks and Sol. Paku, Tairua.
Veronica sp. Shoe Island, Tairua.
Rhabdothamnus sp. Shoe Island, Tairua.
Chenopodium ambrosioides, Linn. Sandy places near the sea shore.
Atriplex patula, Linn. Salt marshes.
Suæda maritima, Dumortier. Sandy places near the sea shore.
Salsola australis, Br. Sandy places near the sea shore.
Scleranthus biflorus, Hook. f. Paku, Tairua.
Pimelea buxifolia, Hook. f. Pakirarahi.
„ *urvilleana*, A. Rich. Paku.
Fagus menziesii, Hook. f. Puriri.
Dendrobium cunninghamii, Lindl. Look-out Rocks.
Gastrodia cunninghamii, Hook. f. Kaueranga.
Cyrtostylis oblonga, Hook. f. Kerikeri Ranges.
Corysanthes oblonga, Hook. f. Tararu Creek.
„ *rotundifolia*, Hook. f. Tararu Creek.
Caladenia minor, Hook. f. Kerikeri.
Chiloglottis cornuta, Hook. f. Kerikeri Ranges.
Pterostylis graminea, Hook. f. Wooded ranges.
„ *puberula*, Hook. f. Kerikeri.
„ *squamata*, Brown. Kerikeri.
Thelymitra imberbis, Hook. f. Kerikeri.
„ *pulchella*, Hook. f. Pakirarahi.
Prasophyllum pumilum, Hook. f. Kerikeri.
Sparganium simplex, Huds. Puriri.
Potamogeton natans, Linn. Kopu.
Astelia insignis. Table Mountain.
Juncus australis, Hook. f. Pakirarahi.
Cyperus ustulatus, A. Rich. Swamps.
Scirpus maritimus, Linn. Kopu.
Lepidosperma australe, Labill. Kerikeri, low hills.
„ *concava*, Br. „ „
Gahnia hectori, Look-out Rocks.
„ *arenaria*, Hook. f. Kerikeri.
Uncinia cæspitosa, Boott. Shoe Island, Tairua.

Carex dissita, Sol. Karaka Creek.
,, *gaudichaudiana*, Kunth. Tairua landing.
Hierochloe redolens, Br. Kerikeri.
Zoysia pungens, Will. Puru.
Glyceria stricta, Hook. f. Piako Towers.
Gymnostichum gracile, Hook. f. Piako Towers.
Gleichenia dicarpa, Br. Table Mountain.
Adiantum æthiopicum, Linn. Kopu.
Lindsæa viridis. Tararu Creek.
Aspidium aculeatum, Swartz. Kaueranga.
,, *capense*. Kaueranga.
Nothochlæna distans, Br. Kaueranga.
Schizæa dichotoma, Swartz. Pepe, Tairua.
Marattia fraxinea, Smith. Tararu Creek.
Phylloglossum drummondii, Kunze. Kerikeri.
Azolla rubra, Br. Kopu.

Art. XL.—*Notice of* Olearia hectori, *Hook. f.* By D. Petrie, M.A.

[*Read before the Otago Institute, 13th November*, 1883.]

An imperfect notice of this species is to be found in Hooker's "Handbook of the Flora of New Zealand." The specimens, from which the description was drawn up, appear to have shown neither flowers nor fruit. As the plant is one of singular interest, I have thought it worth while to direct attention to it, and to make out a full description.

Few of the shrubs indigenous to New Zealand are more worthy of cultivation than this. When fairly grown it bears great numbers of very sweetly scented flower-heads. The heads, which are grouped in fascicles, have a yellow tint, but are not large or conspicuous, rarely exceeding the size of a hazel-nut. The odour, which is singularly powerful and very agreeable without being cloying, strongly resembles that of mellow ripe peaches. In this respect the plant is in no way inferior to many exotics that are cultivated with great care for their delicate scent. The shrub grows to a considerable size, sometimes forming a small tree of 3 or 4 inches in diameter. Such large specimens are, however, rare, and evidently of great age. The common forms are small compact graceful bushes, with very numerous tortuous branches and twigs and light or greyish-green foliage. It is evergreen, and as an ornamental shrub yields to few of our natives. It grows naturally in rich black soil and in dry situations. Near the coast I have seen it only in places where the soil is of volcanic origin; but in the interior of Otago and also in Southland it thrives well in alluvial soil. It can be easily propagated by cuttings. Plants taken from the bush with a very slender complement of roots have done very well in my garden.

In directing the attention of gardeners, amateur and professional, to the merits of this species of *Olearia*, I feel confident that any trouble they may take in procuring and propagating it will be amply repaid by its fine appearance as an ornamental shrub and its delicate scent. Ere many years pass by it should carry the name of our fellow-colonist, Dr. Hector, into many parts of the old world, and be reckoned one of the richest floral gifts of these islands.

The following is a detailed description of the species, which is a remarkably distinct one:—

An erect, compact, twiggy shrub, or small tree, 8–20 feet high. Branches tortuous. Leaves ½–1½ inches long, on slender petioles, obovate or narrowed symmetrically above and below the middle, membranous, covered below with pale grey tomentum, veins distinct.

Heads in fascicles of 10–12, sessile on the ends of short lateral branches, with a thin bract at the base of each head, densely cottony on the outer surface, smelling sweetly and strongly of peaches.

Involucral scales in two series, the inner larger and more membranous, cottony on the back and margins.

Florets 5–8, outer row shortly ligulate; pappus in one series of stout, scabrid, tapering hairs not thickened at the tips. Achene with rather long silky hairs.

It has been gathered in the following localities:—Saddle Hill; Vauxhall, Dunedin; Taiaroa Head; Otepopo Bush; neighbourhood of Invercargill; Nugget Point; and gullies near Clyde, Cromwell and Arrowtown.

In some respects this species differs from all others of the genus and chiefly in having the heads fascicled and the ligulate florets yellow.

Art. XLI.—*Notes on new Species of Plants.* By J. Buchanan, F.L.S. Plates XXXIV–XXXVII.

[*Read before the Wellington Philosophical Society, 13th February,* 1884.]

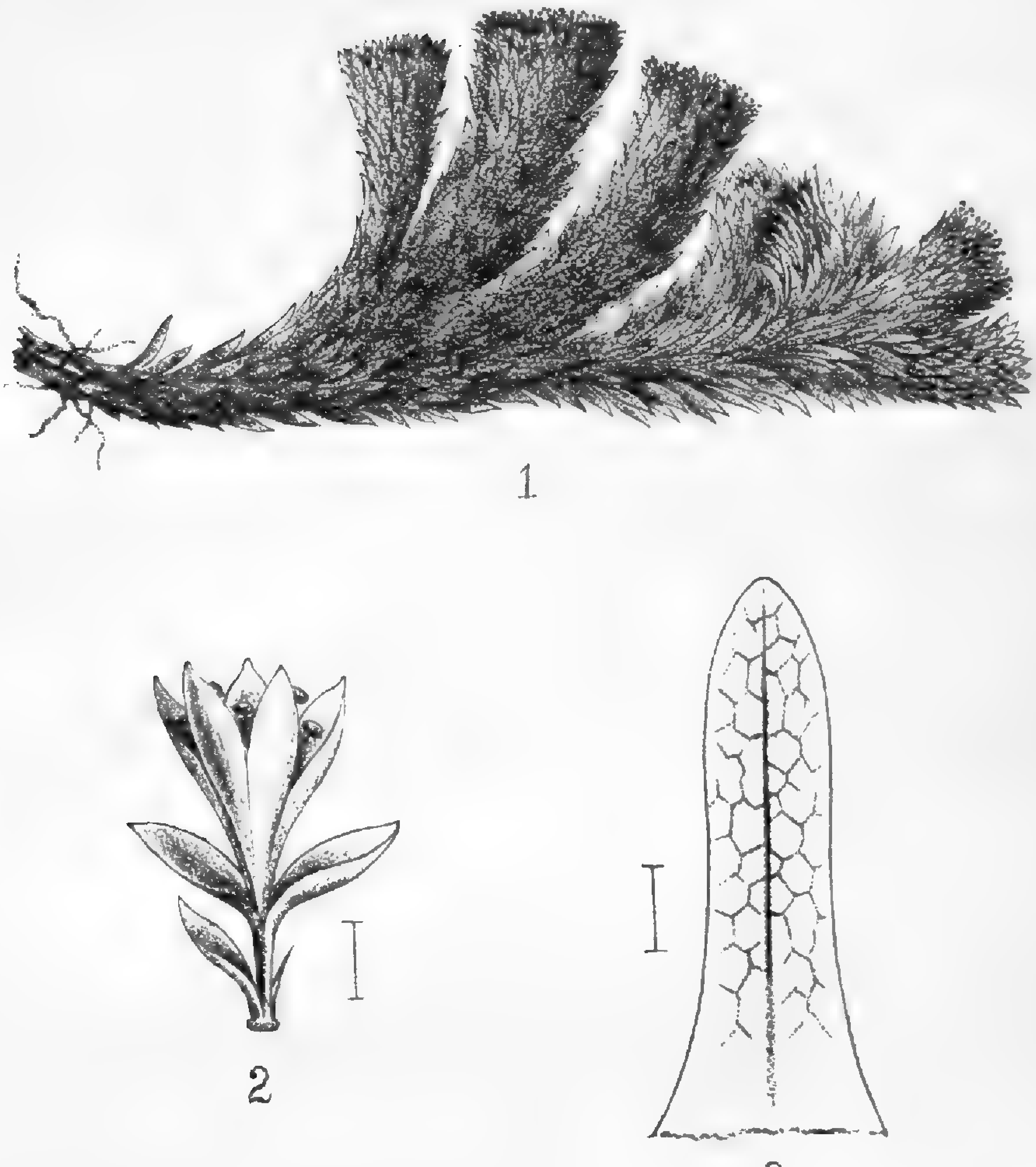
Plagianthus linariifolia, n. s.

A slender upright dense foliaged shrub, with long fascicled leaves. Flowers not seen. Fruit of one indehiscent capsule; capsule narrow, oblong, adherent to the carpel, slightly downy at first, when mature shining black.

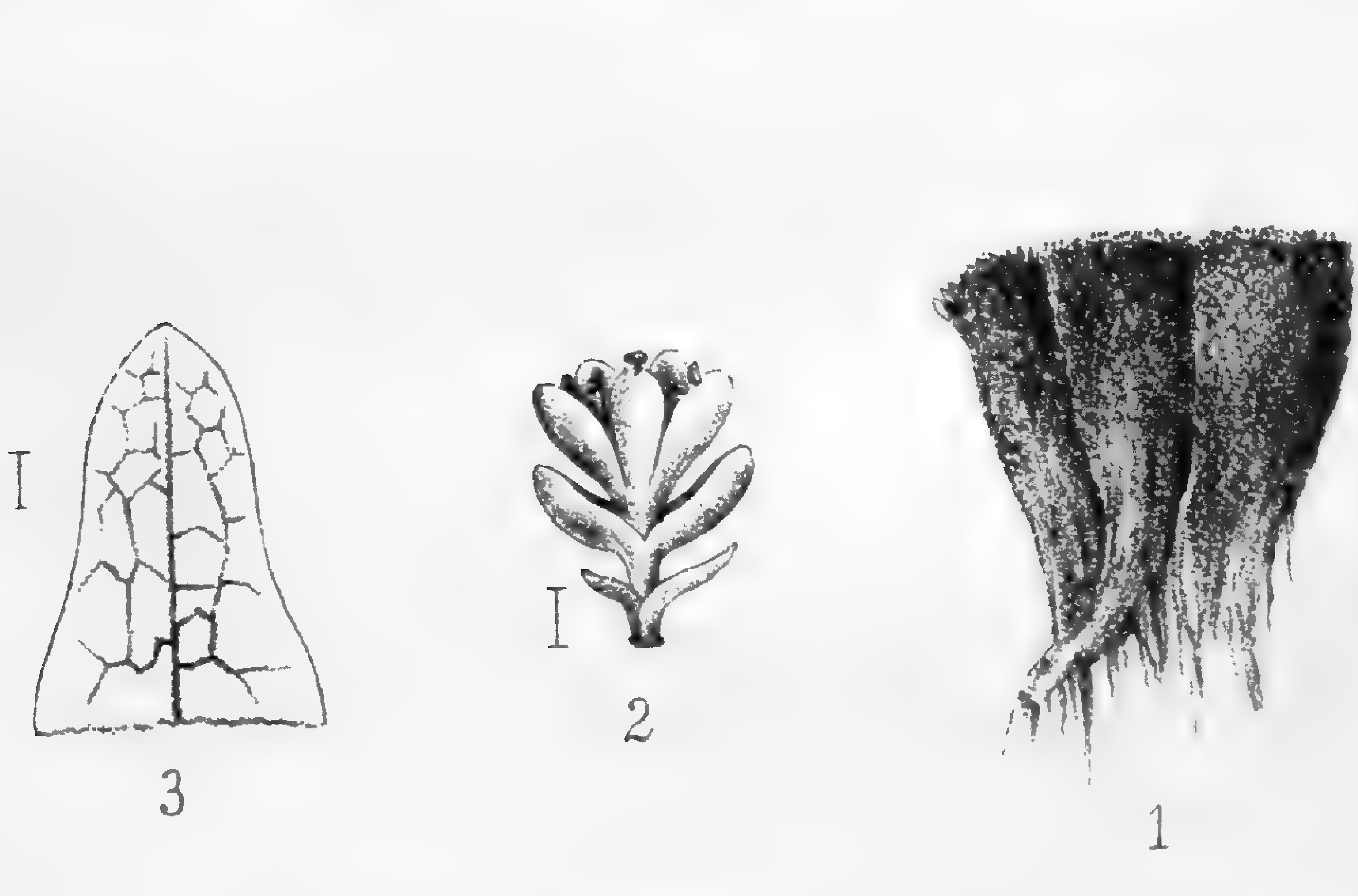
1. PLAGIANTHUS LINARIIFOLIA. n.s.

2. PLAGIANTHUS DIVARICATUS, Forst.

J.B. del. et lith.



HECTORELLA ELONGATA. n. s.



HECTORELLA CÆSPITOSA, Hook. fil.

J.B. del. et lith.

This distinct species is probably peculiar to the west coast of the South Island, while the rigid divaricating branched species of Forster is more peculiar to the east coast. In pl. xxxiv. figures of both have been given, showing the marked difference of foliage, and form of carpels. In *P. linariifolia* the section shows an indehiscent carpel, while *P. divaricata* shows a much smaller carpel, with a large, free, and downy capsule bursting irregularly.

Hectorella elongata, n. s.

A closely branched glabrous plant, forming large soft cushions on the mountains, at altitudes of 5–6,000 feet. Leaves numerous, imbricate, soft, $\frac{1}{4}$ inch long, linear-acuminate, thick at the tip, dilated and membranous at bottom, veins reticulate; flowers white or pale salmon colour, $\frac{1}{4}$ inch long, arranged in circles among the terminal leaves; petals, sepals, and bracts, linear-acute.

In vol. xiv., Trans. N.Z. Inst., this plant was figured and described in error as *Hectorella cæspitosa*, Hook. fil.: since the publication of that volume numerous specimens have been examined from the Mount Aspiring district, Otago, among which two distinct species were found, and to prevent future confusion among collectors both species are here figured.

Carmichælia uniflora, n. s.

A very small rambling glabrous shrub, rooting at the nodes, branches erect, leaves fasicled, $\frac{1}{2}$–$\frac{3}{4}$ inch long and $\frac{1}{30}$ inch broad, striæ 1–3. Flowers $\frac{1}{5}$ inch long, single, on slender glabrous peduncles, with 2 minute bracteoles near the middle; calyx glabrous; teeth distinct, hooked; ovary glabrous.

This minute species is not uncommon in the Waitaki Valley, and has no doubt hitherto escaped observation from its small size. The specimens collected were found growing on rich alluvial soil, and its small proportions cannot therefore be ascribed to want of nourishment.

Sophora prostrata, n. s.

A rigid prostrate rambling shrub 12–18 inches high. Branches interlaced and spreading close to the ground in dense patches. Leaves $\frac{1}{3}$ inch long, glabrous; leaflets 3–5 pairs, ovate, $\frac{1}{10}$ inch long. Flowers $\frac{3}{4}$ inch long, bright yellow, usually in pairs; calyx finely silky. Pods not seen.

This remarkable little species is not uncommon on the lower hills of the Awatere Valley, Marlborough, where it may be found forming flat patches on the ground. The flowers are not seen unless the branches are raised up, which from their great rigidity requires considerable force. No upright form of this species was seen.

Pleurophyllum hookeri, n. s.

Root forming a large mass of few or many succulent fusiform roots. Stem 2–3 feet high, angular and with numerous narrow bracts from 2–4 inches long, covered with white tomentum. Leaves few, circling the lower portion of stem, nearly equal in size, 9–12 inches long, 2–4 inches broad, ovate, acute at top and tapering into a long flat petiole, which in the lower leaves are covered at bottom with long silky hairs, margins minutely serrate, both sides clothed with closely appressed white tomentum which is thicker on the under side. Veins numerous, running nearly parallel at an acute angle. Flowers in globular heads. Heads numerous, $\frac{1}{2}$–$\frac{3}{4}$ inch diameter, racemose, and occupying one-third of the stem, pedicellate, pedicels very narrow, 1–3 inches long, bracteate, and covered with white tomentum. Flowers of the ray few, of the disc numerous, involucral scales in several series narrow, tapering to a long point, pilose on the back.

Common on the hills round Perseverance Harbour, Campbell Island. The notice of a small *Pleurophyllum* in the Antarctic Flora, p. 33, no doubt refers to the present species, although it now proves to be an abundant plant and much larger than then supposed. It is remarkable that so conspicuous a plant should have escaped notice, and this can only be explained by its not having hitherto been seen in flower, although the absence of the large lower leaves might have attracted attention. Many of the present species were seen in flower in the latter end of December, while few of *Pleurophyllum crinitum*, Hook. fil., had developed racemes at that time.

EXPLANATION OF PLATES XXXIV—XXXVII.

Plate XXXIV.

1. *Plagianthus linariifolia*, n. s.
1*a*. Fruit of same in section.
2. *Plagianthus divaricatus*, Forst.
2*a*. Fruit of same in section.

Plate XXXV., A.

1. *Hectorella elongata*, n. s., nat. size.
2. Flower enlarged.
3. Leaf enlarged.

Plate XXXV., B.

1. *Hectorella cæspitosa*, Hook. fil., nat. size.
2. Flower enlarged.
3. Leaf enlarged.

Plate XXXVI.

Sophora prostrata; branch with leaves and flowers nat. size.

Plate XXXVII.

1. *Pleurophyllum hookeri*; plant $\frac{1}{3}$ nat. size.
2. Single head of flowers nat. size.
3. Flower of the disc.
4. Flower of the ray.
5. Flower bract.
6. Pappus hair.

SOPHORA PROSTRATA. n.s.

J.B. del. et lith.

PLEUROPHYLLUM HOOKERI, n.s.

J.B. del. et lith.

ART. XLII.—*Botanical Notes.* By J. BUCHANAN.

[*Read before the Wellington Philosophical Society, 13th February*, 1884.]

Loranthus fieldii, n. s.

LEAVES 1–1½ inches long, linear-oblong, rounded at the tip and narrowed into a very short petiole at the base, mid-rib indistinct. Racemes 3–4 inches long, tetrachotomously 16-flowered. Flowers 1–1¼ inch long, bright crimson, tipped with dark purple, and yellowish towards the base, petals free to the bottom, anthers linear.

A single raceme only of this beautiful *Loranthus* was forwarded by Mr. Field, it was discovered near the base of Ruapehu on *Fagus* sp., and is called by the Maoris "roeroe." More complete specimens will be required before it can be correctly described; in the meantime it is named provisionally after the discoverer.

Bolbophyllum exiguum, F. Muell.

Specimens of this Australian Orchid have been collected in the Collingwood District, Nelson, during the last season by Mr. Dahl, and forwarded to the Colonial Museum, Wellington.

This genus has previously been represented in New Zealand by only one species, *B. pygmæum*, Lindl., a small tufted epiphyte, found on trees and rocks with solitary flowers. The present species may be distinguished by its larger size, and by the peduncles carrying 2–4 flowers.

Calochilus paludosus, R. Brown.

Another Australian orchid discovered by Mr. H. H. Travers in the Collingwood District, Nelson, may also be noticed for the information of botanical visitors to that district.

The present species is a tall slender plant with a long leaf, and two, three, or four dark purple flowers. Sepals 7–8 lines long. Petals not half so long, strongly veined. Labellum covered with long cilia. Column wing produced behind the anther to about its length. Anther as broad as long, very obtuse. Benth. Flora Australiensis, vol. vi.

Dendrobium biflorum, A. Rich.

Mr. Travers sends specimens of a large 2-flowered *Dendrobium* for examination. This is no doubt *D. biflorum*, A. Rich., noticed in the Handbook N.Z. Flora, as a var. of *D. cunninghamii*, Lindl. It is a rare plant in many parts of New Zealand and differs from the latter in its larger size and constant 2-flowers. It would be more satisfactory to treat such distinct forms as species than as varieties in future publications.

Art. XLIII.—*Campbell Island and its Flora.* By J. Buchanan, F.L.S.

[*Read before the Wellington Philosophical Society, 13th February,* 1884.]

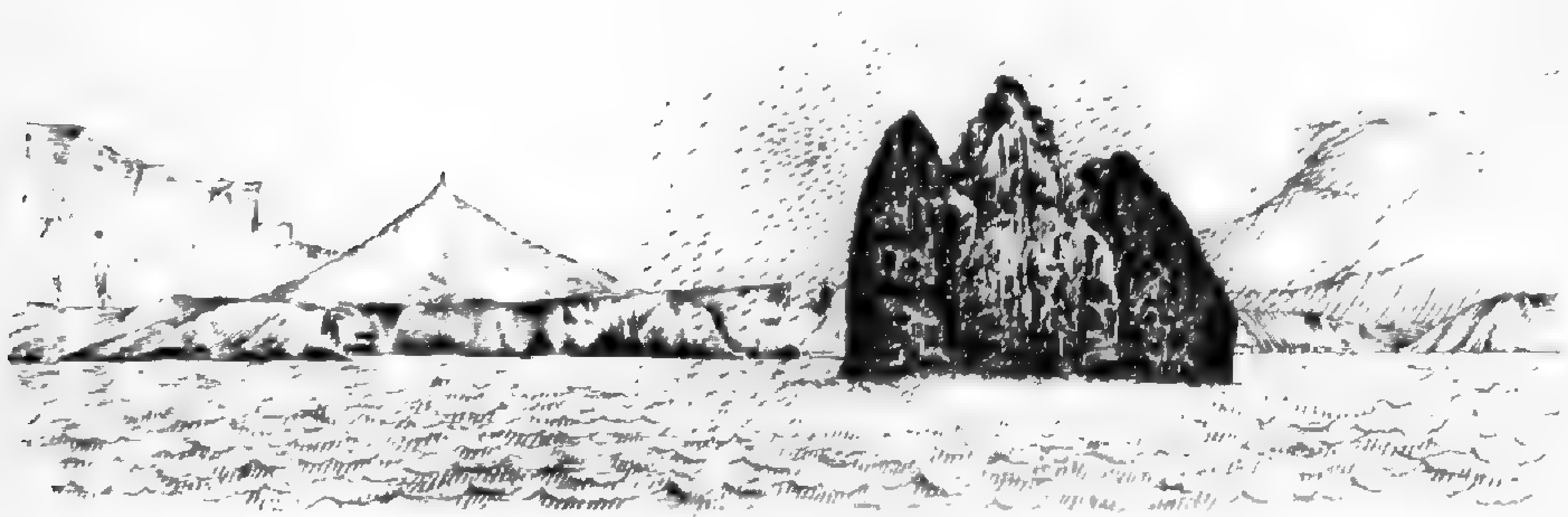
Plate XXXVIII.

In December last, the colonial s.s. "Stella" being ordered to Campbell Island in search of lost seamen, an opportunity was offered to procure a collection of live plants for the various botanical gardens, and also to make an herbarium collection for the Museum. Having been instructed to undertake the duty, and being granted the privilege of a passage by the Marine Department, I provided myself with abundance of paper for plant-drying purposes, carefully packed in a tin box, and other necessaries for plant-collecting. After a favourable passage of three days, Campbell Island was sighted in the early morning of 20th December. This island, as stated in Ross's Voyage, is in lat. 52½° South and long. 169° East. It was first discovered by Frederick Hazelberg in 1810; it is thirty miles in circumference; when approached from the north, it presents a precipitous rocky coast, without any apparent landing-place. As the morning mists lifted and cleared away, numerous outlying rocks and little islands came into view swarming with flocks of sea-fowl, the whole offering to the artist picture-subjects of great beauty. The accompanying sketch (No. 1., pl. xxxviii.) presents a morning scene from the north-east.

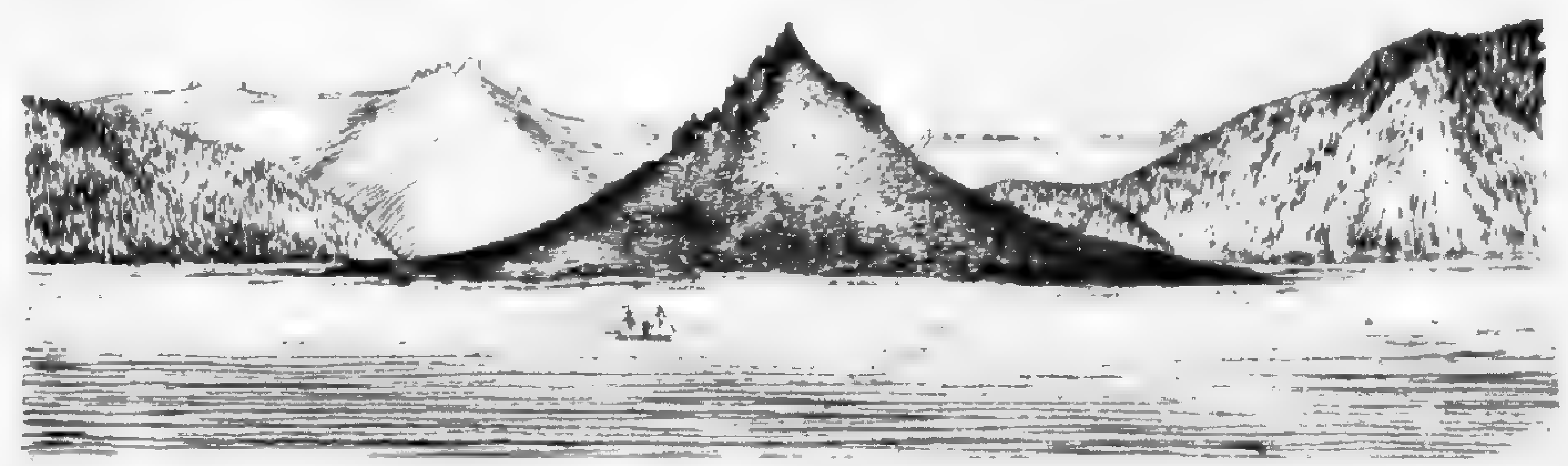
The higher coast-lands show rough broken trachy-dolerite precipices, the haunt of sea-fowl, the snowy appearance of the hill ridges being due to innumerable birds (chiefly the albatross) nesting. The rock sections seen in the sea-cliffs have a peculiar red lined character, produced by the contact of alternate layers of clays or soils with lava beds, thus presenting remarkable parallel red lines on a dark groundwork of trachy-dolerite. The whole coast-line is rugged in the extreme, although inland large flat areas may be seen apparently covered by grasses, and indicating rich pasture; this appearance, however, on closer examination is found to be deceptive, as but few grasses exist, and a coarse wet cyperaceous pasture prevails, which would prove worthless as feed, unless for cattle of a hardy breed that would stand the rigours of the climate. There is no doubt however that, on the lower levels where soil can accumulate, a rich though coarse vegetation exists, but the land is so spongy and wet that the finer grasses cannot thrive. The extreme wetness of the soil is shown by the fact that wherever a plant is dug out with a knife, the hole immediately fills with water, and an indication is thus obtained of the treatment such plants should receive when it is attempted to grow them in a drier climate.

Peat is abundant everywhere on the hill slopes, and in such places the great beauty of the Antarctic flora is seen to best advantage when contrasted with the dark coloured peaty soil. Plants such as *Celmisia vernicosa*,

CAMPBELL ISLAND.
N.E.



CAMPBELL ISLAND
N.



ANCHORAGE
PERSEVERANCE HARBOUR.

Hook. f., with its beautiful purple-tinted flowers, and *Pleurophyllum speciosum*, Hook. f., with its brilliant racemes of purple flowers, may be considered the gems of the southern flora. The numerous tall spikes of *Pleurophyllum criniferum*, Hook. f., and *P. hookeri*, n. sp., mihi, give a peculiar character to both the Campbell and Auckland Islands' flora. No doubt much of this floral luxuriance is due to the richness of the moist vegetable soil and to the fog-shaded atmosphere, the climate during summer being not unlike a moist forcing house; hence it is doubtful if in the absence of these moist conditions much success will attend the cultivation in New Zealand of plants removed there. The large showy plants of Campbell Island are probably confined within an altitudinal range of 500 feet above sea level, but the shrubby or small trees such as species of *Coprosma*, *Dracophyllum*, *Veronica*, and *Myrsine* range from sea-level where they are most abundant to the highest altitudes (1,500 feet), although they are all sparsely distributed everywhere. A very prominent and showy plant *Chrysobactron rossi*, Hook. f., with its bright yellow racemes of flowers may be seen everywhere; the raceme in this plant is often found globe shaped.

The smaller grasses are rare, but several large and noble grasses are abundant, the most conspicuous being *Poa foliosa*, Hook. f., *Danthonia antarctica*, Hook. f., *Hierochloe brunonis*, Hook. f., and *Hierochloe redolens*, Br., but the chief feature of the flora is the abundance of Cyperaceous plants and species of Juncaceæ, most prominent being *Rostkovia gracilis*; this plant also characterises the subalpine flora of New Zealand up to 6,000 feet.

An alpine flora may also be recognized in Campbell Island, as a few plants are only found at the highest altitude, such as *Gentiana concinna*, Hook. f., and that curious little inconspicuous plant *Trineuron spathulatum*, Hook. f., collected in fine flower at an altitude of 1,500 feet.

The only plants collected on this occasion not previously known on Campbell Island were *Pleurophyllum hookeri*, n. s., mihi, *Cotula australis*, Hook. f., *Nertera depressa*, Banks and Sol., *Chenopodium* sp., and *Lagenophora* sp.

It would be an error to assume that the botany of Campbell Island has been exhausted because a few collectors have visited the Island and spent some days there; but when it is considered how often the weather is unfavourable, and how short a period is devoted to collecting, it is remarkable that so much has been done.

On the present occasion, one day and two half days only were available for collecting, and, out of this, one entire day was devoted to digging up living plants, a very excellent collection of the latter being made, but through some inadvertence they went astray during the return voyage. A large collection of dried specimens, however, was secured for the Herbarium of the Colonial Museum, at Wellington, which will prove valuable for future reference. No. 2, pl. xxxviii., shows a characteristic outlier of the trachydolerite rock frequented by immense flocks of sea-fowl. No. 3, pl. xxxviii., is the best harbour in the Island, and a favourite anchorage for sealers.

Art. XLIV.—*On the* Lichenographia *of New Zealand.*

By Charles Knight, F.L.S.

[*Read before the Wellington Philosophical Society, 13th February*, 1884.]

Plates XXXIX.–XLI.

1. *Pilophoron colensoi* (Bab.), Knight.

(Syn. *Stereocaulon colensoi* (Bab.), Flora N.Z., vol. ii., p. 294; Nylander, Synopsis Lich., p. 232.)

Thallus cæspitosus e podetiis formatus. Podetia *intus solida dense granulosa*, strato corticali tenuissimo e gonidiis veris constante. Apothecia plura congesta capituliformia intus alba solida lecanorina,* juvenilia crasse marginata; excipulo thallode albo, corticis structura radiatim disposita, gonidiis veris nullis. Sporæ in ascis cylindrico-elongatis octonæ uniseriales oblongo-ellipsoideæ *simplices* subluteolæ, longit. 0·009 mm., crassit 0·0025 mm. Cephalodia plura in apicibus ramorum brevium congesta, glauco-cœrulescentia, *intus granulis gonimis flavo-viridis, in nodulis* 2 *ad* 4 *dispositis, omnino constantia.*

Supra saxa.

Obs.—The discovery of the spores, now shown to be simple, distinctly shows that Colenso's lichen belongs to the genus *Pilophoron.* Th. Mr. Fries, in his "Monogr. Stereocaulorum et Pilophororum," p. 66, under "*Species minus cognitæ,*" remarks that *Stereocaulon colensoi* is perhaps a form of *Ster. argus.* This view must now be abandoned, as the latter plant has cylindrico-fusiform multiseptate spores (see fig. 1*, pl. xxxix). Babington, on the other hand, considers it allied to *Ster. ramulosum*, but the same objection exists to any proposal which would place Colenso's plant under the genus *Stereocaulon.*

2. *Myriangium duriæi* (Mnt. et Berk.).

Thallus nullus. Apothecium tuberculiformis e matrice erumpens (diam. circiter 3 mm. vel amplius) *toro crasso parenchymatico carbonizato marginatum*; epithecium *carbonizatum*; hymenium *parenchymaticum* luteo-fuscum

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* Quia margo est thallinus, lecanorina nominatur.

LICHENS.

C. Knight. del.

multivesiculare, vesiculis *sparsis singulis ascum globosum singulum includentibus*, paraphysibus *nullis;* hypothecium discretum nullum. Sporæ octonæ oblongæ utrinque obtusæ nonnihil incurvæ hyalinæ normaliter 3-septatæ, longit. 0·02 mm., crassit. 0·0075 mm.

Ad cortices arborum.

Obs.—The Rev. Churchill Babington in "Flora of New Zealand," p. 310, places under the head of *Myriangium inconspicuum* a lichen which Dr. Nylander has since shown to be an Arthonia allied to *Arth. lurida* and has named *Arth. conspicua* (see Nylander's Lich. Novo-Granatense, note, p. 67, 1st ed.). Babington in his remarks does not seem to be aware that there exists in New Zealand a true Myriangium, viz., *Myr. duriæi*, a perfectly developed species of that very curious genus.

3. *Physcia adglutinata*, Flk.

Thallus membranaceus *cinereo-fuscescens v. livido-fuscus, e laciniis parvis multifidis tenuibus arcte adpressis* formatus. Apothecia sessilia nigro-fusca *nuda*, margine integro. Sporæ ovoideo-ellipsoideæ 2-cellulæ, cellulis normaliter tubulo in axi sporæ disposito junctis, fuscescentes, longit. 0·018 mm., crassit. 0·009 mm.

Ad cortices arborum, socia fere semper *Physciæ stellaris.*

4. *Physcia synthalea*, sp. n.

Thallus cinereo- vel glauco-albicans *ad matricem arcte adglutinatus, tenuiter membranaceus* laciniatus, laciniis fragilibus dilatis rugoso-plicatis *confluentibus*, apicibus varie crenatis *passim pertusis*, subtus concoloribus *nudis*. Apothecia *cerino-flava* mox sat fusca plana, margine thallode pallido tumido sæpissime integro. Sporæ fuscæ 4–6-loculares, loculis aut discretis aut tubulo conjunctis, nonnihil varie septatæ, longit. 0·02 mm., crassit. 0·013 mm.

Ad cortices arborum.

5. *Pannaria brunnea* var. *pulverulenta*, Knight.

Thallus *cinereo-fumosus granulato-squamulosus mox in crustam pulverulento-granulosam* conglobatus, hypothallo fusco-atro, granulis gonimis viridis parvis. Apothecia rufo-fuscescentia *innata* conferta interdum symphicarpea plana, madefacta convexa excipulo composito marginata, margine thallode tenui *pulverulento-granuloso*, excipulo proprio dilute colorato, textura supra radiatim disposita; hymenium hypothecio crasso strato gonimico imposito enatum, paraphysibus adglutinatis. Sporæ in ascis cylindrico-elongatis ellipsoideæ incolores, longit. 0·016 mm., crassit. 0·008 mm.

Supra terram humidam.

6. *Lecanora cyrtospora*, sp. n.

Thallus albo-cinereus tenuis minute granulosus continuus (linea atra limitatus?) apothecia *scutelliformia* (diam. 2 mm.) grisea pruinosa plana intus fusca excipulo *mere thallode* marginata, margine crasso pallido *irregulariter* *crenato, ex annulo interiore ornato*, persistente, paraphysibus hypothecio tenui enatis, non bene discretis. Sporæ in ascis clavatis persæpe curvatæ oblongæ utrinque obtusæ simplices incolores, longit. 0·027 mm., crassit. 0·009 mm.

Ad cortices.

7. *Pertusaria cupularis*, sp. n.

Thallus e cinereo glauco-albicans lævigatus areolatus nonnihil appresso-leprosus. Apothecia *monopyrenia* alba sparsa applanato-hemispherica *lecanoriformia*, amphithecio nullo, margine thallode crasso.—(*sæpe e duobus vel pluribus annulis albis constante*)—tandem *fatiscente*, disco depresso albo suffuso nonnihil nudo—(tum vitreo-griseo)—paraphysibus *paucis subtilibus ramosis*. Asci *conferti numerosi* cylindrici. Sporæ ellipsoideæ simplices uniseriales octonæ pluries limbatæ, longit. 0·04 mm., crassit. 0·018 mm.

Ad cortices.

Allied to *Pertusaria sorediata*, Fr.

8. *Pertusaria lævis*, sp. n.

Thallus tenuis cinereo-albidus continuus *v. tenuissime reticulatus.* Apotheciorum verrucæ convexæ *pleiopyreniæ*, circa ostiola minutissima fusco-nigricantes *nunquam depressæ*, paraphysibus imperfectis floccoso-reticulatis, amphithecio *e matrice enato.* Sporæ in ascis cylindrico-elongatis octonæ ellipsoideæ pluries limbatæ nebuloso-incolores, longit. 0·045 mm., crassit. 0·018 mm.

Ad cortices.

9. *Lecidea atrolurida*, sp. n.

Thallus ochro-albicans squamulosus, *squamulis minutissimis appressis*, linea atra limitatus, hypothallo nigro-lurido semi-nudo, *squamulis ipsis obsito.* Apothecia atra *minuta* (diam. circiter 0·5 mm.) mox convexa vel hemispherica, intus fusco-nigricantia, margine concolore obscuro evanescente, excipulo proprio omnino fusco-atro (lamina tenui visum) *e thallo albo oriundo* paraphysibus *ramosis* adglutinatis tandem subpatulis. Sporæ ovideæ incolores, longit. 0·01 mm., crassit. 0·007 mm.

Ad saxa.

Affinis est *Lecideæ fusco-rubenti*, Nyl., et *schistaceæ*, Kn., sed apothecii minoribus.

10. *Lecidea* (Bombyliospora) *monospora*, sp. n.

Thallus olivaceus minute granuloso-squamulosus v. pulvereus. Apothecia *peltata urceolata* atra demum plana, intus luteo-fusca, margine *asperissimo* concolore, excipulo proprio *a linea nigra in epithecium producta circumscripto, structura non radiatim disposita*; hypothecio fusco, paraphysibus bene discretis incoloribus attamen in *pileum atrem oblongum* v. *conicum terminantibus.* Ascus *monosporus.* Sporæ *murali-divisæ* (seriebus circiter 20 transversim 7–9 loculares), ellipsoideæ, longit. 0·07 mm., crassit. 0·028 mm.

Ad cortices arborum.

Obs.—Differs from *Lecid. lecanorella*, Nyl., in the spores being nearly double the size, and the transverse cells much more numerous. The blast cell at the apex of each paraphysis is remarkable.

11. *Lecidea* (Sporastatia) *desmaspora*, sp. n.

Thallus albo-cinereus *farinaceus.* Apothecia e thallo oriunda parva (diam. 0·5 mm.) convexa, madefacta hemispherica, disco immarginato fusco v. atro-fusco, hymenio tenui hyalino, hypothecio fusco crasso, excipulo proprio (*structura radiatim disposita*), *in laminam proligeram continuato*, paraphysibus adglutinatis apice incoloratis. Sporæ in ascis clavatis *numerosissimæ minutissimæ globosæ* (diam. 0·001 mm.) *catenatæ.*

Ad cortices arborum.

12. *Arthonia phymatodes*, sp. n.

Thallus tenuis cinereo-viridulus, matrice rimosa fissa, *subtuberculosus*, tuberculis fertilibus convexis sparsis. Apothecia *minuta* (madefacta, diam. 0·3 mm.) e thalli tuberculis formata et marginata; disco plano *primitus strato thallino tenui tecto*, deinde partito vel omnino nudo vitreo-fuscescenteque; excipulo nullo, hypothecio simplici, paraphysibus paucis *grosse clathrato-ramosis.* Sporæ in ascis *ventricoso-clavatis* nymphæformes normaliter 5-cellulæ, cellulo supremo ampliore, incolores, longit. 0·02 mm., crassit. 0·008 mm.

Ad cortices arborum.

13. *Opegrapha spodoelæina*, sp. n.

Thallus hyepoplodes cinereo-*olivaceus* tenuissimus *continuus*, intus *gonidiis perspicuis, strato hypothallino cum matrice mutata commisto.* Apothecia nigra superficialia linearia (longit. 1·5 mm.) simplicia intus dilute fuscescentia, excipulo nigro, hypothecio *fusco*; epithecio incolore, paraphysibus *ramosis.* Sporæ in ascis ovoideis incolores fusiformes 6–7-septatæ, longit. 0·037 mm., crassit. 0·007 mm.

Ad cortices arborum.

Obs.—Quasi inter *Opegrapham agelæoidem*, Nyl., et *spodopolia*, Nyl., intermedia, differens ab illa thallo olivaceo, ab hac thallo continuo et hypothecio fusco.

14. *Opegrapha stellata*, sp. n.

Thallus tenuis pallide ochro-cinereus lævis continuus, linea atra limitatus. Apothecia lirellæformia, lirellis *elongatis angustissimis flexuoso-contortis stellatim ramosis, madefactis subinnatis* apertis, hymenio incolore, excipulo atro integro, paraphysibus *clathrato-ramosis.* Sporæ in ascis subpyriformibus minutæ incolores *subfusiformes* 1–3-*septatæ*, longit. 0·012 mm., crassit. 0·003 mm.

Ad cortices arborum.

Quasi inter *Opegrapham* et *Graphidem* intermedia.

15. *Opegrapha intertexta*, sp. n.

Thallus albo-cinereus tenuis lævis continuus. Apothecia madefacta *innata*, lirellæformia, lirellis *simplicibus* v. *subramosis* angustissimis rectis v. flexuoso-contortis *ipsis intermixtis*, hymenio incolore, perithecio atro *integro*, paraphysibus *clathrato-ramosis*. Sporæ in ascis *subpyriformibus* minutæ incolores subfusiformes 1–3-septatæ, longit. 0·012 mm., crassit. 0·003 mm.

Ad cortices arborum.

Obs.—Quasi inter *Opegrapham* et *Graphidem* intermedia.

16. *Graphis strigata*, sp. n.

Thallus tenuis e albo cinerascens, nitiusculus *colliculosus* v. *verrucosus*, *fissus*, interdum versus ambitum areolatus. Apothecia *palmato-divisa*, lirellis *a thallo niveo subprominente* cinctis, *apicibus attenuatis*, disco *lato albo-pruinoso, a lineis nigris striato*, raro nudo, tum atro; excipulo atro-fusco *laterali*; hymenium dilute fuscum hypothecio concolore tenui enatum, paraphysibus *rectis* arcte adglutinatis grumosis. Sporæ in ascis cylindricis oblongæ hyalinæ 4-cellulæ, cellulis lentiformibus limbatis, mox fuscæ emortuæ collapsæ, longit. 0·02 mm., crassit. 0·008 mm.

Ad cortices arborum.

Arcte affinis est *Graphidi subtricosæ* (Knight, Linn. Trans., vol. ii., 1882), sed apotheciis pruinosis strigatis, et thallo passim verrucoso, quare specie differt.

17. *Graphis librata*, sp. n.

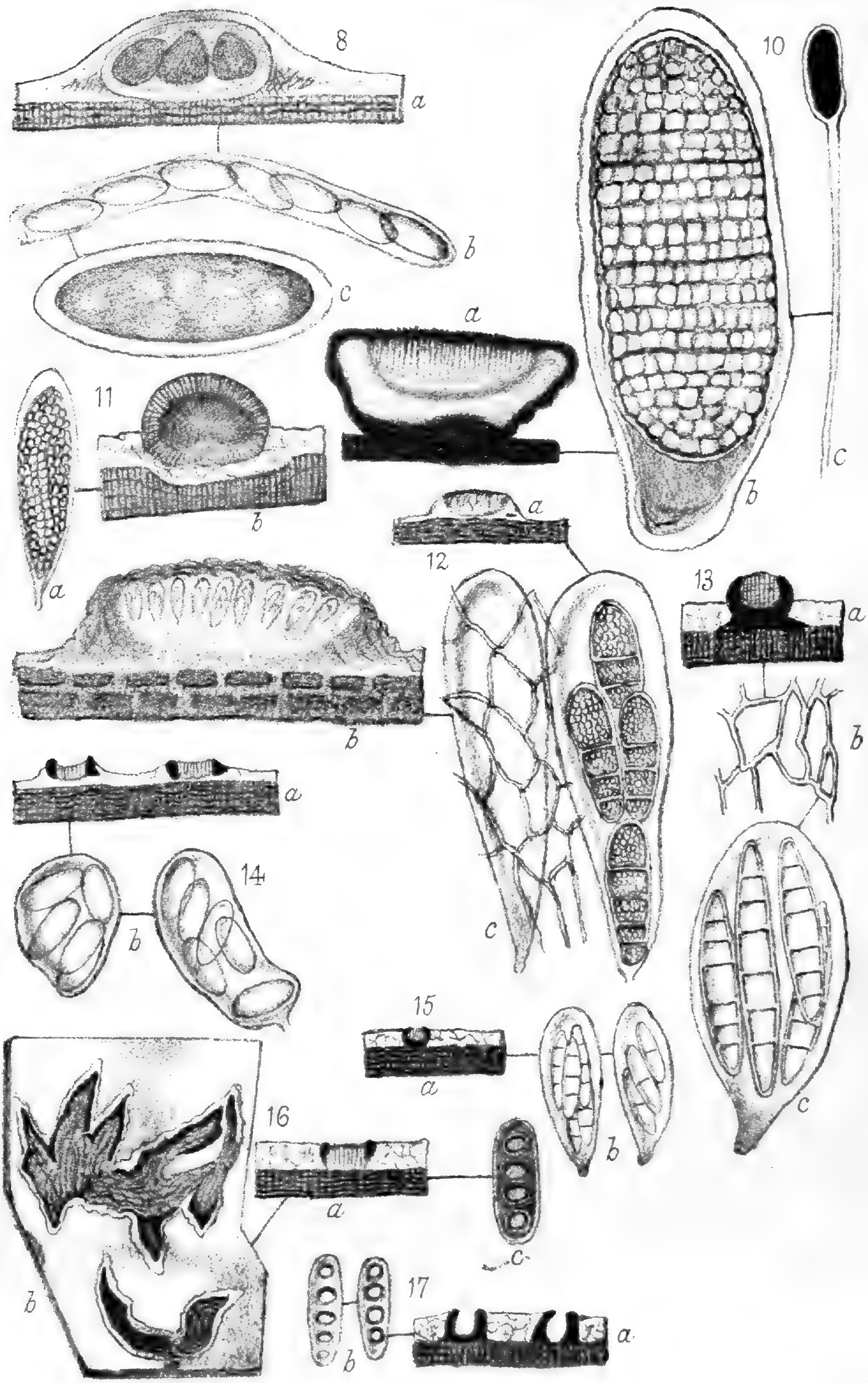
Thallus tenuis pallide fusco-ochraceus *continuus linea atra limitatus*. Apothecia atra lirellæformia angusta sæpissime *simplicia rectiuscula librata* clausa, madefacta *innata*, excipulo atro *integro* v. subintegro, hymenio incolore, paraphysibus distinctis *ramosis*. Sporæ oblongæ 4–5-cellulæ, cellulis lenticularibus incolores, longit. 0·017 mm., crassit. 0·006 mm.

Ad cortices arborum.

18. *Fissurina rugosa*, sp. n.

Thallus cinereo-*olivaceus* tenuissimus *rugoso-verrucosus*, verrucis *ex apothecio fissus*. Apothecia longit. circiter 1 mm. *in matrice subinflata* dilacerata immersa, flexuosa pervaga simplicia conferta, intus incoloria, marginibus thalloideis *tenuibus in latitudinem vix laxatis* (in sectione supra fuscescentibus) paraphysibus adglutinatis gracilibus apice haud coloratis. Sporæ in ascis cylindrico-elongatis ovatæ hyalinæ demum fuscescentes, normaliter uniseriales, 4-cellulæ, cellulis lenticularibus, longit. 0·018 mm., crassit. 0·009 mm.

Ad cortices arborum.



LICHENS.

C. Knight, del.

19. *Fissurina alba*, sp. n.

Thallus tenuis *albidus* subnitens inæqualis, ex apotheciis fissus, continuus, *strato gonidiale viride a corticale albo clare separato*. Apothecia flexuosa simplicia (longit. circiter 1·5 mm. vel ultra) *in matrice immersa*, intus incoloria, marginibus thalloideis tenuibus approximatis (in sectione supra fuscescentibus interdum *bicornibus*); hymenium incolor hypothecio matrice imposito enatum, paraphysibus adglutinatis apice incoloribus. Sporæ in ascis cylindrico-elongatis ovoideæ 4-cellulæ, cellulis lenticularibus, incolores tandem dilute fuscescentes, longit. 0·02 mm., crassit. 0·01 mm.

Ad nudos arborum radices.

20. *Trypethelium bicolor*, sp. n.

Thallus tenuissimus atrofuscus *tuberculosus*, tuberculis fusco-ochraceis nonnihil atro-fuscis, *intus ex apotheciis pluribus et matrice degenerata constantibus;* excipulum integrum carbonaceum *tenue pyriforme* v. globoso-deforme, ostiole tandem nigricante; paraphyses laxe *clathrato-ramosis*. Sporæ in ascis clavatis octonæ oblongæ 4-cellulæ (cellulis limbatis globularibus, septis interpositis inter se separatis) hyalinæ, longit. 0·02 mm., crassit. 0·0075 mm.

Ad cortices arborum vivorum.

Var. *pyrenuloides*. Thallus *e cinereo fuscus* subnitans passim tuberculosus, *maculis asperis et lineis atris aspersus*, tuberculis *atris asperis*. Apothecia *sejuncta* interdum *syncarpea*.

Obs.—Non certum est, anne *Tryp. bicolor* revera sistat Verrucariam. Ad excipulum pyriforme sporesque 4-cellules rationem similis est *Verrucariæ catervariæ*, Fée. Facies thalli fere sicut *Tryp. scoria*, Fée.

21. *Stigmatidium prominulum*, sp. n.

Thallus *albo-ochraceus* tenuissimus continuus. Apothecia in verrucis thallinis *minutis* convexis (latit. circiter 1·5 mm.) omnino immersa, ostiolo pertuso subprominule, amphithecio *supra fuscescente* sed parte *infera incolore vel evanescente*, hymenio globoso incolore, paraphysibus *floccosis*. Sporæ incolores oblongo-ovoideæ 3-septatæ, longit. 0·013 mm., crassit. 0·005 mm.

Ad cortices arborum.

22. *Verrucaria mycospora*, sp. n.

Thallus albo-cinereus areolato-rimosus *haud verrucosus* tenuissimus. Apothecia *minuta* (diam. 0·25 mm.) globosa *sessilia*, perithecio *integro* atro *e matrice imposito*, hymenio subtiliter floccoso dilute fuscescente, paraphysibus *nullis*. Sporæ *fusiformi-dactyloideæ* 5–6-septatæ hyalinæ, longit. 0·025 mm., crassit. 0·003 mm. Spermagonia *prominentia*, spermatiis oblongis, longit. 0·007 mm., crassit. 0·003 mm., sterigmatibus simplicibus infixis.

Ad cortices arborum.

23. *Verrucaria olivaceo-fusca*, sp. n.

Thallus *olivaceo-fuscus* lævis tenuis continuus, apotheciorum verrucis *minutis atro-fuscis* convexis, ostiolo inconspicuo vix unquam pertuso. Apothecia *in matrice subimmersa* orbicularia, perithecio atro integro, hymenio pallido-fusco, paraphysibus *distinctis*. Sporæ hyalinæ mox fuscæ 4-cellulæ, cellulis limbatis, longit. 0·019 mm., crassit. 0·008 mm.

Ad cortices arborum.

24. *Odontrema concentricum*, Stirton.

Thallus cinereo-ochraceus tenuis continuus. Apothecia matrice imposita a thallo leviter irregulariterque obtecta, primo clausa, perithecio *carbonaceo dimidiato ambitu recurvato* mox *dilaniato-dehiscente*, hymenio tandem concavo-discoideo; epithecium *perithecio divulso obsitum*, paraphysibus subtiliter capillaribus apice non dilatis linea fusca tenui enatis. Sporæ in ascis cylindraceis incolores normaliter cylindracæ obtusæ nonnihil elongato-fusiformes, circiter 12-*septatæ*, cellulis quaternis v. lentiformibus, longit. 0·03 ad ·05 mm., crassit. 0·006 ad ·009 mm.

Ad cortices arborum.

EXPLANATION OF PLATES XXXIX—XLI.

Plate XXXIX.

No. 1. *Pilophoron colensoi* (Bab.), Knight.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) Gonidia x 300 diam.
- (*c.*) Granules (pseudo-gonidia) of which the medullary substance of the thalline receptacle principally consists x 900 diam.
- (*d.*) Spores in ascus x 900 diam.

No. *1. *Stereocaulon ramulosum.*
- Ascus and spores x 900 diam.

No. 2. *Myriangium duriæi*, Mont. et Berk.
- (*a.*) Section of carbonized torus and apothecium x 38 diam.
- (*b.*) Section of portion of the above x 150 diam.
- (*c.*) Section x 900 diam. showing ascus and spores in situ.

No. 3. *Physcia synthalea*, sp. n.
- 3 spores x 900 diam.

No. 4. *Physcia adglutinata*, Flk.
- Ascus and spores x 900 diam.

No. 5. *Pannaria brunnea* v. *pulverulenta*, Knight.
- (*a.*) Section of apothecium x 900 diam.

No. 6. *Lecanora cyrtospora*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) Ascus and spores x 900.

No. 7. *Pertusaria cupularis*, sp. n.
- (*a.*) Section of apothecium x 38 diam.

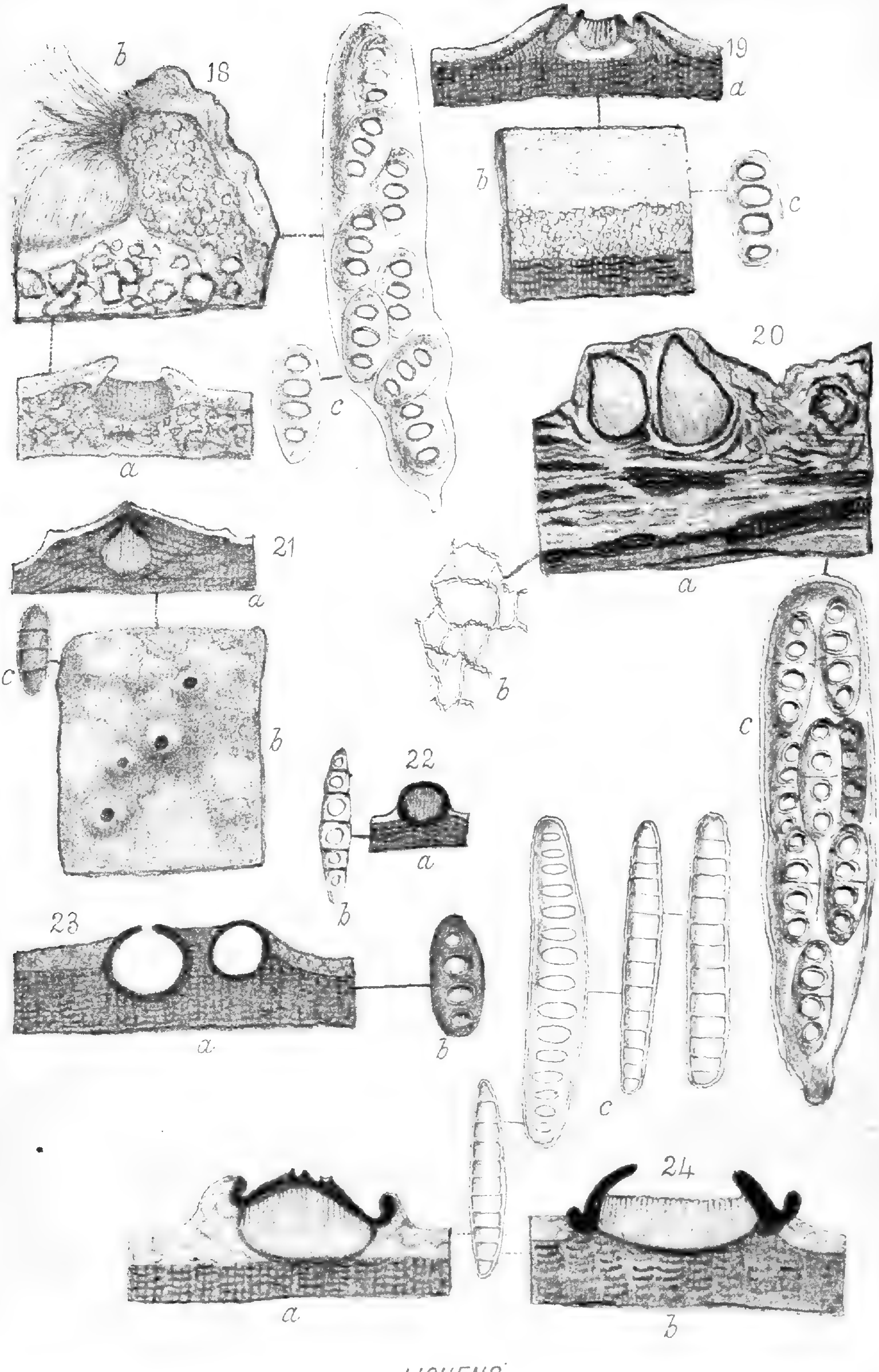


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PLATE XL.

No. 8. *Pertusaria lævis*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) Ascus and spores x 260 diam.
- (*c.*) Spore x 900 diam.

No. 10. *Lecidea* (Bombyliospora) *monospora*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) Spore x 900 diam.
- (*c.*) Paraphyses x 900 diam.

No. 11. *Lecidea* (Sporastatia) *desmaspora*, sp. n.
- (*a.*) Ascus and spores x 900 diam.
- (*b.*) Section of apothecium x 38 diam.

No. 12. *Arthonia phymatodes*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) " " x 150 diam.
- (*c.*) Ascus and spores with clathrato-ramose paraphyses x 900 diam.

No. 13. *Opegrapha spodoelæina*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) Paraphyses x 900 diam.
- (*c.*) Ascus and spores x 900 diam.

No. 14. *Opegrapha stellata*, sp. n.
- (*a.*) Section of apothecia x 38 diam.
- (*b.*) Asci and spores x 900 diam.

No. 15. *Opegrapha intertexta*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) Asci and spores x 900 diam.

No. 16. *Graphis strigata*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) Lichen x 20 diam.
- (*c.*) Spore x 900 diam.

No. 17. *Graphis librata*, sp. n.
- (*a.*) Section of apothecia x 38 diam.
- (*b.*) Spores x 900 diam.

PLATE XLI.

No. 18. *Fissurina rugosa*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) " " x 900 diam., showing matrix below; thallus on right side, with paraphyses attached laterally and at base.
- (*c.*) Ascus and spores x 900 diam.

No. 19. *Fissurina alba*, sp. n.
- (*a.*) Apothecium immersed in matrix x 38 diam.
- (*b.*) Section showing corticular and gonidial strata imposed on matrix x 300 diam.
- (*c.*) Ascus and spores x 900.

No. 20. *Trypethelium bicolor*, sp. n.
- (*a.*) Section showing apothecia immersed in the ruptured and degenerated matrix x 38 diam.
- (*b.*) Paraphyses x 900 diam.
- (*c.*) Ascus and spores x 900 diam.

PLATE XLI.—*continued.*

No. 21. *Stigmatidium prominulum*, sp. n.
- (*a.*) Section of apothecium immersed in matrix x 38 diam.
- (*b.*) Lichen x 38 diam.
- (*c.*) Spores x 900 diam.

No. 22. *Verrucaria mycospora*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) Spore x 900 diam.

No. 23. *Verrucaria olivaceo-fusca*, sp. n.
- (*a.*) Section of apothecium x 38 diam.
- (*b.*) Spore x 900 diam.

No. 24. *Odontrema concentricum*, Stirton.
- (*a.*) Section showing the closed parithecium recurved at base.
- (*b.*) Section showing parithecium open and epithecium expanded, *a.* and *b.* x 38 diam.
- (*c.*) Four spores x 900 diam.

ART. XLV.—*Notice of the Discovery of the genus* Rhagodia *in New Zealand.*

By T. F. CHEESEMAN, F.L.S.

[*Read before the Auckland Institute, 4th June*, 1883.]

THE genus *Rhagodia* was founded by the late Robert Brown, many years ago, on some half-dozen Australian plants agreeing in most characters with *Chenopodium*, but easily distinguished by the fleshy fruit. Several species have since been added, thirteen being described in the "Flora Australiensis;" but up to the present time all of these were supposed to be strictly confined to the Australian continent. Some little interest is therefore attached to the discovery of one of the species in New Zealand, both from its adding a new genus to our Flora, and from affording additional proof of the intimate connection existing between the plants of the two countries. My specimens, which are clearly referable to Brown's *Rhagodia nutans*, the most widely distributed of the species, were obtained during a recent expedition of the Auckland Naturalists' Field Club to the island of Otatau, which, with Rakino and some smaller islets, guards the entrance to the eastern passage to Auckland Harbour. The plant is abundant all round the shores of the island, and on some of the smaller adjacent ones, usually trailing over the rocks a little distance above high-water mark. The following short description may be useful to those who have not access to the "Flora Australiensis" or other systematic works:—

Rhagodia nutans, R. Br. Prodr. 408; Benth. Fl. Austral. 5, p. 156. A much branched, prostrate or procumbent, herbaceous plant. Branches 6–18 inches long, sometimes hard and almost woody at the base. Leaves rather thin, green or occasionally mealy-white, opposite or alternate, very variable in size and shape, ¼–1 inch long, lanceolate to broadly hastate, lobed notched or cordate at the base, acute at the apex, quite entire. Flowers diœcious in the specimens examined, but probably often polygamous, small and green, arranged in short and loose-flowered spikes or panicles at the ends of the branches. Perianth deeply 5-lobed. Male flowers usually with 3 stamens, pistil rudimentary. Female flowers with one or two abortive stamens; ovary depressed globose; styles 2. Fruit globose, fleshy, bright red, ⅛ inch in diameter.

There can be little doubt that *R. nutans* will be found in many localities on our coast line. In habit and general appearance it so closely resembles *Chenopodium triandrum* as to give rise to the suspicion that, in some cases, it has been mistaken for that plant. In proof of this, I would remark that in the second part of the "Handbook" (p. 739) Sir J. D. Hooker quotes an observation of Dr. Hector's to the effect that the utricle of *C. triandrum* "is often fleshy." But this evidently applies to a *Rhagodia*, as all true species of *Chenopodium* have dry fruit. I am inclined to believe that a plant observed by myself several years ago at Whangarei, and more recently on the Taranga Islands, and which was on both occasions noted as *C. triandrum*, should have been referred to *Rhagodia*.

Since writing the above, my attention has been directed to a paper by Baron Müeller, printed in the Trans. N.Z. Inst., vol. v., and in which (see p. 310) *Rhagodia* is included in a list of genera, species of which were collected by Mr. H. H. Travers, in the Chatham Islands, in 1871. Unfortunately, it seems that the specimens have been mislaid, and Baron Müeller has thus been unable to inform me as to the exact species obtained. I have also learned from Mr. Kirk that quite recently specimens of *R. nutans* have been collected by his son, Mr. H. B. Kirk, in a locality in the Wellington Provincial District.

ART. XLVI.—*Additions to the New Zealand Flora.*

By T. F. CHEESEMAN, F.L.S.

[*Read before the Auckland Institute, 17th September,* 1883.]

1. *Celmisia rupestris*, n. sp.

STEMS long, copiously branched, stout and woody, procumbent or prostrate, scrambling over rocks or bank-sides; branchlets ascending at the tips, very densely clothed with closely imbricating leaves. Leaves very numerous, ½–1 inch long, very narrow linear-spathulate or linear-obovate, obtuse, gradually narrowed below and then suddenly expanded into broad membranous sheathing bases, hoary or silky above, beneath covered with soft white tomentum, suberect when young, patent or deflexed when old; margins strongly revolute. Peduncles 1½–3 inches long, solitary and axillary, usually one or two near the tips of the branchlets, densely covered with a fulvous somewhat glandular tomentum; bracts 3–4, linear or linear-oblong. Heads ¾–1 inch in diameter. Involucral scales very numerous, linear, erect, pubescent and glandular. Ray florets rather numerous, not seen fully expanded. Ripe achenia not seen.

Hab. Ravines on Mount Peel, Nelson, alt. 5,000 feet.

A curious and remarkable species, distinct from all others, although allied to *C. walkeri* and *C. ramulosa*. From the former it is distinguished by its smaller size, smaller, narrower, and more woolly leaves with revolute margins, and by the smaller flower-heads. It is at once separated from the latter by its larger size, more copiously branched habit, and by the much larger and very differently shaped leaves.

2. *Senecio pachyphyllus*, n. sp.

A small, robust, densely branched shrub, 3–5 feet high; young branches, leaves, and inflorescence extremely viscid. Leaves 1–1¾ inch long, shortly petioled, oblong or oblong-obovate, entire, obtuse, extremely thick and coriaceous, glabrous above, below covered, except the midrib, with dense white or pale buff closely appressed tomentum; margins revolute. Flower-heads rather broad, ¾ inch in diameter, few (6–20), arranged in terminal laxly branched racemes or panicles. Bracts numerous, varying from linear-spathulate to oblong. Peduncles slender, nearly glabrous, but excessively viscid. Scales of the involucre few, obtuse, rather membranous, nearly glabrous, but with a tuft of woolly hairs at the apex. Ray florets yellow, ¼ inch long, spreading. Pappus hairs white, slender, scabrid. Achenes glabrate.

Hab. Mount Arthur and Mount Peel, Nelson, not uncommon from 3,500 to 5,500 feet alt., *T.F.C.*

Allied to *S. robustus*, Buchanan, but distinguished by its very viscid and coriaceous leaves, narrow few-flowered racemes or panicles, and nearly glabrous peduncles and scales of the involucre.

3. *Potamogeton cheesemanii*, A. Bennett.

("Journal of Botany," March, 1883, p. 66.)

"Stem simple (?)" (branched, T.F.C.), "striated, internodes strongly marked by an irregular annulus. Lower leaves alternate, strap-shaped, gradually attenuated into the petiole, less so at the apex, not denticulate, 5–7 veined, connected with few cross veins, semi-translucent; upper leaves (opposite where the peduncles are given off) varying from lanceolate to oval, the uppermost coriaceous, 11–15 veined, with very numerous cross veins, and close areolation all over the leaf when held against the light. Stipules broad, subacute, very translucent and soon decaying. Peduncles rather slender, slightly thickened towards the middle; spikes dense-flowered, oblong-cylindrical, sepals (perianth leaves) transversely rhombic-orbicular. Fruit small, roundish ovate, slightly compressed, carinated on the back, with a short terminal beak. Embryo curved to one-half its base. Lower leaves $2\frac{1}{2}$–4 inches long, $\frac{1}{4}$–$\frac{3}{8}$ inch broad; lamina of the upper leaves 1–$1\frac{3}{4}$ inches long. Peduncles 2 inches long. Fruiting spikes $\frac{3}{4}$ inch long."—Bennett, *l.c.*

Hab. North and South Islands; common in streams, ponds, and lakes. Altitudinal range from sea-level to 3,000 feet.

This plant, which has long been confounded with small forms of *P. natans*, L., has been described by Mr. A. Bennett in a recent issue of the "Journal of Botany" from specimens collected by me in the vicinity of Auckland, and I reproduce his description here. It is a familiar plant to New Zealand botanists, being by far the most common of our species. The description of *P. natans* in the "Handbook" partly applies to it; and the supposed *P. heterophyllus*, Schreb.? of the same work is probably based on young plants possessing the lower submerged leaves only. The true *P. heterophyllus* has not, to my knowledge, been found in New Zealand.

4. *Carex muricata*, L.

Stems tufted, 12–18 inches high, slender, trigonous, slightly scabrid above. Leaves longer or shorter than the stems, nearly smooth, flat, grassy, striate, $\frac{1}{12}$–$\frac{1}{10}$ inch broad. Spikelets small, few (4–6), androgynous, pale brown, collected into a spike-like head $\frac{1}{2}$–$1\frac{1}{4}$ inch long, male flowers at the top of the spikelets. Bracts ovate at the base, produced into setaceous points usually longer than the spikelets, the lowest sometimes $1\frac{1}{2}$ inch long. Glumes ovate, acuminate or awned, pale chestnut or brown, with a green midrib and hyaline margins. Perigynia only seen in a very young state, then ovate with an acute base, gradually narrowed into a rather long rough and serrate 2-toothed beak. Stigmas 2. (In European specimens the mature perigynia are spreading, ovoid or elliptic-ovoid, smooth, gradually narrowed into a broad serrulate beak.)

Hab. Mount Owen, Nelson; altitude 4,000 feet.

This plant so closely resembles the European *C. muricata* in habit and inflorescence that I can have little doubt that it is a form of that species. At the same time my specimens are all immature, and consequently the identification cannot be considered quite certain. *C. muricata* has a wide range in Europe, Asia, North Africa, and North America, but has not been previously recorded from the southern hemisphere.

5. *Carex cryptocarpa*, n. sp.

Small, densely tufted, glaucous-green. Culms short, 1–3 inches high. Leaves longer than the culms, 2–6 inches, concealing the flowers and fruit, flat, coriaceous, deeply-grooved, margins scabrid, tips incurved when dry. Bracts long, leafy. Spikelets 3–5, very closely approximate, ovoid or oblong, terminal one male, remainder all female, all sessile except the lowest, which is shortly pedunculate and sheathed. Glumes very broadly ovate or rounded, often as broad as long, reddish-brown or chestnut, acute, entire, margins thin and membranous, central portion 3-nerved, produced into an awn of variable length. Perigynia rather larger than the glumes, broadly ovoid or elliptic, unequally biconvex, swollen on the back, nerved; margins thick, serrate above; beak short, stout, 2-toothed. Stigmas 3. Nut trigonous.

Hab. Lake Tekapo, Canterbury; altitude 2,500 feet.

This is closely allied to *C. cirrhosa*, Berggren, but appears to differ sufficiently in its larger size and stouter habit, broader glumes, larger and more turgid perigynia with a shorter beak and serrate margins, and in having 3 stigmas. The nut is trigonous while it is lenticular in all the fruiting specimens of *C. cirrhosa* that I have examined. Old tussocks often present a very peculiar appearance. The centre dies out, leaving a hollow ring which grows on vigorously and often attains a considerable size.

6. *Carex uncifolia*, n. sp.

Small, tufted, usually of a dingy red colour. Stems very short, 1–2 inches high, rarely more, smooth, erect or spreading. Leaves two or three times longer than the culms, narrow, $\frac{1}{30}$–$\frac{1}{40}$ inch broad, convex on the back, concave in front, rarely plano-convex or quite flat, hooked or twisted at the apex when dry. Bracts long and leafy. Spikelets 2 or 3, rarely 4, very small, seldom more than $\frac{1}{4}$ inch long and often much less, from the shortness of the culms packed away at the base of the leaves and concealed by them, close together, sessile, terminal one male, slender, erect, remainder all female, spreading. Glumes reddish-brown with a green centre; those of the male spikelet the largest, lanceolate, acute or obtuse; those of the female much shorter and broader, ovate, obtuse, acute or shortly cuspidate, entire at the tip. Perigynia rather larger than the glumes, dark red-purple, elliptic-oblong, trigonous or almost fusiform, smooth and even, acute at the base, narrowed upwards into a short 2-toothed beak, margins not serrate. Stigmas 3.

Hab. Mountains flanking the Wairau Valley, Nelson; alt. 3,000–4,000 feet.

The habit of this species is that of small and fine leaved specimens of *C. breviculmis*, from which, however, it differs widely in other respects. From the preceding species, and from *C. cirrhosa*, it differs in the much more slender culms and leaves, smaller spikelets, and in the perigynia being trigonous and almost fusiform; or, to take a familiar example, very near to those of *C. lucida* in shape.

7. *Carex petriei*, n. sp.

Culms slender or rather stout, tufted, leafy, 6–18 inches high, quite smooth, usually of a reddish colour. Leaves generally longer than the culms, with broad sheathing bases, blade usually narrow, but variable in width, $\frac{1}{30}$–$\frac{1}{10}$ inch, plano-convex or nearly flat, in stout specimens strict and coriaceous, in slender ones more flaccid, narrowed into slender points that are usually curled and twisted when dry; margins slightly scabrid. Bracts long, upper setaceous. Spikelets 3–5, oblong, $\frac{1}{3}$–$\frac{2}{3}$ inch long, all pedunculate and sheathed, the upper ones on very short stalks, the lower ones on longer filiform ones; terminal one male, remainder all female, moderately close together, or rarely the lower one remote. Glumes ovate, thin and membranous, pale, often nearly white, midrib produced into a moderately long hispid awn; margins often lacerate. Perigynia longer than the glumes, elliptic-oblong or ovoid, turgid, biconvex, smooth and nerveless, shining, dark purplish-brown or nearly black, beak short, 2-toothed. Stigmas 3.

Hab. Mountains of Canterbury, apparently not uncommon between 2,500 and 4,500 feet: *T.F.C.* Dunstan Mountains, Lake Wanaka, and near Naseby, Otago: *D. Petrie.*

Apparently a very distinct species, which, when once recognized, can hardly be confounded with any other. The leaves are remarkable for their fine curled and twisted points, and very broad sheathing bases. The spikelets have a somewhat curious appearance from the combination of pale coloured glumes with dark, almost black, perigynia. The species is named after Mr. D. Petrie, of Dunedin, who has collected it in several localities in Otago, and to whom I am indebted for many specimens and much valuable information respecting the *Carices* of the district.

ART. XLVII.—*A Revision of the New Zealand Species of* Carex.

By T. F. CHEESEMAN, F.L.S., Curator of the Auckland Museum.

[*Read before the Auckland Institute, 12th November,* 1883.]

THE genus *Carex*, the largest among *Cyperaceæ*, and indeed of the *Glumiferæ* generally, is well represented in New Zealand, as in most temperate and mountainous countries. In New Zealand, too, the species possess that tendency to variability which has made their elucidation so difficult and perplexing to the student of northern floras, and which, through the diverse views entertained by authors as to the amount of difference required for specific distinction, has led to the needless multiplication of names, and much confusion as to the limits and range of the species. Here, fortunately, the creation of species out of mere varieties has not been so regularly and consistently carried out; although, as New Zealand naturalists are no more likely than their European brethren to agree on the *quæstio vexata* of what constitutes a species, a very similar result may be anticipated. Notwithstanding this, the study of the genus in New Zealand has been beset with serious difficulties, few of which have yet been removed. In some cases the species have been described from insufficient material, the descriptions being consequently incomplete and inexact; in others the specimens were from one or two localities only, and, although numerous, did not always represent the predominant form of the species. Mistakes in the identifications have thus occurred, apart from the difficulty that is commonly experienced in recognizing, from descriptions alone, species of so variable a genus as *Carex*. But it is hardly necessary to pursue this part of the subject further—all qualified persons are aware that considerable confusion exists, and that the species are in urgent need of revision. The want of confidence in their own conclusions, openly expressed by those who have specially attended to the genus, may be taken as a fair proof of this statement.

Under these circumstances, I have ventured to prepare the following re-arrangement of our species. Of its imperfections and deficiences, no one can be more sensible than myself,—many of them are inseparable from the pursuit of systematic botany in a country where there are no large public herbaria and few scientific libraries; and, as to the rest, I trust that they are not more numerous than what might be expected to attach to the first attempt made in the colony to revise the species of a difficult genus like *Carex*. Such as it is, I can state that it is based upon the actual study in the field of most of the species; in addition to the conscientious examination of many hundreds of dried specimens from all parts of the islands, and a comparison of these with allied plants from other parts of the world.

For the original discovery of *Carex* in New Zealand, we are indebted to the labours of Banks and Solander, during Cook's first voyage. Eleven species are included in their collections, now preserved in the British Museum. Most of these were named and fully described in manuscript by Dr. Solander, but were never actually published. Several of the same species were gathered by Forster, in Cook's second voyage; by D'Urville and Lesson, in the two French exploring expeditions that visited New Zealand in 1822 and 1827; and during the several visits of Allan and Richard Cunningham, from 1826 to 1838; but no fresh forms appear to have been discovered. From time to time descriptions of these were published by European botanists, who were not always cognizant of each other's work, so that in some cases the same plant received several names. About 1836 Mr. Colenso commenced his well-known botanical explorations. His collections were forwarded periodically to Kew, and seem to have included specimens of all Banks' and Solander's species, as well as eight additional ones, mostly from the previously unexplored central districts of the North Island. Some of his discoveries were collected, a little later, by Dr. Sinclair, M. Raoul, and others, with one or two fresh ones. In 1853 Sir Joseph Hooker published the first volume of his "Flora Novæ Zealandiæ." This contains an excellent synopsis, from the pen of the late Dr. Boott, of the 22 species then known to inhabit New Zealand. Twelve or thirteen of these were published for the first time, some four or five under the manuscript names previously applied by Dr. Solander. During the ten years following the publication of the "Flora" little attention was paid to the *Carices*, so that Sir Joseph Hooker records only three additional species in the "Handbook of the New Zealand Flora," issued in 1864. His arrangement is mainly that of Dr. Boott, but few changes being made. *C. secta* was merged with *C. virgata*; *C. solandri* was considered to be identical with the Norfolk Island *C. neesiana*; and *C. fascicularis* and *C. forsteri* were united. This is the last attempt to give a collected arrangement of the whole of the New Zealand species.

But although no systematic sketch of the genus has appeared since the publication of the "Handbook," numerous additions have been made to the list of species. Dr. Berggren, who specially attended to the genus during his travels in New Zealand, has described and figured five new ones in the "Minneskrift" of the University of Lund for 1878. His descriptions have been lately reproduced in the "New Zealand Journal of Science," but it is a matter for regret that the excellent plates are not generally accessible in the colony. The Otago species have been most carefully and assiduously collected by Mr. Petrie, who has described the new ones, eight in number, in various communications to the New Zealand Institute. His *C. goyeni* is clearly referable to Boott's *C. raoulii*, a species which has been much misunderstood. The remaining seven appear to be perfectly distinct. Lastly, in volumes xiv. to xvi. of the Transactions, I have given notices of seven additions. Further examination has led me to doubt the distinctness of one of them, *C. cinnamomea*, but I think that the rest will be generally admitted.

To those who have not previously studied the genus, the following résumé of its general characters will be of some service. Of course it will be understood that the remarks made refer to the New Zealand species only.

Size, etc.—In size the species vary from little more than an inch or two in height, as in small varieties of *C. acicularis*, *C. inversa*, *C. cirrhosa*, and *C. uncifolia*, to four or even five feet, as in large forms of *C. paniculata*, *C. ternaria*, and *C. trifida*. In habit most of the species form compact, close-growing tufts, very similar to those of many other Cyperaceous plants, but usually more grassy. A few have a looser and more open habit of growth.

Rhizome.—All the species are furnished with a rhizome or creeping stem, clothed with rudimentary scale-like leaves, and on its lower side giving origin to the roots, while from its upper surface it throws up the culms or leafy branches. In *C. pumila* it is long and wide-creeping, and in consequence the culms are often far distant from one another. Some tendency to this is also shown by *C. inversa*, and in a lesser degree by *C. colensoi*; but in the other species, as a rule, the rhizome is short, though often stout and repeatedly branched. In the varieties of *C. paniculata*, the rhizomes are often matted together, growing under and over one another, and forming, with the roots and the lower portions of the old culms, huge tussocks resembling the stems of tree-ferns, and sometimes three to four feet high, and one to two feet in diameter. Similar but much smaller tussocks are sometimes produced by *C. subdola* and other species.

Culms.—These ascend vertically upwards from the rhizome, and except in the above-mentioned case of *C. pumila* are usually placed in close juxtaposition, forming tufts more or less dense. They are unbranched in all the New Zealand species. In section they are commonly trigonous or triquetrous; but in a few species are round, as in *C. acicularis*, or oval, as in *C. viridis*. They are usually grooved or striated, and the edges are very frequently scabrid with small harsh projections, but may be quite smooth and even.

Leaves.—At the very base of the culms we frequently find a number of small scale-like leaves, very similar to those clothing the rhizome, and generally of a dark colour. These pass abruptly or gradually into the foliage leaves, of which there are two main types. First, that in which the leaf is plano-convex. This division includes *C. acicularis*, (which has a nearly terete leaf) *C. viridis*, *C. buchanani*, *C. pulchella*, *C. petriei*, *C. comans*, *C. cheesemanii*, and *C. littoralis*. Second, that in which the opposite surfaces are about parallel to one another. In this class the leaf may be quite plane, as in *C. pyrenaica*, *C. leporina*, *C. raoulii*, etc.; involute, as in *C. colensoi*, *C. echinata*, etc.; or keeled, as in *C. lucida*, *C. dipsacea*, etc. The leaves are usually grooved or striate; sometimes with a strong vein on either side of the midrib,—*e.g.*, *C. ternaria*. *C. forsteri*, etc.; and the margins and veins are commonly furnished with minute sharp projections, which all point towards the base of the leaf, so that the skin is frequently cut or scratched if it be drawn sharply through the fingers. In breadth the leaves vary from nearly or quite filiform to one-half or three-quarters of an inch.

Inflorescence.—The flowers, which are invariably unisexual, are arranged in spikelets of various forms and size, according to the species. The spikelets may be either solitary, as in *C. pyrenaica* and *C. acicularis*; or few in number, varying from 3 to 6, 8, or 10, as in the great majority of the species; or very numerous and arranged in a compound panicle, as in the varieties of *C. paniculata*, and to a lesser degree, in *C. kaloides*. The individual spikelets may be either few or many flowered; erect, spreading, or pendulous; sessile or stalked; close together or more or less distant; and such characters are often useful in the discrimination of the species. As regards the character of the flowers composing them, the spikelets may be androgynous, with the male and female flowers intermixed in the *same* spikelet, or unisexual, in which case they are placed in *different* spikelets. This is an important distinction, and has been made use of to divide the genus into two main groups. It is not, however, altogether absolute, as in the androgynous series spikelets composed wholly of female or male flowers can often be found, and one of the New Zealand species, *C. viridis*, is even occasionally diœcious. Similarly, in the unisexual group the female spikelets generally have a few male flowers at the base or apex. The male spikelets are far more rarely mixed, but *C. raoulii* invariably has them partly female, and occasionally this is the case in *C. dipsacea* and *C. forsteri*.

Flowers.—Each spikelet is composed of an indefinite number of floral bracts or glumes, in the axils of which the flowers are situated. The glumes vary in shape, according to the species, from rounded to lanceolate or linear: they usually have a stout midrib, frequently produced into an awn of variable length; and thin and membranous, often lacerate margins. Those of the male spikelets generally differ slightly in shape from the female; and those from the lower part of a spikelet seldom exactly match those from the upper portion.

The male flowers are of very simple structure, consisting of three stamens, without any signs of hypogynous bristles, scales, or other rudiments of a perianth. They are very uniform in all the species, and call for few remarks here.

The female flowers are composed of a single-celled, one-ovuled ovary, crowned by a short style terminated by two or three long and slender stigmatic branches. The ovary and lower portion of the style are enclosed in a peculiar bottle or flask-shaped organ called the perigynium, swollen in its lower part, but gradually contracted towards the top into a narrow oblique or bidentate mouth, closely surrounding the style. It varies exceedingly in shape and other characteristics, but is tolerably constant in each species, and has thus been largely used for specific circumscription. Inside the perigynium, and between it and the ovary, there often exists a minute bristle-like body called the *seta*, or *rachilla*, and usually considered to be a barren pedicel. In the allied genus *Uncinia* this bristle is invariably present, is much longer, hooked at the tip, and produced beyond the mouth of the perigynium.

The perigynium is a structure unknown except in *Carex* and its immediate allies, and much discussion has arisen as to its nature and probable origin. Three principal views have been advocated. First, that it represents a perianth. Second, that it is to be regarded as of staminal origin. Third, that it is composed of one or perhaps two modified bracts. The first hypothesis was for long widely accepted, but recent researches have brought to light an almost overwhelming amount of evidence in favour of the last—or that the perigynium is morphologically to be regarded as an altered bract, and the rachilla a rudimentary axis. For a full exposition of the evidence in favour of this, reference should be made to two papers by Dr. McNab and Professor Thistleton Dyer, printed in the Journal of the Linnean Society (Botany, vol. 14, pp. 152–154).

It follows from the above view of the structure of the female flowers that each perigynium must be looked upon as constituting a one-flowered spikelet. In the inflorescence of *C. lucida*, for instance, the terminal spike of male flowers would be regarded as a single many-flowered spikelet; the lower spikes of female flowers as each consisting of numerous one-flowered spikelets. Similarly, an androgynous spikelet, like that of *C. pyrenaica*, must be regarded as being composed of a single several-flowered male spikelet, and numerous one-flowered female spikelets.

Fruit.—This is a minute trigonous or lenticular achenium or nut, enclosed in the persistent and hardened perigynium. Its characters are very uniform throughout the species, and are seldom of value for systematic purposes.

Geographical Distribution.—Under the remarks on each species I have briefly indicated the geographical range, so far as it is known to me; but it will be well to give a summary here. Of the 40 species admitted, 25, or almost exactly three-fifths, are peculiar to the country. Of the 15 that are found elsewhere, 11 are recorded from Australia and Tasmania. Nine of the species are found in Europe, all of which, curiously enough, also inhabit North and West Asia, and North America. Seven are natives of Southern or Eastern Asia; six of temperate North and South Africa; while four or five have been recorded from extra-tropical South America. The annexed table will show the distribution of each species at a glance. It is remarkable that most of the species with androgynous spikelets are found out of New Zealand, while in the section with unisexual spikelets nearly all are endemic.

The distribution of the species within the colony is given as fully as possible, although there is much room for improvement. On the West Coast of the South Island they have hardly been collected at all, and almost nothing is known of those inhabiting the elevated central districts of the North Island. I have, therefore, not attempted to draw up any general conclusions on this point, feeling sure that such would require considerable modification within a short time.

Before passing to the strictly systematic portion of this paper, I have to express my obligations to many kind friends and correspondents for assistance in preparing it. My thanks are specially due to Mr. D. Petrie of Dunedin, who has liberally supplied me with full suites of specimens of the Otago species, accompanied by many valuable notes. I am also indebted for specimens and information to Mr. G. M. Thomson, Mr. H. Tryon, Mr. T. Kirk, Mr. J. Buchanan, and others. My most grateful thanks are due to Sir J. D. Hooker for his unwearied kindness in comparing my specimens with those in the Kew herbarium. Sir F. Müeller has liberally forwarded a complete series of the Australian species, which has been of much service to me. For specimens of the European forms I am indebted to Mr. A. W. Bennett of Croydon, Dr. J. Müller of Geneva, and Dr. Levier of Florence, while I have to thank Mr. Canby and Mr. Martindale for many of the American species.

In conclusion, it is my wish that this paper may be looked upon simply as an attempt to revise and re-arrange the New Zealand species of *Carex*, based upon the additional information that has been obtained since the publication of Sir J. D. Hooker's "Handbook." The preparation of a more detailed monograph of the species would have been premature, until the country has been more completely explored, and the species more generally and exhaustively studied.

Geographical Distribution of the New Zealand Species of *Carex*.

—	Endemic.	Australia and Tasmania	Europe.	North and West Asia.	South and East Asia.	North and South Africa, Canary Islands, etc.	North America.	South America.
C. pyrenaica	..	×	×	×	..	..	×	
C. acicularis	..	×						
C. inversa	..	×						
C. colensoi	×							
C. parkeri	×							
C. leporina	..	..	×	×	..	..	×	×?
C. echinata	..	×	×	×	..	×	×	
C. muricata	..	..	×	×	×	×	×	
C. teretiuscula	..	..	×	×	×	×	×	
C. paniculata	..	×	×	×	..	×	×	
C. viridis	×							
C. kaloides	×							
C. vulgaris	..	×	×	×	×	..	×	×
C. subdola	×							
C. ternaria	×							
C. buchanani	×							
C. lucida	×							
C. dipsacea	×							
C. raoulii	×							
C. devia	×							
C. testacea	×							
C. wakatipu	×							
C. cirrhosa	×							
C. cryptocarpa	×							
C. uncifolia	×							
C. pulchella	×							
C. petriei	×							
C. comans	×							
C. cheesemanii	×							
C. littoralis	×							
C. dissita	×							
C. neesiana	..	×						
C. longiculmis	×							
C. trifida	..	..	..	..	..	..	..	×
C. breviculmis	..	×	..	..	×			
C. pumila	..	×	..	..	×	..	..	×
C. flava	..	×	×	×	×	×	×	
C. vaccilans	×							
C. forsteri	×							
C. pseudo-cyperus		×	×	×	×	×	×	×

Synopsis of the Species.

Section I.—Spikelet solitary, simple, terminal. (Sp. 1–2.)

Leaves grassy, flat, flexuous; spikelet oblong; bract short or 0 .. .. 1. *C. pyrenaica*

Leaves terete, strict, grooved; spikelet ovoid; bract usually long .. .. 2. *C. acicularis.*

Section II.—Spikelets several or many, androgynous or rarely diœcious, sessile, forming a compact or more or less interrupted sometimes paniculate-compound or decompound inflorescence. Stigmas 2. (Sp. 3–12.)

A. Spikelets all androgynous; female flowers above, male below.

Leaves usually flat; spikelets approximate, green or pale perigynia ovate, beaked, serrate .. .. 3. *C. inversa.*

Leaves involute, wiry; spikelets approximate, brown; perigynia broadly ovate, not beaked, serrate .. .. .. 4. *C. colensoi.*

Leaves flat, grassy; spikelets approximate, purplish-brown; perigynia ovate, compressed, entire .. .. .. 5. *C. parkeri.*

Leaves flat; spikelets approximate, pale brown; perigynia narrow-ovoid, margined, beak long, serrulate .. .. 6. *C. leporina.*

Leaves narrow, keeled; spikelets spreading, close together or distant; perigynia squarrose, ovate-lanceolate, corky at the base, nerved, beak long .. .. 7. *C. echinata.*

B. Spikelets all androgynous; male flowers above, female below.

Tufted, slender; spikelets in a linear or oblong head ½ to 1½ inch long; perigynia pale, spreading, hardly nerved .. 8. *C. muricata.*

Hardly tufted, slender; spikelets in an ovoid head ½ to 1 inch long; perigynia dark brown, polished, nerved below 9. *C. teretiuscula.*

Tufted, often very tall and stout; spikelets many, in a narrow or loose panicle 6 to 18 inches long; perigynia ovoid, turgid, nerved or nearly smooth .. .. .. 10. *C. paniculata.*

C. Spikelets some androgynous, others wholly pistillate or wholly staminate, or inflorescence altogether diœcious. Perigynia narrow lanceolate, very long beaked.

Diœcious, or with few females in the male inflorescence, and few males in the female; leaves semi-terete, strict; spikelets in a linear head 1 inch long .. .. .. 11. *C. viridis.*

Most of the spikelets wholly pistillate, the staminate flowers few, and irregularly placed; leaves keeled; spikelets in an open panicle 4 to 9 inches long .. .. .. 12. *C. kaloides.*

Section III.—Spikelets separate, usually stalked, unisexual; the male spikelets constantly uppermost, rarely mixed with female flowers; the lower spikelets all female or with a few male flowers at the base or apex. (Sp. 13–40.)

A. Stigmas 2. Female spikelets often wholly unisexual, the male flowers, when present, usually at the top of the spikelet, rarely below.

From 6 to 18 inches high; spikelets 3 to 6, short, erect; glumes obtuse .. .. 13. *C. vulgaris.*

Tall, grassy, slender, 1 to 3 feet high; spikelets 4 to 8, long; glumes mucronate .. .. 14. *C. subdola.*

Tall, stout or slender, 1 to 4 feet high; leaves often ½ inch broad; spikelets numerous, 8 to 25, long stalked and pendulous; glumes awned .. .. 15. *C. ternaria.*

B. Stigmas 2. Female spikelets often wholly unisexual; the male flowers, when present, usually at the base of the spikelets, rarely at the top.

* Spikelets usually more or less distant, or the upper ones alone approximate (often all approximate in 19. *C. raoulii*).

Leaves semi-terete, usually red; glumes pale, almost white; perigynia plano-convex, smooth, margins serrate .. 16. *C. buchanani.*

Leaves narrow, flat, keeled; spikelets slender, loose-flowered; glumes acute, cuspidate or awned; perigynia turgid, smooth, polished, margins entire .. .. 17. *C. lucida.*

Leaves narrow, flat, keeled; spikelets stout, close-flowered; terminal one sometimes partly female; glumes rounded, obtuse; perigynia divaricating, unequally biconvex, smooth, with serrate margins .. .. 18. *C. dipsacea.*

Leaves broad, flat, not keeled; terminal spikelet almost invariably partly female; glumes bifid, awned; perigynia strongly nerved, with serrate margins .. .. .. 19. *C. raoulii.*

Leaves short, flat, keeled, coriaceous; male spikelet stout; perigynia dark coloured, almost black, biconvex, nerved and wrinkled, margins entire .. .. 20. *C. devia.*

** Spikelets usually approximate (sometimes distant in 21. *C. testacea*)

Culms slender, filiform, 1 to 2 feet, often much elongated in fruit; perigynia plano-convex .. .. 21. *C. testacea.*

Culms rather stout, 4 to 12 inches high, shorter than the leaves; perigynia unequally biconvex .. .. .. 22. *C. wakatipu.*

Culms very short, stout, 1 to 4 inches; spikelets concealed by the leaves; perigynia plano-convex, slightly nerved. Leaves often spirally twisted at the apex when dry .. 23. *C. cirrhosa.*

C. Stigmas 3. Female spikelets either wholly unisexual, or with a few male flowers at the base or apex of the spikelet.

* Perigynia quite glabrous, hardly spreading when ripe, beak short, stout.

† Small, 2 to 6 inches high. Culms extremely short, so that the spikelets are hidden among the leaves.

Short, stout, densely tufted; leaves flat, grooved; glumes broad-ovate or rounded; perigynia broadly ovate, turgid, unequally biconvex, serrate above.. .. .. .. 24. *C. cryptocarpa.*

Small, slender; culms tufted but spreading; leaves narrow, concave; glumes narrow-ovate; perigynia elliptic-oblong, trigonous or fusiform .. .. 25. *C. uncifolia.*

†† Slender, 6–18 inches high; leaves narrow, $\frac{1}{15}$–$\frac{1}{40}$ inch, usually plano-convex; male spikelets solitary.

Culms slender, flaccid; leaves longer than the culms, filiform, keeled; spikelets all sheathed, lowest one basal; perigynia trigonous .. .. 26. *C. pulchella.*

Stouter, leaves with broad sheathing bases and fine often curled and twisted points; spikelets all sheathed and stalked; glumes pale; perigynia dark, smooth and turgid 27. *C. petriei.*

Culms filiform, shorter than the leaves; spikelets short, sessile or the lowest shortly pedunculate, perigynia lanceolate, plano-convex, margins serrate .. .. .. 28. *C. comans.*

Culms filiform, usually longer than the leaves; spikelets slender, lower on long filiform peduncles; glumes and perigynia as in *C. comans*, but broader .. .. .. 29. *C. cheesemanii.*

Pale-green; culms slender; spikelets short and broad, often close together; perigynia ovoid, turgid, biconvex or nearly trigonous, smooth, not serrate .. .. .. 30. *C. littoralis.*

††† Tall, stout or slender, from 1½ to 3 feet or more. Leaves broad, ⅛ to ½ inch, flat or keeled, grassy. Male spikelets usually more than one (except in *C. dissita*).

Stout or slender, 1 to 2 feet high; spikelets 4 to 8, long or short, ½ to 2 inches long by ⅛ inch broad, male spikelets usually solitary .. .. 31. *C. dissita.*

Tall and slender, 2 to 3 feet high; culms often elongating in fruit; spikelets 5 to 10, terminal 2 to 4 male, female slender, usually on long filiform peduncles, lower compound .. .. 32. *C. neesiana.*

Stout, 2 to 3 feet high; spikelets 5 to 6, two terminal male, female very stout and broad, over ⅓ inch diameter; glumes and perigynia broadly ovate .. .. .. 33. *C. longiculmis.*

Very large and stout, culms often 4 feet high and leaves ½ inch broad. Spikelets 6 to 12, 2 to 4 inches long, very stout, upper 2 to 4 male; glumes narrow; perigynia obovate-oblong, stipitate .. .. 34. *C. trifida.*

** Perigynia pubescent, not spreading when ripe, beak short.

Small, 2 to 9 inches high, culms much shorter than the leaves .. .. 35. *C. breviculmis.*

*** Perigynia glabrous, spreading after flowering, large, smooth and turgid.

Rhizome long, stout, creeping in sand, etc.; leaves glaucous, longer than the culms .. .. 36. *C. pumila.*

**** Perigynia glabrous, strongly costate-nerved, narrowed into a long and slender sharply 2-toothed beak, spreading when ripe (except in *C. vaccilans*).

Pale yellowish-green, tufted, 4 to 9 inches high; leaves flat; spikelets 3 to 6, crowded; perigynia ovoid, suddenly narrowed into the beak, strongly nerved.. .. .. 37. *C. flava.*

Culms 1 to 2 feet high; leaves flat, harsh; spikelets 5 to 9, distant, 1 to 2½ inches long, very slender, hardly ⅛ inch in diameter; perigynia fusiform, hardly spreading when ripe .. .. 38. *C. vaccilans.*

Culms 1½ to 4 feet; leaves flat, harsh; spikelets 5 to 9, stout, distant, terminal one often mixed with female flowers; perigynia small, shortly fusiform, spreading .. .. 39. *C. forsteri.*

Culms 2 to 4 feet; leaves flat, soft, green and grassy; spikelets 3 to 5, pedunculate, nodding, close together, or the lower alone distant; perigynia large, very narrow, fusiform or triquetrous.. .. .. 40. *C. pseudo-cyperus.*

SECTION I. Spikelet solitary, simple, terminal.

1. **C. pyrenaica,** *Wahl. in Act. Holm.*, 139; *Boott, Ill. Car.*, iv., 148, t. 475, 476; *Hook. fil. Fl. Nov. Zeal.*, i., 280; *Handbook N.Z. Fl.*, 312.

North Island.—Tops of the Ruahine Mountains, *Colenso* (*fide* "Handbook.")

South Island.—Summit of Mount Arthur, Nelson, alt. 5,000–6,000 feet; Raglan Range and mountains flanking the Wairau Valley, 5,000–6,000 feet; mountains above Arthur's Pass, Canterbury, alt. 3,500–6,000 feet; Mount Dobson, near Lake Tekapo, 5,000–6,000 feet, *T.F.C.* Mount Aspiring, Otago, alt. 5,000 feet, *D. Petrie*!

Usually from 3 to 9 inches high, but taller specimens are sometimes seen. The leaves are described by Hooker as "longer than the culms," but this is only the case in the flowering stage, the culms elongating considerably as the fruit ripens. All my New Zealand specimens have the style nearly constantly 2-branched, in this respect differing from numerous European and American specimens that I have examined, and in which the style is nearly uniformly 3-branched. They thus approach the Australian *C. cephalotes*, F.v.M., which, judging from examples kindly forwarded by Sir Ferdinand Mueller, can only be separated from our plant by the broader and flatter, hardly stipitate perigynia, and might well be regarded as a variety only.

C. pyrenaica has an extensive range out of New Zealand. It is found on the high lands of Northern and Central Europe, Northern Asia, and in America along the line of the Rocky Mountains from Alaska to Utah and Colorado.

2. **C. acicularis,** *Boott, in Hook. fil. Fl. Nov. Zeal.*, i., 280, t. 63; *Ill. Car.*, iv., 157, t. 508, f. 2; *Hook. fil. Handbk. N.Z. Flora*, 312; *Benth. Fl. Austral.*, vii., 437. C. archeri, *Boott, in Hook. fil. Fl. Tasm.*, ii., 98, t. 150; *Ill. Car.*, iv., 156, t. 508, f. 3. C. pyrenaica, *F. Muell. Fragm.*, viii., 251, *not of Wahl.*

North Island.—Tops of the Ruahine Mountains, *Colenso* (Handbook).

South Island.—Not uncommon in the mountains of Nelson and Canterbury, alt. 2000–5000 feet. Otago, mountains above Lake Harris, *T. Kirk.* Also in Tasmania and Victoria.

A well-marked species, easily distinguished from the preceding by the strict and nearly terete leaves, shorter spikelets, and erect subulate bract. It varies greatly in size, and in the number of flowers in the spikelets, but its other characters appear to be fairly constant.

SECTION II. Spikelets several or many, androgynous or rarely diœcious, sessile, forming a compact or more or less interrupted sometimes paniculate or decompound inflorescence. Stigmas 2.

3. **C. inversa,** *R. Br. Prodr.*, 242; *Boott, Ill. Car.*, iv., 151, t. 486–488: *Hook. fil., Fl. Nov. Zeal.*, i., 281; *Fl. Tasm.*, ii., 99; *Handbk. N.Z. Flora*, 312; *Benth. Fl. Austral.*, vii., 438; *F. Muell. Fragm.*, vii., 252.

North Island.—Near Auckland, *T. Kirk, T.F.C.*; Thames Valley, Upper Waikato and Waipa, *T.F.C.*; Hawke's Bay and Ruahine Range, *Colenso* (Handbook); Waimarama, Hawke's Bay, *H. Tryon*! Wellington, rare, *T. Kirk.*

South Island.—Wangapeka Valley, Buller Valley, and other localities in Nelson Province, *T.F.C.*; Canterbury, *Armstrong* (Trans. N.Z. Inst. xii., 344); Otago, Lake Wanaka, Outram, and Strath Taieri, *D. Petrie*! Deep Stream, *G. M. Thomson*! Dart Valley, *T. Kirk.* Altitudinal range from sea-level to over 3,000 feet.

Var. *radicata.*—Smaller, 2–4 inches high. Culms short or almost wanting, so that the spikelets are nearly radical, and much overtopped by the leaves; leaves wiry, involute, filiform; perigynia prominently nerved, narrowed into a long tapering serrate beak. Lakes Tekapo and Pukaki, Canterbury, altitude 2,500 feet, *T.F.C.*

The species, which is also common in many parts of Australia and Tasmania, can be easily distinguished from the following by its grassy habit, pale-coloured spikelets, and beaked perigynia. It varies greatly in height—some of my Nelson specimens are over eighteen inches, and Mr. Kirk informs me that he has gathered equally luxuriant ones in the Wellington District. On the other hand, specimens from the Upper Waikato are much depauperated.

The variety to which I have applied the name *radicata* is a very distinct looking plant, but as at present it is only known from one district I hesitate to describe it as a new species. It differs markedly from the type in the very short culms, involute filiform leaves, and longer beak to the perigynia; but the Australian variety *major* has perigynia very similar in shape, and the length of the culms is a variable character in most of the species. Possibly some of its characters may be due to the dry and arid climate of the district in which it was collected.

4. **C. colensoi,** *Boott, in Hook. fil. Flora Nov. Zeal.*, i. 281, t. 63, b.; *Handbook N.Z. Flora*, 312.

North Island.—Probably not uncommon on the dry grassy plains in the interior. Upper Thames and Patetere, *T.F.C.*; Patangata, Hawke's Bay, *W. Colenso* (Handbook); Ruataniwha Plains and Taupo, *H. Tryon.*

South Island.—Common throughout in hilly and grassy districts, ascending to 4,500 feet. *Sinclair and Haast* (Handbook); *Travers* (Handbook); *Buchanan*! *Armstrong*! *D. Petrie*! *G. M. Thomson*! *T.F.C.*

A distinct and well-marked species, apparently confined to New Zealand.

5. **C. parkeri,** *Petrie, Trans. N.Z. Inst.*, xiii., 332.

South Island.—Otago, on a hill near Mount Aspiring, alt. 5,000 feet, *D. Petrie! G. M. Thomson!*

I exceedingly regret that I only possess two immature specimens of this curious little plant, and am therefore unable to add anything to Mr. Petrie's description. It is clearly distinct from all the New Zealand species, but appears to be in some measure allied to the northern *C. lagopina*, Wahl., so far as the state of my specimens admits of a comparison being made.

6. **C. leporina,** *L. Species Plant.*; *Cheeseman, Trans. N.Z. Inst.*, xiv., 301; *Kirk, l.c.*, 384. C. ovalis, *Good., Trans. Linn. Socy.*, ii., 148.

North Island.—Ohariu Valley, near Wellington, *T. Kirk!*

South Island.—Lower Motueka, Ngatimoti, Rosedale, Graham River, and other localities in the Nelson Provincial District: *T.F.C.*

New Zealand specimens present no points of difference from the English plant, which is also found in Northern and Central Europe, Greenland, Siberia and Western Asia, and in America along the line of the Rocky Mountains. A reported locality in the Falkland Islands needs confirmation (Flora Antarctica, 2, p. 362). It may be easily recognized by its flat leaves, slender culms, compact pale brown heads of spikelets, and by the narrow wing which surrounds the perigynia.

7. **C. echinata,** *Murray, Prodr. des stirp. Gott.*, 76; *F. Muell. Fragm.*, viii., 252; *Benth. Fl. Austral.*, vii., 439. C. stellulata, *Good., Trans. Linn. Socy.*, ii., 144; *Hook. fil. Flora Nov. Zeal.*, i., 281; *Handbk. N.Z. Flora*, 312.

North Island.—Probably not uncommon in the elevated districts of the central and southern portions of the island. Swamps in the Upper Thames Valley (a large stout form), *T.F.C.*; Bogs near Lake Taupo, *Colenso* (Handbook).

South Island.—Common in marshy places in the mountain districts of Nelson and Canterbury, alt. 1,000–4,000 feet. Stewart Island, from sea-level, *D. Petrie! G. M. Thomson! T. Kirk.* I have seen no Otago specimens.

Easily separated from all its New Zealand allies by the squarrose perigynia. Very variable in size, robustness, number and position of the spikelets, etc. The ordinary form closely resembles the common state in Europe; but I have a large coarse variety from the Thames Valley with stems nearly two feet high, and numerous distant spikelets. A tall slender variety with distant spikelets has also been gathered in Stewart Island by Messrs. Petrie and Thomson. *C. echinata* is also found in Northern and Central Europe, North Africa, North and West Asia to the Himalaya Mountains, and in North America.

8. **C. muricata,** *L. Species Plant.*; *Cheeseman, Trans. N.Z. Inst.*, xvi., p. 411.

South Island.—Mount Owen, Nelson; alt. 4,000 feet, *T.F.C.*

Elsewhere I have stated that the identification of the New Zealand plant with the northern *C. muricata*, L., must not be taken as finally settled until mature fruiting specimens are obtained. So far as habit, foliage and inflorescence are concerned, there is little apparent difference; but the young perigynia hardly match those of a similar age in English and Swiss specimens. *C. muricata* is common in many parts of Europe, and is also found in North Africa, North and Central Asia to the Himalaya Mountains, and in North America. It has not been previously recorded from the southern hemisphere.

9. **C. teretiuscula,** *Good., Linn. Trans.*, ii., 150; *Hook. fil. Fl. Nov. Zeal.*, i., 281; *Handbk. N.Z. Flora*, 313.

North Island.—Tangoia, Hawke's Bay, *Colenso* (Handbook); Ruataniwha Plains, *H. Tryon*!

South Island.—Not uncommon in marshy places in the mountain districts. Motueka Valley, Wairau Valley, Upper Waimakariri, Lake Tekapo, etc., *T.F.C.*; Lake Ohau, *Haast* (Handbook); Lake Wakatipu, Valley of the Dart, *T. Kirk*; Strath Taieri, Port Molyneux, *D. Petrie*! Altitudinal range from sea-level to over 3,000 feet.

By many authors this species is united with *C. paniculata*, some northern forms of which approach it very closely. *C. teretiuscula*, however, has a very different habit, and never forms the dense tussocks of *C. paniculata*. It is usually much smaller, the stems more slender and wiry, the panicles (or spikes) much shorter and broader, and the perigynia are also slightly different. But there is little danger of its being confounded with the New Zealand varieties of *C. paniculata*, all of which are widely divergent.

Outside New Zealand, *C. teretiuscula* is found in North and Central Europe, the Himalaya Mountains, and in North America.

10. **C. paniculata,** *L. Species Plant.*, 1,383; *Kunth, Enum.* ii,, 359; *F. Muell. Veg. Chath. Isl.*, 59; *Benth. Fl. Austral.*, vii., 440.

Var. *appressa.*—Stouter, stems more acutely angled; leaves wider (often nearly ½ inch); panicles more erect and rigid, stouter and broader, with more densely packed spikelets; perigynia plano-convex, margins incurved, faces very prominently nerved. C. appressa, *Br. Prodr.*, 242; *Hook. fil. Fl. Antarct.*, i., 90; *Flora Tasm.*, ii., 99; *Handbook N.Z. Flora*, 313; *Boott, Ill. Car.*, i., 46, t. 119, 120.

Var. *virgata.*—Slender, panicle longer and narrower, often interrupted below, perigynia smaller, prominently nerved. C. virgata, *Sol.*; *Boott, l. c.*, t. 121, 122; *Hook. fil. Fl. Nov. Zeal.*, i., 282; *Handbook N.Z. Flora*, 313.

Var. *secta.*—Larger, rootstocks often matted together and forming miniature trunks 2–4 feet high. Panicle larger, more slender, much more compound, often with lax drooping branches; perigynia smaller and broader, faintly nerved or quite smooth and polished. C. secta, *Boott in Hook. fil. Fl. Nov. Zeal.*, i., 283; *Ill. Car.*, t. 123, 124.

North and South Islands.—The varieties *virgata* and *secta* abundant throughout, from the North Cape to Stewart Island, and from sea-level to an altitude of over 3,000 feet. Var. *appressa.*—*South Island.*—Near Dunedin and Otago Peninsula, *G. M. Thomson*! *D. Petrie*! Milford Sound, *Dr. Hector, G. M. Thomson.* Auckland and Campbell Islands, *Sir J. D. Hooker.* (Handbook.)

I have followed Mr. Bentham and Sir F. Mueller in uniting the three plants mentioned above with the northern *C. paniculata, L.*; a course long ago indicated by the sagacious Robert Brown. Small specimens of *C. appressa* (and particularly some Tasmanian ones), are almost identical with European examples; but usually the plant differs in its larger size, stouter habit, and much longer panicles, which in *C. paniculata* are seldom more than 4 or 5 inches long, but in *C. appressa* are sometimes over 18 inches, and proportionally stout. *C. virgata* recedes from *appressa* in the narrower foliage, still longer but much more slender panicles, and smaller perigynia; but transition states are occasionally seen. *C. secta* has drooping panicles often 2 feet long, with lax spreading branches, and in its extreme form is widely different from any northern variety of *C. paniculata.* Reduced or mountain forms, however, gradually approach *C. virgata*, the panicles becoming shorter, and the side branches less developed. After the study and comparison of many specimens, both New Zealand and foreign, it appears to me that the differences between the three varieties and between them and the typical *C. paniculata* are mainly those of habit, size, and luxuriance, and that there are no structural deviations of sufficient importance available for specific distinction.

C. paniculata is widely distributed in New Zealand, and perhaps contributes more to the general physiognomy of the vegetation than any other species of the genus. Everyone who has had occasion to pass through swampy districts is familiar with the huge tussocks formed by the matted rootstocks of the variety *secta*, sometimes from four to five feet high, with a diameter of nearly two feet. Outside New Zealand, Australia and Tasmania the species ranges through Europe and Western Asia. A variety is found in California, but the plant seems to be unknown in Eastern America.

11. **C. viridis,** *Petrie, Trans. N.Z. Inst.*, xiii., 332. Pale whitish-green. Stems slender, wiry, tufted, terete below, compressed or plano-convex above, grooved, perfectly smooth, 6–24 inches high. Leaves shorter than the

stems, narrow, $\frac{1}{25}$ inch broad, erect, strict and wiry, concave in front, convex behind, or plano-convex, grooved, margins smooth or slightly scabrid. Inflorescence nearly diœcious or altogether so; spikelets pale, almost white, few flowered, sessile, collected into a linear terminal spike $\frac{1}{2}$–$1\frac{1}{2}$ inch long; those of the male plant with occasional female flowers or altogether unisexual; those of the female sometimes with a staminate flower at the top of the spikelets. Bracts short. Glumes lanceolate, thin and membranous, pale, acuminate or awned. Perigynia long and narrow lanceolate, plano-convex, nerved, tapering into a very long bidentate serrate beak. Stigmas 2.

South Island.—Upper Waitaki, Mackenzie Plains, Lakes Tekapo and Pukaki, alt. 2,000–4,000 feet, *T.F.C.*; Rough Ridge, alt. 3,000 feet; Nevis Valley, alt. 2,000 feet; and other localities in Otago, *D. Petrie*! Upper Shotover, *P. Goyen*!

A most distinct species, whose only near ally appears to be the following. I have given a full description of the plant, as Mr. Petrie does not allude to the nearly diœcious inflorescence and some other curious points.

12. **C. kaloides,** *Petrie, Trans. N.Z. Inst.*, xiii., 332.

South Island.—Apparently plentiful in mountain districts throughout. Common in river valleys in the interior of Nelson, *T.F.C.*; slopes of Mount Torlesse, Broken River, Upper Waimakariri, Mackenzie Plains, Lakes Tekapo and Pukaki, and other localities in Canterbury, *T.F.C.*; interior of Otago, plentiful, *D. Petrie*! Altitudinal range 800–3,500 feet.

Allied to *C. viridis*, but easily separated by its larger size, less strict habit, broader, flatter, and more grassy leaves, and larger often loosely branched panicles. The Nelson specimens as a rule have much larger, more compound, and more numerously flowered panicles than those from Canterbury and Otago, but I find no other difference. I have never seen specimens wholly unisexual, as in *C. viridis*, but the male flowers vary greatly in number; in some cases the panicles being almost entirely pistillate, while in others a considerable portion of the upper spikelets are male.

C. kaloides and *C. viridis* are sharply marked off by their narrow lanceolate and long-beaked plano-convex perigynia; none of the other New Zealand species even approaching them in this respect. Both are peculiar to the colony.

SECTION III.—Spikelets separate, usually stalked, unisexual; the male spikelets constantly uppermost, rarely mixed with female flowers; the lower spikelets all female, or frequently with a few male flowers at the base or apex.

13. **C. vulgaris,** *Fries, var.* **gaudichaudiana,** *Boott, Ill. Car.*, iv., 169, t. 567; *Benth. Fl. Austr.*, vii., 442; *F. Muell. Fragm.*, viii., 257. C. gaudichaudiana, *Kunth, Enum.*, ii., 417; *Hook. fil. Fl. Tasm.*, ii., 99, t. 151, A.; *Handbk. N.Z. Flora*, 313.

North Island.—Near Auckland; Valley of the Thames; etc.: *T.F.C.* Probably not uncommon in the high interior country.

South Island.—Common in moist places in mountain districts, rarer in the lowlands. Nelson—Mount Arthur plateau, ascending to 4,500 feet; Red Hills; Raglan Range; Wairau Gorge, etc.: *T.F.C.* Canterbury—Upper Waimakariri; Arthur's Pass; Burke's Pass; Mackenzie Plains; Lakes Tekapo and Pukaki; Tasman River, etc.: *T.F.C.* Canterbury Plains: *T. Kirk.* Otago—abundant in the interior: *J. Buchanan! D. Petrie! G. M. Thomson!*

This and the two following species form a small group possessing rather broad lenticular or flattened nerved perigynia, with remarkably short beaks. *C. vulgaris* is easily separated from the other two by its much smaller size, few, short and nearly sessile spikelets, and by the usually obtuse glumes. Our plant is generally kept as a distinct variety, although some specimens can hardly be distinguished from northern forms. In size it varies exceedingly—from one or two inches to nearly two feet,—and the breadth of the leaves, number and size of the spikelets, shape of the glumes, colour and shape of the perigynia are all subject to considerable variation. The perigynia are very frequently attacked by the fungus *Ustilago urceolorum*, and ultimately converted into a dusty mass of spores. In some districts it is difficult to find specimens free from the *Ustilago*.

C. vulgaris has a wide geographical range. It is abundant in the colder regions of Europe, Asia, and America, extending northwards as far as Greenland and Behring Straits. In the southern hemisphere, outside New Zealand, it is abundant in Australia and Tasmania, and is also found in Chili.

14. **C. subdola,** *Boott, Trans. Linn. Socy.*, 20, 142; *Hook. fil. Fl. Nov. Zeal.*, i., 282; *Handbook N.Z. Flora*, 314.

North Island.—Not uncommon in marshy places, from Mongonui southwards.

South Island.—Nelson: Acheron Valley, *Travers* (Handbook); Upper Takaka and Mount Arthur plateau, 2,500–4,000 feet, *T.F.C.* Canterbury: various places in the Southern Alps, *T. Kirk*, *T.F.C.* Stewart Island: *T. Kirk.* Altitudinal range from sea-level to nearly 4,000 feet.

A tall, leafy, grassy species, very common in swamps in the northern portion of the colony. It is allied to the European and Australian *C. acuta*, L.; but the oblong emarginate glumes, usually furnished with a stout awn from the centre of the emargination, are very different to the narrow, gradually tapering glumes of *C. acuta*.

As in *C. acuta*, it often happens that in some of the lower flowers of the female spikelets the rachilla is produced beyond the perigynium, sometimes bearing one or two flowers with imperfect or fully developed perigynia.

This is an additional proof of the axial nature of the rachilla, and of the correctness of the theory that the perigynium is composed of a modified bract.

15. **C. ternaria,** *Forst. Prodr.*, no. 549; *Hook. fil. Fl. Nov. Zeal.*, i., 282; *Handbk. N.Z. Flora*, 314. C. geminata, *Schkuhr, Car.*, 75. C. polystachya, *A. Rich. Fl. Nouv. Zél.*, iii., t. 21.

Var. α.—Tall and stout; leaves broad, often over $\frac{1}{2}$ inch; spikelets numerous, stout, pendulous.

Var. β, *gracilis*.—Tall, slender; leaves $\frac{1}{8}$–$\frac{1}{5}$ inch; spikelets usually numerous, long, often over 4 inches, very slender, sometimes hardly $\frac{1}{8}$ inch in diameter. Approaches *C. subdola.*

Var. γ, *pallida*.—Stout, leaves often rigid and coriaceous; spikelets fewer, short, pale, on long filiform peduncles; perigynia broader and more turgid, hardly nerved, sometimes with serrate margins.

North and South Islands.—Varieties α and β abundant throughout, from the North Cape to Stewart Island and the Auckland Isles, and from sea-level to 4,000 feet. Var. γ.—Marshy places in the mountains of the South Island, apparently plentiful, *D. Petrie*! *T.F.C.*

This is one of the most variable of the New Zealand *Carices*, as also one of the most common and widely diffused. I have endeavoured to sort its numerous forms into three main varieties, as characterized above; but it must be borne in mind that there are numerous intermediates. Var. α is usually of general occurrence in lowland districts, by the margins of swamps, along the banks of streams and in open gullies. It is often over 4 feet in height, with broad harsh and cutting leaves $\frac{1}{2}$ inch or more across, and numerous (12–24) dark brown stout pendulous spikelets, that are often 3 or 4 inches long by $\frac{1}{3}$ inch broad. Var. *gracilis* is usually found in woods. Small forms appear to pass into *C. subdola*; but ordinarily it can be distinguished by the longer awns to the glumes, and more numerous ternate or quinate pendulous spikelets. The extreme form of var. *pallida* has a very distinct appearance, and is probably the same as the supposed new species briefly noticed in the "Handbook" as having been collected by Haast near Lake Ohau. But in many districts transition forms between it and var. α can be collected.

C. ternaria appears to be confined to New Zealand.

16. **C. buchanani,** *Berggren, Journ. of Botany*, 1880, p. 104. C. tenax, *Berggren in Physiograph. Saltskaps Minneskrift Lund*, 1878, t. 3, f. 1–7 (a name already occupied).

South Island.—Abundant in hilly and mountain districts throughout, rare in the lowlands. *Berggren, Armstrong*! *Buchanan*! *Petrie*! *G. M. Thomson*! *T.F.C.* It also probably occurs in the mountainous districts in the centre of the North Island, but I have seen no specimens from thence, A well-marked species, excellently described and figured by Dr. Berggren. Among the species with two styles it is easily recognized by its usually reddish colour, densely tufted habit, strict semi-terete leaves, pale-coloured glumes and elliptic plano-convex serrate perigynia. Dr. Berggren considers that it is allied to *C. raoulii*, but I can find but little affinity with that plant, which differs altogether in habit, foliage, glumes and perigynia.

Mr. Petrie informs me that *C. buchanani* is rapidly increasing in the central districts of Otago, spreading along the sides of water-races, and in river valleys that have had the dense native vegetation cleared away. In Canterbury and Nelson it is usually found on the shingle-beds of the large rivers; but it also ascends the mountains.

17. **C. lucida,** *Boott, in Hook. fil. Fl. Nov. Zeal.*, i., 283; *Ill. Car.*, t. 173; *Hook. fil. Handbook N.Z. Flora*, 314.

North and South Islands.—Abundant throughout, from the North Cape to Stewart Island. Altitudinal range from sea-level to 3,500 feet.

This is a well-known and widely-spread species, and in its ordinary state cannot be confounded with any other. The narrow keeled leaves; distant long and narrow somewhat loose-flowered spikelets; usually entire glumes; and the biconvex turgid smooth and polished perigynia are good distinguishing characters. The culms often elongate considerably after flowering, becoming prostrate, and sometimes attaining a length of four or five feet. This form commonly has much paler glumes and perigynia than the type, but these are unimportant differences. The style-branches appear to me to be invariably two only; unless a doubtful plant with three styles, from the Wairau Valley, Nelson, of which I possess immature specimens only, be referable to this species.

18. **C. dipsacea,** *Berggren, Physiograph. Saltskaps Minneskrift Lund*, 1878, t. 7, f. 8–14.

North Island.—Tokano and Omatangi (near Lake Taupo), *Berggren, l. c.*; Mount Egmont Ranges, alt. 3,000 feet, *H. Tryon*! Upper Waikato and Patetere, *T.F.C.*; abundant in the swamps of the Middle and Lower Waikato nearly to the mouth of the river, *T.F.C.*

South Island.—Nelson—Lower Motueka, Graham River, Wangapeka Valley, Wairau Valley, *T.F.C.*; Canterbury—Southern Alps, *Berggren, l.c.*; Upper Waimakariri, Lake Tekapo, *T.F.C.*; Otago—Manuherikia Valley, Strath Taieri, Waikouaiti, Upper Waipori, Catlin's River, *D. Petrie*! Altitudinal range from sea-level to 3,500 feet.

A larger species than the preceding, of a deeper green colour. The spikelets are much shorter and stouter, the flowers much more closely packed, the glumes broader, rounded and obtuse at the top; and the perigynia are sharply serrate. I find that the male spikelet is not unfrequently partly female, a point not alluded to by Dr. Berggren, whose description and plate are otherwise very accurate.

19. **C. raoulii,** *Boott, in Hook. fil. Fl. Nov. Zeal.*, i., 283. Yellowish or dark green. Culms rather stout, laxly tufted, 9 inches to 2 feet in height, triquetrous, scabrid. Leaves usually longer than the culms, $\frac{1}{8}$–$\frac{1}{4}$ inch broad, flat and grassy, grooved, coriaceous, margins scabrid. Bracts long and leafy. Spikelets 4–7, pale, stout, erect, approximate and sessile, or the lower ones distant and shortly pedunculate, $\frac{1}{2}$–1 inch long, $\frac{1}{4}$ inch broad; all female but usually with a few male flowers below, the uppermost generally longer with more male flowers below. Glumes pale brown, broadly ovate, thin and membranous, 3-nerved, deeply bifid, awn long, stout and hispid. Perigynia broader and longer than the glumes, elliptical, narrowed to the base and upwards into a rather long and stout 2-toothed beak, strongly nerved, unequally biconvex; margins serrate above. Stigmas 2. *Ill. Car.*, iii., 109, t. 333; *Hook. fil. Handbk. N.Z. Flora*, 314. C. goyeni, *Petrie, Trans. N.Z. Inst.*, xiv., 363.

South Island.—Not uncommon in mountain districts. Nelson—Graham River, Wangapeka Valley, Mount Owen, etc.: *T.F.C.* Canterbury—Akaroa, *Raoul*; Southern Alps, *Sinclair and Haast*; Broken River basin, Upper Waimakariri; Lakes Tekapo and Pukaki; *T.F.C.* Otago—head of Lake Wakatipu, *D. Petrie*!; near Lake Wanaka, *J. Buchanan*! Altitudinal range from 250–3,000 feet.

Although *C. raoulii* is one of the most distinct species of the genus in New Zealand, there has been considerable misconception respecting it, and by many it has been confounded with *C. testacea.* I therefore give revised descriptions of both species. Its main characters lie in the loose open habit, comparatively broad flat leaves, in the terminal spikelet being always partly female, and in the elliptical strongly nerved and serrate perigynia, which are unequally biconvex, and narrowed both upwards and downwards. In *C. testacea* the perigynia are much broader, plano-convex and almost hemispherical, and in addition to the very different habit the terminal spikelet is never mixed with female flowers.

20. **C. devia,** *Cheeseman, Trans. N.Z. Inst.*, xv., 301.

South Island.—Mountain districts in Nelson, not uncommon above 2,500 feet: *T.F.C.*

Allied to *C. testacea*, but readily distinguished by its different habit, stouter culms, rigid and coriaceous grooved leaves, very stout clavate male spikelets, and more turgid biconvex perigynia, with a shorter broader beak and entire margins.

21. **C. testacea,** *Sol.* mss.—Stems tufted, slender, leafy, nearly smooth, from 4 to 18 inches high, in some forms elongating in fruit and becoming prostrate, occasionally reaching 4–5 feet in length. Leaves longer or shorter than the stems, flat, involute or keeled, $\frac{1}{15}$–$\frac{1}{8}$ inch broad, striate; margins more or less scabrid. Spikelets 3–5, pale brown, close together or rarely distant, sessile, or the lower shortly peduncled; the upper one male, slender, $\frac{3}{4}$–2 inches long; lower female only, or sometimes with a few male flowers below, rarely above, short and broad, erect, $\frac{1}{2}$–$1\frac{1}{4}$ inch long, $\frac{1}{4}$–$\frac{1}{3}$ inch broad. Bracts leafy, very long, overtopping the spikelets. Glumes broadly ovate, thin and membranous, bifid at the apex, with a long or short awn, pale brownish usually dotted with chestnut, median portion more or less conspicuously 3-nerved. Perigynia rather smaller than the glumes, very broadly ovate, plano-convex, nerved, polished and shining, purplish at the apex, paler below, or wholly pale brown; beak very short and broad, with two widely-divergent teeth; margins entire or serrate above. Stigmas 2.—*Boott in Hook. fil. Fl. Nov. Zeal.*, i., 282; *Hook. fil. Handbk. N.Z. Flora*, 314.

North and South Islands.—Abundant throughout, from the North Cape to Stewart Island. Altitudinal range from sea-level to 3,500 feet.

An extremely variable plant, especially in the length of the culms, which in some forms hardly elongate after flowering, in others reach a length of from 3 to even 5 feet, lying prostrate on the ground. The description in the "Flora of New Zealand" is much more correct than the later one given in the "Handbook," where it is stated that the perigynia are not serrate above, which they very frequently are; and also that it can be distinguished from *C. raoulii* by the glumes *not* being 2-fid—whereas they are almost invariably bifid in both species. It seems probable that more species than one have been included in the description given in the "Handbook."

Some of the forms which I include under *C. testacea* should perhaps have been briefly characterized as varieties. For instance the lowland form, often common near the coast, on sand-hills, etc., differs in several respects from the mountain state. But I find so many intermediates that for the present I have thought it best to give a sufficiently wide specific description and to postpone actually characterizing trivial varieties until more is known of their range and limits.

22. **C. wakatipu,** *Petrie, Trans. N.Z. Institute*, xiv., 363.

South Island.—Canterbury—mountains above the Broken River, alt. 3,500 feet; mountains above Arthur's Pass, 4,000 feet; Lake Tekapo, alt. 3,000–4,500 feet, *T.F.C.* Otago—Ben Lomond, near Queenstown, alt. 3,000–5,000 feet; Lake Wanaka, alt. 3,500 feet, *D. Petrie*!

This is principally distinguished from *C. testacea* by its smaller size; shorter and stouter culms; and more strongly nerved biconvex perigynia. It is usually from 6 to 12 inches high, but alpine specimens are much depauperated, only 2 or 3 inches high, bearing two or three short and stout spikelets sunk amongst the leaves.

23. **C. cirrhosa,** *Berggren, Physiograph. Saltskaps Minneskrift Lund,* 1878, 29, t. 7, f. 27–34.

South Island.—Waimakariri River, *Berggren.* Lake Lyndon, alt. 2,500 feet, *J. D. Enys*! *T. Kirk*! *T.F.C.*

A curious little plant, first discovered by Dr. Berggren, and excellently described and figured by him. Its only near ally is the following species:—

24. **C. cryptocarpa,** *Cheeseman, Trans. N.Z. Inst.*, xvi., p. 412.

South Island.—Vicinity of Lake Tekapo, Canterbury, alt. 2,500 feet. *T.F.C.*

This is near to *C. cirrhosa*, but differs in its larger size and stouter habit; broader glumes; larger more turgid perigynia, with shorter beaks and serrate margins; and in having 3 stigmas. The nut is trigonous, while it is lenticular in all the fruiting specimens of *C. cirrhosa* that I have examined. Old tussocks of this species often have a most peculiar appearance. The centre dies out, leaving a hollow ring which grows on vigorously. In dry weather the leaves all curve inwards towards the centre of the ring, giving the tussock the appearance of a cushion with a low centre.

25. **C. uncifolia,** *Cheeseman, Trans. N.Z. Institute*, xvi., p. 412.

South Island.—Mountains flanking the Wairau Valley, Nelson, alt. 3,000–4,000 feet, *T.F.C.*

Differing much in habit from the two preceding species, never forming close compact tufts, but having more of the habit of small and fine leaved specimens of *C. breviculmis*. Besides this, the culms and leaves are much more slender, spikelets smaller, and the perigynia of a very different shape, being trigonous or almost fusiform, or, to take a familiar example, very near to those of *C. lucida* in shape. As I only have it from one locality, some little allowance must be made for the description. Small specimens are often hardly more than an inch or two in height, but large ones attain 5 or 6 inches.

26. **C. pulchella,** *Berggren, Physiograph. Saltskaps Minneskrift* Lund, 1878, 29, t. 7, f. 20–26.

South Island.—Mountains near the Bealey River, Canterbury, *Berggren.*

I am not in a position to add anything to Dr. Berggren's description of this species, for although I am inclined to refer to it some specimens of a plant gathered in the Wairau Valley, Nelson, they are much too immature to warrant a positive conclusion. Dr. Berggren remarks that it is distinguished from *C. comans* by the flaccid culms; sheathed spikelets, the lowest of which is nearly basal; and by the turgid perigynia, which exceed the glumes in length. From *C. testacea* it is at once removed by the number of the style-branches, narrower and smoother perigynia, and by the remote lower spikelet.

27. **C. petriei,** *Cheeseman, Trans. N.Z. Inst.*, xvi., p. 413.

South Island.—Mountains above the Broken River, and near Arthur's Pass, alt. 3,000–4,500 feet; ravines at the foot of Mount Dobson, and between Lake Tekapo and Lake Pukaki, alt. 3,000 feet, *T.F.C.*; near Naseby; Dunstan Mountains, alt. 3,000 feet; Lake Wanaka, alt. 3,500 feet, *D. Petrie*!

I take this to be a perfectly distinct and well-marked form, easily distinguished from any of the species with 3 styles by its usually reddish colour; by the broad sheathing bases to the leaves and their fine points, which are curled and twisted when dry; by the small and narrow spikelets, all of which are sheathed and stalked, and the lower on filiform peduncles; by the remarkably pale coloured glumes; and by the narrow ovoid or elliptic-oblong turgid perigynia, which are quite smooth and even, and of a dark brownish- or purplish-black colour. It seems to be conveniently placed near *C. pulchella* although by no means closely allied to that plant. From *C. testacea* and the allied species it is at once removed by the number of styles and the shape of the perigynia.

28. **C. comans,** *Berggren, Physiograph. Saltskaps Minneskrift Lund*, 1878, t. 7, f. 15–19.

North Island.—Sandy shores near Hokianga, *Berggren*; near Kaihu, Northern Wairoa, *T.F.C.*; Paparoa, (Kaipara), *T. Kirk.*

With this species I am imperfectly acquainted, for although I believe that I have gathered it in the Northern Wairoa district, my specimens are few in number and very immature. Judging mainly from Dr. Berggren's plate and description, it is separated from the allied species with three stigmas by the slender habit, filiform plano-convex leaves, which are longer than the culms, remote short-stalked or sessile spikelets, and by the narrow plano-convex perigynia, with the margins sharply and coarsely toothed towards the apex.

Near Lake Tekapo, Canterbury, I have collected specimens of a plant closely allied to the above, but differing in the stouter habit, much larger and broader glumes with longer awns, and rather broader perigynia. I had placed it as a variety of *C. comans*, but Mr. J. G. Baker, of Kew, who has done me the favour of comparing it with an authentic specimen of *C. comans* received from Dr. Berggren, considers it to be distinct. I hesitate, however, to describe it as new until better acquainted with Berggren's plant.

29. **C. cheesemanii,** *Petrie, Trans. N.Z. Inst.*, xv., 358.

South Island.—Apparently common in hilly and mountainous districts. Wairau Valley; Buller Valley; Wangapeka Valley and other localities in the interior of Nelson, *T.F.C.* Upper Waimakariri and near Mount Dobson, Canterbury, *T.F.C.* Upper Waipori; Strath Taieri; Maniototo Plain; Nevis Valley and other places in Otago: *D. Petrie*! *G. M. Thomson*!

This is probably nearest to the preceding species, and although differing in several characters might well be regarded as a variety only. The culms are longer and more slender, often considerably exceeding the leaves; the leaves are flatter and rather narrower, although variable in this respect; the lower spikelets are usually on long filiform peduncles; and the glumes and perigynia are rather broader. Like several other New Zealand species it is often a red-brown colour. Large and coarse specimens have some slight outward resemblance to small forms of *C. lucida*, but in reality differ altogether in leaves, glumes, and perigynia.

30. **C. littoralis,** *Petrie, Trans. N.Z. Inst.*, xv., 358.

North Island.—Probably not uncommon in brackish-water marshes. Whangarei Harbour; Manukau Harbour; marshes by the Thames and Piako Rivers; Tauranga Harbour, *T.F.C.*

South Island.—Nelson Harbour and marshy places by the shores of Blind Bay, *T.F.C.*; Port Chalmers; Paterson's Inlet (Stewart Island), *D. Petrie*! *G. M. Thomson*!

This species appears to be confined to brackish-water swamps. It has been confounded with *C. testacea*, with which, however, it has little affinity. It is nearer to *C. comans*, but is easily recognized by its larger size and stouter habit, more closely placed spikelets, and particularly by the more turgid biconvex or trigonous perigynia, not (or very obscurely) serrate above.

31. **C. dissita,** *Solander*, mss.; *Boott in Hook. fil. Flora Nov. Zeal.*, i., 284; *Ill. Car.*, i., t. 176; *Hook. fil. Handbk. N.Z. Flora*, 316.

North and South Islands.—Abundant in most districts, and ranging from sea-level to 3,500 feet. alt.

Var. β, *lambertiana.*—Much stouter, leaves broader, sometimes over ¼ inch. Spikelets much longer and stouter, sometimes 2½ inches long, erect, short stalked. Glumes more deeply bifid. C. lambertiana, *Boott in Hook. fil. Fl. Nov. Zeal.*, i., 284; *Handbk. N.Z. Flora*, 317.

North and South Islands.—Apparently not uncommon throughout. I have not myself seen specimens from Otago, but I am informed by Mr. Kirk that it occurs both there and in Stewart Island.

Var. γ.—Culms usually overtopped by the leaves; spikelets paler, short-stalked, lowest often compound; glumes with longer awns.

North Island.—Common in the Auckland Provincial District.

C. dissita is undoubtedly one of the most variable species we possess. Commencing with the small form found abundantly in mountain swamps, and which is often hardly more than 6 or 9 inches high, with narrow leaves and three or four short and small spikelets, every step can be traced into the tall grassy variety so generally distributed in both lowland and upland districts, and which is often more than two feet high, with 6–8 loosely placed, often pendulous, spikelets. This again varies into the stouter and harsher form hitherto kept distinct under the name of *C. lambertiana*, but which is certainly only entitled to rank as a variety—all its differences being those of size and luxuriance, and none of them being even tolerably constant. Another curious state, which is found in many localities in the Auckland Provincial District, has many of the characters of *C. lambertiana*, but differs in the softer foliage, shorter and much paler spikelets, the lowest of which are almost invariably compound, and much shorter culms. In the compound spikelets it approaches *C. neesiana*, but differs altogether in habit and the short stalk to the much larger spikelets. *C. neesiana* is certainly a close ally of *C. dissita*, but appears to be sufficiently distinct in the different habit, numerous male spikelets and compound lower female ones on long pendulous stalks. The distinction of entire glumes, given by Hooker in the "Handbook," breaks down when a large suite of specimens is examined, the glumes varying in both species from quite entire to deeply bifid, and the length of the awn is equally inconstant.

32. **C. neesiana,** *Endl. Prodr. Fl. Ins. Norfolk*, 24; *Boott, Ill. Car.*, iv., 136, t. 436; *Hook. fil. Handbk. N.Z. Flora*, 316. C. solandri, *Boott in Hook. fil. Fl. Nov. Zeal.*, i., 284; *Ill. Car.*, i., t. 176.

North Island.—Not uncommon in wooded districts.

South Island.—Queen Charlotte Sound, *Banks and Solander* (Handbook); Wangapeka, Upper Wairau and other localities in Nelson, *T.F.C.*; Banks Peninsula, *Armstrong*!; Akaroa, *T. Kirk*; near Dunedin and on Stewart Island, *D. Petrie*!

This is principally distinguished from *C. dissita* by the taller, more slender habit; longer culms, often becoming elongated in fruit and prostrate; more numerous male spikelets (the male spikelets are seldom more than one in *C. dissita*); and by the compound long peduncled lower female spikelets. The perigynia and glumes are much alike in both species.

C. neesiana is found in Norfolk Island, but does not seem to extend into Australia or Tasmania.

33. **C. longiculmis,** *Petrie, Trans. N.Z. Inst.*, xiv., 363.

South Island.—Paterson Inlet, Stewart Island, *D. Petrie*! *G. M. Thomson*! *T. Kirk*!

A very distinct species. Easily separated from *C. dissita* var. *lambertiana*, by its different habit; shorter, much stouter, pale brown spikelets, and longer beak to the broader and somewhat stipitate perigynia. From *C. trifida* it is removed by its smaller size and more slender habit, less numerous and smaller spikelets, broader glumes, and very different perigynia. The short broad blunt spikelets remind one of those of some species of the *Vesicariæ* section, but the perigynia are unlike.

34. **C. trifida,** *Cav. Ic.*, 41, t. 465; *Boott in Hook. fil. Fl. Antarct.*, i., 89; *Fl. Nov. Zeal.*, i., 284; *Handbk. N.Z. Flora*, 316. C. incrassata, *Solander, mss.* C. aristata, *D'Urv.*

South Island.—Totaranui (Queen Charlotte Sound) *Banks and Solander* (Handbook); Akaroa, *Raoul*; Dusky Sound, *Lyall*; near Dunedin, *D. Petrie*! *G. M. Thomson*! Auckland and Campbell Islands, *Sir J. D. Hooker* (Flora Antarctica).

Also common in temperate South America, from Chili and Fuegia to the Falkland Islands. Its large size, stout habit, and numerous massive spikelets readily distinguish it from any other species found in New Zealand.

35. **C. breviculmis,** *R. Br. Prodr.*, 242; *Boott in Hook. fil. Fl. Nov. Zeal.*, i., 283, t. 63; *Fl. Tasm.*, ii., 101; *Handbk. N.Z. Flora*, 316; *Boott, Ill. Car.*, iv., 181; *F. Muell. Fragm.*, viii., 255; *Benth. Fl. Austral.*, vii., 445.

North and South Islands.—Abundant in dry places from the North Cape to Stewart Island. Altitudinal range from sea-level to 3,000 feet.

Easily distinguished by its pubescent perigynia. It has a wide range outside New Zealand, being found in Lord Howe Island, South-eastern Australia and Tasmania, the Himalaya Mountains, and in China and Japan.

36. **C. pumila,** *Thunb. Flora Japon.*, 38; *Benth. Fl. Hongkong*, 482; *Fl. Austral.*, vii., 445; *Boott, Ill. Car.*, iv., 217; *Hook. fil. Handbook N.Z. Flora*, 315. C. littorea, *Lab. Fl. Nov. Holl.*, ii., 69, t. 219; *R. Br. Prodr.*, 243; *Hook. fil. Fl. Nov. Zeal.*, i., 284; *Fl. Tasm.*, ii., 200.

North and South Islands.—Abundant on sandy shores and on sand-dunes, from the North Cape to Stewart Island.

A well-marked plant. The long running rhizomes sending up distant stems; the glaucous keeled leaves; and large, smooth and turgid perigynia, exceeding in size those of any other New Zealand species, are conspicuous characters. Common in Eastern Australia, in Tasmania, and in some parts of extra-tropical South America, and also found on the coasts of China and Japan.

37. **C. flava,** *L. Species Plant.*; *Kunth Enum.*, ii., 446; *Benth. Fl. Austral.*, vii., 444. C. cataractæ, *R. Br. Prodr.*, 242; *Hook. fil. Fl. Tasm.*, ii., 101, t. 151; *Handbook N.Z. Flora*, 315; *Boott, Ill. Car.*, iv., 204.

South Island.—Amuri, *T. Kirk*! Southern Alps, *Sinclair and Haast* (Handbook); Canterbury Plains, *T. Kirk*; Lakes Tekapo and Alexandrina, and by the Tasman River, *T.F.C.*; Waitaki River, *Haast*; Dunedin, *D. Petrie*! Lake District of Otago, *J. Buchanan*! Stewart Island, *T. Kirk*. Altitudinal range from sea-level to over 3,000 feet.

I have followed Mr. Bentham in uniting the Tasmanian and New Zealand *C. cataractæ* with the northern *C. flava*; the differences between the two forms being hardly of specific value. New Zealand specimens never seem to attain the size of European, and as a rule the spikelets are much more closely compacted, and the perigynia smaller. In all my specimens the beak of the perigynium is shorter than in the typical *C. flava*, in this respect approaching the variety *œderi*, often kept as a distinct species. Specimens from Swanport, Tasmania, kindly forwarded to me by Baron Müeller, have indeed perigynia almost indistinguishable from those of *C. œderi*, as is stated in the "Flora Australiensis;" but I have not seen any specimens collected in New Zealand that exactly match them.

C. flava has a wide distribution; being found through the greater portion of Northern and Central Europe, in temperate North America, Madeira, Western and Central Asia to the Himalaya Mountains, and in Tasmania.

38. **C. vaccilans**, *Sol., mss.*; *Boott in Hook. fil. Fl. Nov. Zeal.*, i., 285; *Handbk. N.Z. Flora*, 317.

North Island.—Not uncommon on declivities in dry woods, especially near the sea. I have seen no specimens from the South Island.

This is a handsome and in my opinion very distinct species. Sir J. D. Hooker remarks (Handbook, p. 311) that it should perhaps be united with *C. dissita*; but the long and slender spikelets, narrow entire glumes, and much longer and narrower fusiform beaked perigynia do not appear to show any close alliance to that plant. In habit and in the shape of the perigynia there is considerable resemblance to the next species, which has induced me to place the two plants close together. *C. vaccilans* is, however, much smaller in all its parts, and the perigynia do not spread when mature.

39. **C. forsteri,** *Wahl. in Act. Holm.*, 1803, 154; *Boott in Hook. fil. Fl. Nov. Zeal.*, i., 285; *Hook. fil. Handbk. N.Z. Flora*, 315 (in part only). C. debilis, *Forst. Prodr.*, 92, *non Michx.* C. recurva, *Schkuhr Car.*, f. 84. C. punctulata, *A. Rich. Fl. Nouvelle Zél.*, t. 22. C. cinnamomea, *Cheeseman, Trans. N.Z. Inst.*, xiv., 301, *not of Olney.*

North Island.—Whangarei Heads; Thames Goldfields; Raglan; near Gisborne, *T.F.C.*; Wellington, *T. Kirk.*

South Island.—Lower Motueka, Graham River, Wangapeka Valley, and other localities in Nelson, *T.F.C.* Akaroa, *T. Kirk.* Altitudinal range from sea-level to 3,000 feet.

In the opinion of many botanists, *C. forsteri* ought not to be separated, save as a variety, from the plant named *C. fascicularis* by Solander. The two were kept as distinct by the late Dr. Boott in his account of the genus given in the "Flora of New Zealand," but were united by Sir J. D. Hooker in the "Handbook." Sir Ferd. von Müeller, in the eighth volume of his "Fragmenta," adopts Hooker's views as to the identity of *C. forsteri* and *C. fascicularis*, and reduces both to the widely distributed *C. pseudo-cyperus*, L.; and in this he is apparently followed by Mr. Bentham ("Flora Australiensis, 7, p. 449). With the reduction of *C. fascicularis* to *C. pseudo-cyperus* I perfectly agree; but at present I am not prepared to adopt similar views with respect to *C. forsteri*. After an examination of numerous specimens from both Islands, and a comparison with New Zealand, Australian, and European examples of *C. pseudo-cyperus*, it appears to me that *C. forsteri* differs in several prominent characters. Its habit is by no means the same, being nearer that of *C. vaccilans*, but stouter; the leaves are harsher and more rigid, differing much from the soft and grassy foliage of *C. pseudo-cyperus*; the spikelets are much more distantly placed, the males being often two or three in number; and the perigynia are smaller and broader, with much shorter beaks. The plant described by me as *C. cinnamomea* (a name, by the way, preoccupied by a North American species), I am now convinced must be reduced to *C. forsteri*. It is usually of a more slender habit, with longer awned glumes, bright red-brown spikelets, and still smaller perigynia with shorter, obscurely-toothed beaks.

40. **C. pseudo-cyperus**, *L. Species Plant.*, 1387; *Kunth Enum.*, ii., 501; *F. Muell. Fragm.*, viii., 249; *Benth. Flora Austral.*, vii., 448; *Boott, Ill. Car.*, iv., t. 451, 452. *C. fascicularis, Sol. ex Boott in Hook. fil. Fl. Nov. Zeal.*, i., 283; *Boott, Ill. Car.*, i., t. 139, 140.

North and South Islands.—Abundant throughout, in marshes or swampy woods. Altitudinal range from sea-level to 3,000 feet.

This is the *C. forsteri*, *β minor* and *γ fascicularis* of the Handbook. As stated in the remarks to the preceding species, I quite agree with Mueller and Bentham in uniting it with the northern *C. pseudo-cyperus*. The species, in some of its forms, is found in Europe, Western and Southern Asia, North and South Africa, North and South America, and in Australia.

Addendum.

In addition to the above species, Mr. Kirk* has added *C. chlorantha*, Br., a common Australian and Tasmanian plant closely allied to *C. paniculata*. His specimens were gathered, some years ago, in a locality within

* Trans. N.Z. Inst., vol. x., appendix, p. 42.

the precincts of the City of Auckland. In this station it has since become extinct; and as the plant has not been observed elsewhere in New Zealand, I am of opinion that it should be regarded as a chance introduction only.

Mr. Colenso * has also described a *C. spinirostris* as new. His description, however, is exceedingly vague; and the only specimen I have seen is in such poor condition that I have been unable to form an opinion as to the validity of the species.

* Trans. N.Z. Inst., vol. xv., p. 335.

III.—CHEMISTRY.

Art. XLVIII.—*On the Pottery Clays of the Auckland District.*

By J. A. Pond.

[*Read before the Auckland Institute, 20th August,* 1883.]

In the year 1876, I had the honour of reading a paper before this Institute on "a few of the fire-clays of this district," since which period the frequent opportunities I have had of examining the different deposits has led me in no way to alter my opinion as to the great value and extent of them, and since then I have seen and examined so many other beds of these alluviums that I make no apology for bringing before you to-night a few notes upon another series embraced in the very extended term, pottery clay. By this is meant that material of which the finest of our china and parian ware, and the roughest of our earthenware, are made; from the pure white kaolin obtained by the disintegration of the granite, to the rough ochreous clays and marls whose red and grey tints are so well known. Included with these is the terra cotta, a soft unctuous clay with a large percentage of peroxide or carbonate of iron regularly distributed. This, if of good texture and thoroughly admixed, will yield in the muffle a biscuit of the most delicate shades of redness; this is terra cotta, the use of which has increased very much of late in England, large houses being built entirely of it.

In dealing with the commercial values of heavy materials, such as clay, full consideration must be given to the removal of the same for shipping purposes, the carriage to market being always a serious factor. In dealing with this subject I have not been unmindful of this factor, and clays which are really of value on account of their texture or purity are passed over on account of the impracticability of bringing them to market.

Of the clays I have examined the great majority lack the whiteness of the true kaolin, and the biscuits from them vary from white to a full bright red. Those having light creamy tints to buffs are very plentiful, and I have no doubt that in many of these instances, when the beds are properly opened and worked, they will improve in uniformity and whiteness.

From Mongonui and Awanui I have received samples of excellent pottery clay, some being nearly white, but the majority of a cream tint. From Whangaroa I received through Mr. Will a sample of pipe-clay of pure whiteness, very unctuous and refractory, a nearly pure silicate of alumina. There is, I believe, a large deposit of this material. From the Bay of Islands I have obtained clays of fine texture, fairly white, perfectly free from grit and fit for the potter without elutriation. In the Wade District, extending to Riverhead, we have a very varied assortment of clays, fit for all purposes of pottery material with the exception of the finer wares. From Mercury Bay I have received samples of fine, white, unctuous clays, but as to the extent of the deposits I have no information. In the Waikato, near Hamilton, there are some excellent clays, the biscuit of which is of a pure white. Some of these clays have been worked up into medallions, slabs, and ornaments by Mr. Wright, who has resided a long period in that portion of the district engaged on pottery work, and whose workmanship is in the highest degree ornate. Though these clays are so excellent they have not been proved as to extent, and I think it questionable whether they will be found free from iron in more than small deposits. And here we have the drawback at present of lengthy rail carriage to the centre of population in the district. At the coal mines, Kawakawa, Whangarei, Taupiri, and Miranda, we have the refractory clays accompanying the coal measures, but these will be of value only in the rougher articles of pottery, owing to the presence of iron pyrites in nodules or finely distributed, and shrinkage, from the amount of bituminous material present. I come now to the last of the locations where I have found any great extent of clays for varied purposes, and so situated as to be within reasonable distance of fuel and adjacent to this city where the articles may be brought to market and for export. I allude to the Drury and Papakura basin, overlying which are the plastic clays. Here, over several square miles of country, we have clays from the whitest material, giving a biscuit of great purity to yellow, grey and blue clays yielding biscuits from a light cream to a deep rich red, which will give a terra cotta of great beauty. I have analyzed some of these deposits, and here append the results :—

	Yellow Red Clay (terra cotta).	Blue Clay (pinkish creamy biscuit).
Silica	59·2	62
Alumina	29·9	29·5
Oxide of Iron	9·7	6·3
Lime	trace	trace
Magnesia	trace	·6
Water	1·2	1·6
	100·0	100·0

In reference to these deposits, I do not for a moment claim any discovery with respect to them, as Dr. Hochstetter, in a lecture delivered at the Mechanics' Institute in 1859, calls attention to these beds, advising the establishment of potteries for the manufacture of earthenware, and further states "remarkably suitable clays of every necessary variety have been shown to exist in the neighbourhood," and also furnishes the results of two bore holes put down by Mr. Ninnis at Drury, which show a depth of 69 and 64 feet respectively through clays of many colours from white to brown, the seams varying from 1–11 feet in thickness. A few months since I paid a visit to these bore holes, but there is little to see beyond the position in which they were sunk. To obtain a knowledge of these beds, however, it will be found, by skirting the Karaka estuary on both sides from the ferry to Papakura and Drury, that many fine sections can be obtained of the clays *in situ*, most of them having but little overburden, and stripping will not be so serious a matter as at the bore holes indicated by Dr. Hochstetter. In some places there are 30 feet of clays, in three or four distinct beds, differing slightly in their chemical composition though more or less varied physically. Some of them are very argillaceous, and a few arenaceous, while for variety I know of no district where it can be equalled. After carefully inspecting a number of these sections, I have found nineteen distinct characters, either chemically or physically, of which about twelve will be of value for pottery work. So pure are some of these clays as to require no elutriation,—as they are won from the cutting so they can go to the pug mill. Amongst them there is one terra cotta so rich in colour without any addition or treatment that this alone would be a valuable acquisition, and when we bear in mind the extent to which terra cotta ware is now coming into use, it will be seen that this is no fancy sketch.

In the future we shall undoubtedly see extensive works located in this portion of the district for the use of these valuable clays, and the working of these beds will be greatly facilitated by a small canal between the Manukau and Waitemata waters.

Before leaving this part of my subject a few words upon a peculiar clay from Kaitaia may not be out of place. Having received some samples from the north of fine unctuous pipe-clay, I was informed by Mr. Kelly, of Mongonui, that they used a similar clay to make the roads with in that part of the district, and a large sample was forwarded to me, at my request, by Mr. Houston, who states that after spreading upon the roads at first, the horses stick fast, and have great difficulty in making their way, but that it soon hardens, and, after once becoming so, no amount of rain will cause it to puddle again.

It has been found by later experience, however, not to have proved so valuable a material for road purposes as was expected. The surface becoming abraded in the summer, suffers from the strong winds, which remove a good deal, thus rendering it necessary to frequently repair. On examination this material proves to be a diatomaceous earth, the diatoms being intermixed with very finely divided silica. The exceeding minuteness of these fossil diatoms is so great that under a power of 2,000 diameters the microscope only reveals their globular form. The finely divided state of this siliceous material is the cause of its bedding so firmly while wet.

In concluding, it will be interesting to review the extent of our importations into New Zealand of this class of goods during the last few years. Under this head we will include fire-bricks, china and parian ware, earthenware, drain pipes, and stoneware, the amount being as per invoice assessed for duty:—in 1877, £52,691; in 1878, £49,791; in 1879, £67,164; and in 1880, £34,951; to this last sum must also be added £1,050 for earthenware passed as free goods. When we add to these figures the cost of freight, breakage, and duty, the latter at 15 per cent., it will be seen that the subject I have brought before you is one well worthy a little consideration.

IV.—GEOLOGY.

Art. XLIX.—*A few Notes on Thermal Springs at Lyttelton.*

By R. M. Laing.

[*Read before the Philosophical Institute of Canterbury, 4th October,* 1883.]

Hot springs are found on the sides of most active volcanos, and very often in the vicinity of extinct ones, hence their presence at Lyttelton is not to be wondered at; nor is it strange that the ones to be described should hitherto have been overlooked, for they are out of the way of ordinary travellers. On going along the road from Lyttelton to Governor's Bay, several beaches of sand and one of shingle are passed on the left. It is on the southern extremity of the last mentioned beach that the springs in question are situated, at a distance of about two and a half miles from Lyttelton, and half a mile from Raupaki (the Maori pa).

They are two in number; the more northerly one lies on a grass bank several yards above high-water mark. The water bubbles up from a muddy bottom into a brick well, about three feet in diameter, and two feet six inches deep. Thence it flows into a second and much larger cistern, which is used as a drinking trough for cattle. These troughs were, I believe, built by Mr. W. Webb, of Lyttelton, who, however, does not seem to have noticed the temperature of the water in them. The second spring, which is just within high-water mark, is situated about twenty-five yards to the south of the other, at the foot of a steep bank. The water flows out from a crevice in the rock on to the shingle, and runs down in a streamlet to the sea. Midway between the two springs the sand and shingle are cemented together by carbonate of lime into a crust several inches in thickness, that extends from high to low water-mark. In this cement numerous shells are embedded, apparently the same as those existing on the beach at the present day. Since the sea is continually washing over this incrustation, and breaking off pieces here and there, it is probable that at the time of deposition the outlets of the springs were further from high-water mark than they are now. At that time, too, the flow was probably greater, for in many other places between the springs there are patches of carbonate of lime coating the rocks, and in a crevice close by there are a number of small stalactites composed of the same substance.

The water in both springs, as it issues from the ground, is clear and bright in appearance, and almost tasteless. As yet it has not been chemically analysed, consequently its medicinal properties, if any, are unknown.

It may, however, be remarked that some of the best known mineral waters of Germany are altogether tasteless. In any case an analysis would prove interesting. I have twice carefully observed the temperature of the springs, once in July, 1882, and again in July, 1883. On both occasions the day was cold and overcast. The following are the results in degrees Fahrenheit :—

	July, 1882.	July, 1883.
Temp. of sea	44°	41°
" air	46°	42°
" 1st spring ..	69°	67°
" 2nd " ..	73°	73°

It will be observed that the maximum temperature obtained was the same on both occasions. Hence it cannot be due to any temporary increase of thermal activity at this place; but is probably to be attributed to the expiring heat of the volcanic agencies which formed the Lyttelton crater.

Art. L.—*On the Occurrence of some new Minerals in New Zealand.*

By S. Herbert Cox, F.C.S., F.G.S., Assist. Geologist & Inspector of Mines.

[*Read before the Wellington Philosophical Society, 15th August*, 1883.]

Chalcotrichite.

I have to call attention to the occurrence in New Zealand of another copper mineral not hitherto found here.

The specimen in question is the rhombic form of the red oxide of copper, known as *Chalcotrichite*, and it occurs as a number of fine acicular crystals in the ordinary red oxide or *Cuprite* at the Champion Copper Mine, Aniseed Valley, Nelson.

This being the first time that this mineral has been found in New Zealand, it is interesting to note its occurrence.

Epidote.

In July a specimen was forwarded from Greymouth for analysis by Mr. J. E. Warner, of which he states :—"In the locality whence this was taken there are thousands of tons of boulders of the same material, most of them from a foot to two feet in diameter." Mr. Skey determined this mineral to be *Epidote*, traversed by thin veins of quartz. It has a specific gravity of 3·464. Hardness 6 to 6·5, and is of a pale brown colour.

Tellurium Minerals.

In October, Dr. Hector received from Mr. Pond two specimens obtained from the Maria Mine, Karangahake, and the Moa Mine, Te Aroha, which yielded respectively to Mr. Pond's assay :—

	Silver.	Gold.
Maria Mine	447 oz. 10 dwt.	Trace.
Moa Mine	3,928 oz.	234 oz. 5 dwt. per ton.

These minerals were subsequently tested for Tellurium by Mr. Skey, with the result that in each case its presence in considerable quantities was proved, and from that from the Moa Mine the Tellurium was isolated.

In the case of the Maria Mine the Tellurium is evidently in combination with silver, and the mineral is accordingly *Hessite*; but at the Moa Mine the presence of gold, in the proportion of 1 gold to 16·5 silver, would indicate that the mineral must be *Petzite* if the gold is in combination with the Tellurium, or *Hessite* if the gold occurs in an uncombined state.

This is the first instance of Tellurium being found in New Zealand, and is therefore of special interest.

ART. LI.—*On the Lower Gorge of the Waimakariri.*

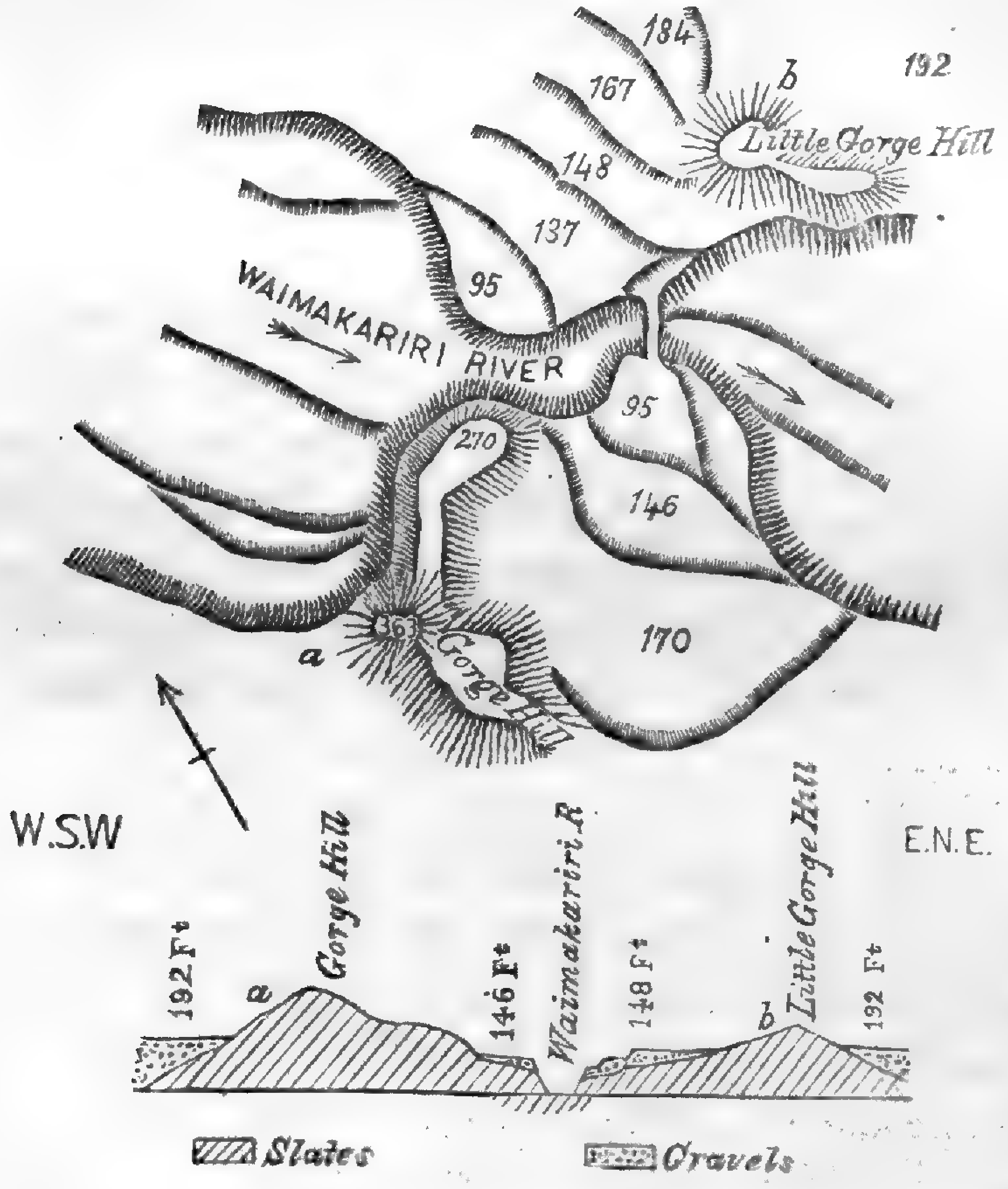
By Captain F. W. HUTTON.

[*Read before the Philosophical Institute of Canterbury, 15th November,* 1883.]

A TRIANGULAR portion of the Canterbury Plains projects into the mountains just north of the Malvern Hills. On the north it is bounded by Mount Torlesse, on the south-west by the Malvern Hills, to the east it merges into the main portion of the plains. This triangular portion of the plains slopes rather rapidly to the east, being at an elevation of 1,400 or 1,500 feet at the base of Mount Torlesse, and falling, in a distance of ten or twelve miles, to about 800 feet at the eastern end of the Malvern Hills and at West Oxford. The even surface of the plain is broken by deeply terraced valleys of the rivers that run through it, and by several small hills situated towards the eastern margin. Two of these hills—Racecourse Hill and Little Racecourse Hill—near the south-east corner of the triangle, are entirely composed of rounded shingle like that of the plains, and remind one of the Eskers of Ireland or the Kames of Scotland. I have not closely examined Racecourse Hill, but Little Racecourse Hill contains large angular erratic blocks washed out of some former morainic deposit, and now completely mixed up with river shingle, but there is no boulder clay.

Racecourse Hill is oblong in form and rises about 50 feet above the plain. Little Racecourse Hill is long, narrow, and rather curved, the concavity facing the east end of the Malvern Hills. Its height above the plain is about 30 or 40 feet. Gravel deposits are also found in places round the base of the Malvern Hills, at estimated altitudes of from 50–70 feet above the present level of the plains.* Ice-borne erratics are found in the upper portions of the triangle and extend down as far as the ford just below the junction of the Kowhai and the Waimakariri. These erratics are embedded in river shingle. Dr. von Haast also mentions large morainic accumulations on the western slopes of Abner's Head, a part of the Malvern Hills.† In addition to these shingle hills, three others, formed of rocks of far more ancient date than the gravels, rise through the plains. They are View Hill, Gorge Hills and Burnt Hills.

The Waimakariri River, rising in the heart of the New Zealand Alps, breaks abruptly into the middle of the north side of this triangle through a deep rocky gorge, called the Upper Gorge, at the eastern base of Mount Torlesse, and runs with a southerly course for about two miles, until it is joined by the Kowhai coming in an easterly direction from the apex of the triangle. The Waimakariri then flows in a south-easterly direction for about $4\frac{1}{2}$ miles to Gorge Hill, which it cuts into two portions—Gorge Hill on the south-west and Little Gorge Hill on the north-east—forming what is called the Lower Gorge. This is crossed by the bridge for the Oxford and Sheffield railway now in course of construction.



* See Geological Reports for 1873-74, p. 57.

† Geology of Canterbury and Westland, p. 392.

That a river running in a shingle plain should make straight for a rocky hill and, instead of flowing round it, should cut it in two, is a remarkable phenomenon; and it is an account of this phenomenon and an attempt to explain it that forms the subject of the present paper.

First as to the facts which have to be explained. Both Gorge Hill and Little Gorge Hill are formed of thin bedded slates and sandstones dipping 75° to W.S.W. at the bridge, but getting flatter higher up the river. On the right bank is Gorge Hill, 363 feet above the level of the river-bed at the bridge.* From the summit a spur runs towards the river in an E.N.E. direction. Its altitude at the river gorge is about 270 feet. Then, following the same line, comes a depression occupied partly by the river, partly by gravel beds, and then, still continuing the same direction, is Little Gorge Hill, 216 feet high. The depression in the slate rocks between these two hills forms a steep-sided, flat-bottomed col, in which the river has cut a narrow perpendicular gorge about 90 feet in depth; the remainder of the col being covered with beds of river shingle, capped by a deposit of silt which, in colour and in structure, resembles the silt deposit at Lyttelton. No fossils have been detected anywhere in the neighbourhood, except the so-called annelid tubes in the slates.

The plains at the north-west foot of Gorge Hill are 192 feet above the river-bed at the bridge, and they extend from thence to the Malvern Hills without any terraces. The plains at the north-east foot of Little Gorge Hill are also 192 feet above the river-bed, and from here also they stretch over to Oxford without any terraces, except some small ones formed by the River Eyre which have nothing to do with the subject of the present paper. The river-bed, both above and below the gorge, is very wide and deeply terraced; but all the terraces, when they approach the gorge from above, contract suddenly and then, below the gorge, expand again as suddenly as they contracted, thus appearing like an hour-glass, the narrow neck of which is at the gorge. It is evident, therefore, that the river has never left the gorge since it first began to cut into the plains and form terraces. However much it may have swayed from side to side, either above or below, the hard rocks of the gorge have always held it like a vice ever since it began to cut below the present level of the plains. But how is it that the plains are at exactly the same level on both sides of the gorge hills? And how is it that the river has cut through the hill instead of running round it?

* The heights of the two Gorge Hills are taken from the trigonometrical survey of Canterbury as given by Dr. von Haast in his "Geology of Canterbury and Westland," p. 476; the levels of the terraces are from the survey for the Oxford and Sheffield railway, kindly supplied me by Mr. G. P. Williams. All the levels here given are calculated from the bed of the river at the bridge, taken as the datum. This datum is 808 feet above high-water mark at Sumner. The figures on the plan show the height in feet above the river-bed at the bridge.

It is possible that at some former period a glacier may have overflowed these hills although there is no evidence of it, for the steepest slopes face the mountains; but if such has been the case it could not in any way account for the facts we wish to explain. A glacier certainly did not deposit rounded stones in large flat plains, and as these stones have evidently been brought down by the river, it follows that any glacier action that might at one time have existed here must have been entirely obliterated by the river gravels long before the phenomena we are now discussing came into existence. We may therefore dismiss all notions of a glacier as a cause. All the gravels in the neighbourhood have certainly, as I have said, been brought down by the river. But is it possible that the river could have deposited them at exactly the same level on both sides of the hills? I think not. But supposing, for the present, that this is possible, can river action alone account for the rest of the facts?

The steep sides of the col in the Gorge Hills and underneath the gravels, as shown by the railway cutting on the left bank of the river, prove that the col itself was cut by the river. This col must have been subsequently filled up with shingle and silt to the level of the highest terrace inside the col, that is to 148 feet above the present river-bed, or 58 feet above the bottom of the col. After that the river must have once more cut down through the shingle and rock and excavated its present gorge. It is evident that the river could not have commenced cutting the col until shingle had been piled up as high as the rocky spur out of which the col has been cut; for until that was done, it could not overflow the spur, but must have run round it. Now not only is there no trace of a river-bed on either side of the hills, but the shingle is not sufficiently high on either side to cover the spur; and as the river could not have piled up shingle over the spur without also piling it up to at least the same height on either side of the hill, it follows that this shingle, which must formerly have existed on both sides of the hill, has been since removed.

There is evidence in the two racecourse hills, and in the gravel beds round the eastern base of the Malvern Hills, previously mentioned, that the shingle did, at one time, reach a level some 50 or 70 feet higher than at present, and consequently it must at that time have completely covered Little Gorge Hill and a large part of the spur; but not Gorge Hill itself, which would still have projected more than 100 feet above the plain. The river may, therefore, at that time have run over the spur at the eastern base of Gorge Hill, and gradually excavated the col. But it seems to me impossible that the river after cutting the col, could have left it and swept off all the shingle to exactly the same level on each side of the hills, and then have returned to the col to cut the gorge. My reasons for thinking so are, firstly, because there are no traces of terraces between the Gorge Hills and the margins of the plains; secondly, because having once cut the col the river would be held there by the hard rocks on either side exactly as it is held now; and, thirdly, because in order to remove the shingle-beds above the present level of the plains, the river must have first filled up the col with gravel to at least this height before it left the col, and there is no evidence of its having done so; the highest terrace inside the col being only 148 feet above the river-bed. Consequently the river can never have left the col since it first excavated it, and it is therefore impossible that the river could have removed the missing gravel beds on each side.

If now we take the only other possible view; that is, we suppose—although there is no evidence in favour of it—that the col was formed by some other agency than the river, which merely filled it and the surrounding plains to their present level; and then, happening to run through the col when it commenced cutting down—which is very improbable—it formed the present gorge. If we take this view then we shall not be able to explain, first, how the river could deposit flat beds of shingle, some ten miles wide, between Sheffield and Oxford; nor, second, can we explain the origin of Racecourse, and Little Racecourse Hills, and the gravel beds round the eastern base of the Malvern Hills; which are shown by the form and arrangement of the materials composing them not to be portions of old moraines, although Little Racecourse Hill contains re-arranged morainic matter. Neither of these hypotheses will explain the facts. If we suppose that the col was cut by the river, large masses of gravel must have been removed without any apparent cause. If we assume that the river did not cut the col, then we cannot account for the gravel hills rising above the plains. Evidently river action alone cannot explain the whole of the phenomena.

The following is my explanation:—The shingle brought down by the rivers not only formed the present plains, but accumulated to a thickness of some 50 or 70 feet higher than at present. At this time Gorge Hill projected above the shingle, but Little Gorge Hill and a large portion of the spur between the two were buried. The river, swaying about in the plains between Oxford and the Gorge Hill, was arrested in its southerly swing by the latter, and then, running along the north-easterly base of the hill over the spur, it cut down through the gravel beds into the rocks and formed the col. A period of general subsidence of the land followed, during which the river partly filled up the col again with shingle, but at length, the depression still going on, the sea reached, and passed, this portion of the plains, sweeping away the upper 50 or 70 feet and reducing all to a common level, except the Racecourse Hills. The col, remaining as the estuary of the river, never filled up to the height of the plains at their reduced level, and, on the land being re-elevated, it remained as the river channel and was gradually cut down into the gorge.

There are several quite independent reasons for thinking that the sea has flowed over the Canterbury Plains; but these I need not repeat here as they will be found in the Transactions of the New Zealand Institute, vol v., p. 387, and in the Geological Reports for 1873–74, pp. 56–58.

On the other hand two objections may be fairly raised to my hypothesis. First, that there is no trace of flattened sea-shingle; and second, that there are no marine fossils. With regard to the first objection we must remember that the form of beach shingle depends a good deal on the structure of the rocks from which it has been derived, and that if the rocks have not a schistose or slaty structure the shingle must remain for a considerable time within reach of wave action before it can acquire a flattened form. This objection may therefore be got over by supposing that subsidence and re-elevation were continuous and tolerably rapid. The second objection rests only on negative evidence as no fossils of any kind have been found. It is of no value here where the beds, except quite the upper portions, are allowed to be of fluviatile origin, and are composed of shingle through which water easily percolates; for under these circumstances all calcareous remains are soon dissolved. I think, therefore, that the objections to the hypothesis here put forward are of far less weight than the objections to any other hyphothesis; but, whatever value may be attached to the argument, it is certain that no theory of the formation of the Canterbury Plains can be satisfactory if it fails to account for the lower gorge of the Waimakariri.

Art. LII.—*Recent Discoveries in the Neighbourhood of Milford Sound.* By Donald Sutherland. Communicated by Alexander McKay.

[Read before the Wellington Philosophical Society, 15th August, 1884.]

Plate XLII.

Messrs. Sutherland and McKay, well known as explorers and prospectors of Western Otago, have for some years past devoted their attention to the vicinity of Milford Sound, and from their principal camp at the head of that Sound, they have explored the country in almost every direction. Surrounded as Milford Sound is by impassable mountains to the east and north, the valley of the Arthur River lying southward of the head of the Sound presents the only hopeful route by which to reach the Lake District of Otago. The eastern branch of the Arthur River, above Lake Abraham, was explored to its source, but no outlet was discovered in this direction, the valley being bounded on either hand and closed at its upper end by high and excessively rugged mountains, presenting some of the most remarkable scenery to be met with in the whole district.

The mountains on the north-east side of the valley are specially striking, and have been called by their explorers the Balloon Mountains. From the river valley these rise as vertical precipices to a height of 5,000 feet, and attain an altitude between 8,000 and 9,000 feet above sea-level. It is here that the Sutherland Falls are situate, which have a height of 5,000 feet, a considerable volume of water being precipitated from that height in an almost unbroken sheet into the valley where this is not more than 800 feet above sea-level. At the source of the more westerly branch of the river, a pass was discovered leading in the direction of the head of Bligh Sound, by which it is hoped communication may be established with some of the western arms of Te Anau Lake.

It seems certain from Maori report that by this way an available route exists, but as yet no European has reached Te Anau Lake, starting from Milford Sound,—or Milford Sound from the other end of the journey.

It is, however, probable that a route this way to Milford Sound was known to the Maoris, as on several points of it traces of temporary or more permanent camps have been discovered.

It is not with the results of these explorations that this paper more particularly deals, but with those of subsequent date made on the coast-line between Milford and Bligh Sounds.

Eighteen months ago McKay left Milford Sound, and Mr. Sutherland has since, for the most part, explored single-handed. A few days since he passed through Wellington and gave me an account of his later discoveries which, in his own words, is as follows :—

"During the month of October last I made an attempt to reach the top of Mitre Peak following the valley on its south side, hoping thus to gain the top of the ridge connecting the Mitre with the Llawrenny Peaks to the south. In this I failed, as the upper end of the valley is surrounded by precipices or smooth rock surfaces, sloping at high angles on which no footing could be found. The upper end of this valley is considerably wider than the middle and lower part forming a semi-circular basin surrounded by precipices as pronounced on the side next the Llawrenny Peaks as towards the Mitre.

"Towards the upper end of the valley blocks of marble occur in the detritus covering the low grounds, but marble was nowhere observed *in situ*. There is also considerable quantity of the purer hornblende rock of which samples had formerly been obtained in the lower part of this valley.

"I next determined to examine the coast-line south of the entrance to Milford Sound, and as weather availed used the boat for this purpose. Landing two miles south of Fox Point, at the mouth of a valley running some distance back into the ranges, I explored this to its upper end considerably east of the entrance to Milford Sound. Its length may be estimated at six miles, its width as two. The valley and the ranges to the north and south are covered with heavy bush.

"For a distance of four miles back from the beach the valley is but little above sea-level, and the stream flowing through it, though of no great volume, is sluggish and navigable for boats for the four miles mentioned. Towards its upper part this valley narrows, and unlike that on the south side of Mitre Peak, does not open out to form a semi-circular basin surrounded by precipices. The mountains are nevertheless very abrupt, and many large slips choke the upper part of this valley, making travelling difficult.

"There is here a greater variety of rocks than in Milford Sound. The principal rock is schist, similar to that met with at Fox Point. Quartz is abundant, although no reefs of this were noticed. Marble and asbestos also occur, but there is an absence of the hornblende rock found in the valley south of Mitre Peak.

"Continuing to the southward I next landed at Poison Bay, and explored the valley of the river which enters the sea at that place. This stream has a volume little less than the Cleddau River at the head of Milford Sound. It drains the south and south-west slopes of the Llawrenny Peaks. Six miles from the coast the river issues from a deep narrow gorge, beyond which it divides into two branches, the largest of which has a direction at first to the south-east, but towards its source turns more to the eastward. The smaller branch rises to the north-east among the Llawrenny Peaks. Below the gorge the course of the river is between west and north-west to the sea. Its valley in this part has a breadth of a mile and a half of flat alluvial land. The hills bounding it slope to the valley at moderate angles, though here and there they are broken by deep gulches and ravines. The country in this part is heavily covered with bush.

"Blue clay-slate is the most abundant rock. This is not a mica schist, but more of a roofing slate, splitting freely into thin flagging. Marble and greenstone occur in the bed of the stream, and in the slaty beds several quartz reefs were noted.

"The valley varies but little in breadth, being as wide at its upper end as near the coast. The river enters the sea on the south side of the bay.

"Leaving Poison Bay I went five miles to the southward, and landed at Little Bay, where entering a tidal river I determined to follow this as far as I could with the boat. This river (pl. xlii.), which is about two chains in width, has on its bar a depth of three fathoms at low water, inside of which there is a greater depth. Followed inland the average width of this tidal river is maintained for a distance of one and a half miles, beyond which it expands

SCALE. 1 Mile ½ Inch.

SUTHERLAND SOUND.

and forms a salt-water lake, divided into two parts by a shingle bar, dry at low water. The lower part has its greatest length across the valley, being better than a mile in this direction, and about half a mile in breadth from the outlet to the shingle bar dividing it from the upper part of the lake. In this basin the depth of water is very considerable, some twenty fathoms.

"The shingle bar, dividing the lake into two parts, and dry at low water, is about half a mile wide at low water; no river connects the two parts of the lake, but the water from the upper part flows over or percolates through the shingle, so that no principal stream is formed.

"Beyond this the upper part of the lake, better than a mile in width, extends to the eastward a distance of six miles, and is bounded on the north side by precipitous mountains not quite so nearly vertical as in Milford Sound. On its southern side the lake has a fringe of flat land, three quarters of a mile wide, between it and the mountains, which are less abrupt than on the northern side of the lake, saving towards its upper end, where they are equally so. At its upper end the lake is narrowed to less than half its greatest width, and there receives two rivers coming from the north-east and south-east respectively, much as the Cleddau and Arthur rivers enter Milford Sound.

"Near their entrance into the lake these rivers are each about a chain in width, and though the weather was fine and the rivers low, they were not fordable when I saw them. That coming from the north-east has a valley about a quarter of a mile in width, and for a mile this has a moderate fall, beyond which it has a higher slope, and appears to become a rugged mountain valley, although the mountains on either side are not remarkably abrupt.

"The stream falling into the lake on the south side is rather the largest of the two. This flows over a rough bouldery bed in a valley considerably less than a quarter of a mile wide, which terminates half a mile from the lake, beyond which the river flows in a tremendous ravine, not more than two or three chains in width, whose vertical sides rise to a height of 1,500 or 2,000 feet.

"By these two rivers a small delta has been reclaimed from the upper part of the lake; and off the mouth of the northern river a small island of shingle is dry at high water. From the sea into the lower part of the lake the tide runs in with a rate of five knots, and over the shingle bar at the rate of three knots an hour.

"The lake abounds with fish in the lower basin, and in the lower part of the upper, though none were caught at its upper end, and following them there is no scarcity of sharks, which infest the tidal river and the lake wherever other fish are found.

"Below the lake the alluvial land between it and the sea is about one and a half miles wide, heavily timbered and abounding with bird life,—wekas are especially abundant; scarcely less so are pigeons, kakas, kiwis, kakapos, and roas. Redbills and penguins are in great numbers on the shingle bar between the two parts of the lake when the tide is out, and as far as birds and fish supply it, there is no scarcity of the means of living.

"The characters of the rocks here resemble more that variety of granite found in the Cleddau River, at the head of Milford Sound, than the other localities of which the rocks have been noticed. There is yet a greater number of varieties than in the Cleddau river-bed; but in all these there is still a resemblance."

Such is Mr. Sutherland's narrative, and I take it for granted that it is sufficiently interesting and important to merit being read here; and from this it may be inferred that besides the larger sounds excavated to such a depth that they are now deep arms of the sea extending far inland from the coast-line, there was a second series of sounds the glaciers that excavated which were connected with less extensive snow-fields,—the great glacier of Milford Sound (a branch of which filled the valley of the Arthur River) dividing these from the greater snow-fields of the Darran Mountains and their southern continuation; they thus were unable to excavate their beds to the same level.

Some of these as we see are now filled and form level lands fit for settlement, while in the case of the Salt-water Lake inland from Little Bay, this is yet a sound to all intents and purposes, owing its greater depth and length to the fact that there is here between the watershed to the Arthur River and the coast-line a greater breadth and a greater elevation of the country than further to the north, south of Milford Sound, and west of the Arthur River.

The glacier excavating this sound must have been fed from the Balloon Mountains, and is an evidence of the correctness of Mr. Sutherland's estimate, that these are higher than the mountains immediately south of Milford Sound.

This lake at Little Bay is not the only example of the kind on the west coast of Otago. Lake McKerrow, in the lower part of the Hollyford Valley and its tidal river, presents the same phenomenon on a much larger scale. That, however, belongs to the valleys of the larger glaciers reaching back to the Darran Mountains, while this has been excavated by the glaciers of the coast ranges.

The distances, as estimated by Mr. Sutherland, may not be in all cases correct, the difficulties of travelling in such a country leading to an over-estimate of these.

Art. LIII.—*Direct Evidence of a Change in the Elevation of the Waikato District.* By Ashley Hunter, C.E.

[*Read before the Auckland Institute, 12th November,* 1883.]

In December, 1875, a paper entitled "Observations on the Evidence of recent Change of Elevation of the Waikato District," was read before this Institute by Mr. James Stewart. In it the author endeavoured to show by certain evidence that the Waikato District had at one time a considerably greater elevation than it has at present. The following additional evidence as bearing on the subject and going to prove most conclusively that such has been the case may prove interesting:—

In designing the present railway bridge at Hamilton it was originally estimated that the cast-iron cylinders would reach a solid foundation at a depth not greater than 40 feet below the present surface-bed of the river; subsequent events, however, proved that this was far from being the case. The cylinders were sunk by the pneumatic process, and excavated by manual labour under air-pressure until a depth of about 60 feet was reached, and the air pressure of 32lbs. per square inch being more than the men could stand, dredging was resorted to.

The excavation throughout the cylinder sinking showed nothing but layers of pumice and quartz sand until the excavations were carried to their present depths, when it was shown by the dredge bringing up large lumps of hard coarse greensand that the formation of the old river-bed had been struck.

The western pair of cylinders were sunk to a depth of 80 feet, and the eastern pair of cylinders to a depth of 55 feet below the present bed of the river. The fact of the eastern cylinders resting upon the same formation as the western cylinders, but at a level 25 feet higher than the latter, proved that they were resting not upon the old river-bed but upon the eastern bank of the old river-bed. This is important as showing that the old river must have had a very high velocity to have scoured out a channel more than 25 feet deep through such a hard formation. Reducing the railway levels to high-water mark at Auckland, we find that the formation level of the Hamilton Bridge, which is practically the level of the surrounding district for some miles, is 126 feet above high-water at Auckland, while the level of the old bed of the river is 51 feet below high-water at the same place. If we assume that in olden times the general inclination of the river from this point towards the sea was the same as now, viz., about 9 inches to the mile, then the minimum change of elevation which we can certainly assign to this portion of the Waikato District at least is about 80 feet.

It is also, perhaps, worthy of note that the Waikato River, just above Cambridge, is at the present time flowing on its oldest and lowest bed of rock, whereas at Hamilton it is at present flowing on a bed 80 feet above its lowest bed, and supposing these two portions of the district to have maintained the same relative levels one to the other, then, looking at what would have been the difference of level of the old river-bed at these two points, there is tolerably conclusive evidence that the river between Cambridge and Hamilton must at one time have had all the velocity of a mountain torrent. As the country lowered relatively to sea-level the river would loose in velocity, and so the large quantities of sand which it held in suspense would be gradually deposited as shown at Hamilton.

V.—MISCELLANEOUS.

Art. LIV.—*Some Remarks upon the Distribution of the Organic Productions of New Zealand.* By W. T. L. Travers, F.L.S.

[*Read before the Wellington Philosophical Society, 15th August,* 1883.]

In the course of last year's proceedings of this Society I brought under its notice some remarks upon the distribution of the land and wading birds found within the New Zealand zoological sub-region.* Whilst engaged in preparing the paper in which I treated of this subject, I was struck with the fact that the fauna and flora of the main islands of New Zealand present features very similar to those which so much impressed the late Mr. Darwin in connection with the organic products of the Galipagos Islands. That group, as you are aware, is situated under the equator, within five or six hundred miles from the western coast of America. None of the islands composing it are large, and all consist of volcanic rocks of recent origin. The group was first systematically examined by Mr. Darwin during the visit of the "Beagle" in 1835, and he tells us that, seeing that most of its organic products were aboriginal creations, occurring nowhere else, he felt, in viewing them, that both in space and in time he seemed to be brought somewhat near to that great fact—that mystery of mysteries—the first appearance of new beings on this earth. He points out, however, that notwithstanding this dissimilarity, all the organic products of the islands in question showed a marked relationship to those of America, and he concluded, therefore, that whilst the group looked almost like a world of itself, it could only be considered as a satellite of the great continent, whence it had evidently derived a few stray colonists, and had received the general character of its indigenous productions.

But the feature which most impressed him in considering these productions, was, that notwithstanding the general proximity of the several islands to each other, each of them possessed species, both of birds and plants, which were not to be found upon any of the others. As a striking example of this, in the case of the birds, he mentions that each of the three species of mocking-thrush which he found there was peculiar to a particular island or to some particular sub-group of the archipelago, and he adds, that although his attention was not soon enough called to the fact to enable him to determine whether the same rule prevailed in relation to a singular group

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* Trans. N.Z. Inst., xv., pp. 178 to 187.

of finches, which formed the greater number of the species of birds found on the islands, he had sufficient reasons for believing that some of the species of the sub-group *Georpiza* were confined to separate islands.

The occurrence of a similar peculiarity in the distribution of a considerable proportion of the birds of New Zealand, struck me whilst engaged in preparing the tables annexed to my former paper, and at the same time drew my attention to the fact that the features which so much impressed Mr. Darwin in connection with the organic productions of the Galipagos, also characterized to a large extent those of New Zealand. In order that you may be enabled to appreciate this peculiarity, I propose to call your attention to some of the more remarkable instances in the case of the avi-fauna and flora.

Beginning with the case of the birds, you will find, on reference to table iii., annexed to my last year's paper, that there are eighteen species peculiar to the main islands of New Zealand, nine peculiar to the North Island, and sixteen peculiar to the South Island. Of the species peculiar to the North Island, there is only one belonging to any genus which contains more than one species and is represented by other species of the same genus in both islands. Of those peculiar to the South Island, there are six belonging to genera which contain more than one species, and are represented by species in both islands, but these six comprize two species of *Nestor* and two of *Apteryx*.

The eight species which remain in the North Island belong to genera not represented by any common form in both islands, and ten of the species peculiar to the South Island are similarly unrepresented; and yet, of the nine species peculiar to the North Island, we have seven which are represented by allied species in the South Island, whilst except the South Island species so represented in the North Island, none of the remaining nine are represented by species in the latter island.

The remarkable character of this distribution becomes even more striking, when attention is called to some of the special instances. Take, for example, the case of *Orthonyx albicilla*, the North Island form of the genus, and compare it with *Orthonyx ochrocephala* of the South Island. To the eye no two birds can be more distinct, and yet in their notes, in their movements, in their mode of feeding and in their nesting, these birds are practically undistinguishable, indicating unmistakably their descent from a common ancestor. Singularly enough, however, the North Island bird is found frequenting the thickets in the rich and varied forest down to sea-level, whilst the South Island one is rarely found outside of the *Fagus* forest, or below an elevation of 500 or 600 feet. Still the curious fact remains, that whilst the conditions of life under which both birds are placed appear to be identical, so great an amount of modification should have occurred in one or other of the forms, assuming either of them to retain the ancestral characters. Take next the two species of *Turnagra.* Now, whilst in these we do not find the same marked differences in plumage as in *Orthonyx*, there can nevertheless be no confusion of the two, and yet with respect to these birds also, there is absolutely nothing in their habits, or modes of life which would enable us to distinguish between them. The distinction in the next instance,—that of the two species of *Glaucopis,* —is still less marked, but affords, when we consider their habits of life, even a more peculiar case in connection with the question of distribution. The North Island bird is a little the more robust of the two, and its wattles are unicolor, varying from bright blue to purple, whilst the South Island bird has the tail, only, blackish at the tip, and its wattles are bicolor, the point of attachment being blue, whilst the rest is red or orange. Wattles are what is termed a secondary sexual character, and why such a variation as that which appears in this case should have taken place, seeing that they are not confined to one sex only, is certainly very unaccountable. As in the other cited cases the habits of three bird species are absolutely identical, this similitude extending so far, that in each, the bird, when feeding upon the leaf of some succulent herb, such as that of the sow-thistle, holds it in its foot after the manner of a parrot.

The differences between the two species of *Apteryx* peculiar to the South Island, and the one peculiar to the North Island, are also well marked, whilst we have, in regard to this genus, the singular fact, that the fourth and remaining species (*Apteryx oweni*) is common to both habitats. This rests, as yet, upon the authority of a single specimen only, alleged to have been found in some part of the Tararua Range. The person by whom the specimen is said to have been obtained, was engaged in surveys which required him to pass some time upon elevated parts of the range, and as he had no apparent motive for practising deception in the matter, and was not sufficiently conversant with the avi-fauna of these islands to see the full significance of his discovery, I am disposed to accept his statement as true until some cogent reasons for distrusting it have been brought forward. The circumstance that two or three specimens of *Stringops habroptilus* have been found in the Kaimanawa Range, lends, as I think, some colour to the probability that *Apteryx oweni* is still an inhabitant of the North Island.

The difference between the species of *Petroica*, and those of *Ocydromus* peculiar to the North Island, and the species of the same genera in the

South Island, are not so marked as in the instances already mentioned, nor would they be likely to excite so much attention. In neither of these is there any form common to both islands.

If we include in this discussion the case of the Chatham Islands, we shall find that there are eight species of birds peculiar to that group and the main islands of New Zealand, and six peculiar to the group itself; that out of the latter one species is represented by separate species of the same genus found in each of the main islands, differing from them, however, in external characters only, and four species allied to, but differing a good deal from species common to both the main islands, whilst one species, of which only two specimens were ever obtained, differs from any member of the family to which it belongs. The first case is that of *Petroica traversi*, the second comprises *Anthornis melanocephala*, *Sphenœacus rufescens*, *Gerygone albofrontata*, and *Rallus dieffenbachii*, and the last is *Cabalus modestus*.

But, besides the peculiarities already noticed, there are others of a still more remarkable character. For example, the North Island possesses two birds which are not found anywhere else within the sub-region of which it forms part, namely, *Pogonornis cincta* and *Heteralocha acutirostris*. The first of these belongs to the *Meliphagidæ*, represented in the main islands and the Chathams by five species altogether, three of which are commonly distributed in the main islands, a fourth being a variety of one of those confined to the Chathams, the fifth being the bird under consideration. Its range even in the North Island, is restricted, although there is nothing in its habits or structure to prevent its being as widely distributed as the other members of the *Meliphagidæ*. The second case, that of *Heteralocha acutirostris*, is even more remarkable, for in its most especial feature, namely, the difference in the bill in the sexes, it is scarcely paralleled by any other bird. Its range, like that of *Pogonornis*, is also very restricted, but there is nothing in its habits or in its apparent wants, or in the general conditions of life in which it is placed, which would appear to render the forests of the South Island an unsuitable habitat.

The South Island furnishes almost equally interesting cases, namely, *Nestor notabilis* and *Notornis mantelli*. There is nothing, *à priori*, against the assumption that the *Notornis* may have originally inhabited the North Island also, and have been extirpated by man. At present it is found only in the south-western parts of the South Island, and is evidently rare, only three specimens having as yet been obtained. It is an interesting fact that another species of this genus, *Notornis alba*, is found in Norfolk Island, one of the distant outliers of the New Zealand zoological sub-region. *Nestor notabilis*, commonly known as the Kea, belongs to the family of the parrots, but is said to have developed the instincts and habits of a bird of prey. It is found in the mountains of the north-western parts of Otago, and its restriction to this range is remarkable, seeing that *Nestor meridionalis*, with which it is very closely allied, ranges over both islands. I have already alluded to the case of *Cabalus modestus*, found on one of the outliers of the Chatham group, only two specimens of which have ever been obtained.

I now propose to call attention to some of the more remarkable instances in the flora of New Zealand, which are calculated to illustrate the parallelism in distribution of the organic productions of these islands and those of the Galipagos Group, premising, however, that the flora of New Zealand has large affinities with those of Australia and South America. In this connection Dr. Hooker points out that—"Of the 303 New Zealand genera of plants described in his Handbook of 1864, about 252 are common to it and Australia, and 174 to it and South America; and that of the 935 species of flowering plants, 677 are peculiar to the Islands, 222 are Australian, and 111 American." The affinity between the flora of New Zealand and that of Australia is singular enough, seeing the great gulf which lies between the two districts; but in view of the fact that the warm ocean current which runs southward along the coasts of Australia and Tasmania, curls round the southern part of New Zealand, and that Australian birds have frequently been borne across the intervening sea during the strong north-west gales which constantly blow upon the western coasts of these islands, it is far less striking than the fact that so many South American forms are represented in our flora.

In the latter connection I may mention, incidentally, a very singular matter. Amongst the insects of New Zealand is one called *Peripatus*, which has been the subject of elaborate descriptions by Mr. Mosely (one of the naturalists of the "Challenger" expedition), and by Captain Hutton, and which is only found in New Zealand, in Chili, and at the Cape of Good Hope. As this insect inhabits only decayed wood, its distribution is most extraordinary, and can, apparently, be accounted for only upon the supposition of a former land connection between the three localities.

The instances to which I am about to call your attention in connection with the distribution of the flora of the main islands of New Zealand are taken from the "Handbook" already referred to, but are confined, as you will observe, to the *Phanerogams*. I am, of course, aware that in some respects these instances may no longer be strictly accurate in extent, but there is nothing in recent additions to our knowledge to affect the general principle which they illustrate.

The first column in the following table indicates the number of species of each genus which are common to both islands; the second those peculiar to the North; and the third those peculiar to the South Island:—

Genus.	Both Islands.	North Island only.	South Island only.
Ranunculus	6	3	11
Pittosporum	2	6	2
Pomaderris	0	3	0
Carmichælia	5	0	3
Metrosideros	3	5	1
Ligustricum	1	0	9
Panax	8	1	1
Coprosma	13	9	0
Olearia	8	3	8
Celmisia	4	0	19
Cotula	7	0	4
Raoulia	3	0	9
Haastia	0	0	3
Senecio	4	5	9
Dracophyllum	2	4	5
Veronica	14	6	21

These instances are sufficient for the purpose of illustrating the proposition contained in this paper, but those who choose to verify it further will find abundant evidence of it in the published accounts of our flora. The New Zealand case, however, is not so striking as that of the Galipagos, as will appear from the following account given by Mr. Darwin. He tells us that in James Island thirty out of the thirty-eight endemic species are peculiar to it, as were twenty-two out of the twenty-six found in Albemarle Island, the same special feature also prevailing in Charles and Chatham Islands. He further illustrates this peculiarity in distribution by the case of *Scalesia*, an arborescent genus of the *Compositæ*, confined to the Archipelago, and containing six species, not one of which was found to grow on any two islands, and he adds, to use his own words "the distribution of the tenants of this Archipelago would not be nearly so wonderful, if, for instance, one island had a mocking-thrush, and a second island some other quite distinct genus; or if the different islands were inhabited, not by representative species of the same genera of plants, but by totally different genera, as does to a certain extent hold good; but it is the circumstance that several of the islands possess their own species of mocking-thrush, finches, and numerous plants, these species having the same general habits, occupying analogous situations, and obviously filling the same place in the natural economy of this Archipelago that fills me with wonder. I must repeat, that neither the nature of the soil, nor the height of land, nor the climate, nor the general character of the associated beings, and therefore their action one on another, can differ much in the different islands, and there seems to be no special difference in the productions of the windward and leeward groups, the only possible natural division of the Archipelago." In attempting to throw light upon the remarkable difference in the inhabitants of the different islands, he points out that, as the Archipelago is free, to a most remarkable degree, from gales of wind, neither the birds, insects, nor lighter seeds, would be blown from island to island, and that the profound depth of the ocean between them and their apparently (in a geological sense) recent volcanic origin, rendered it highly unlikely that they were ever united, a consideration far more important than any other with respect to the geographical distribution of the inhabitants of the group.

But although certainly less striking than that of the Galipagos, the New Zealand case, when carefully examined, and taken with especial reference to the very narrow strait which separates the two islands, and the probability that they were once united, is one of great peculiarity, masked however by the greater extent of the flora, and of the number of orders represented in proportion to the number of genera and species of each.

Without going more at length into this subject, which might be wearisome, I think I have shown sufficient to excite the attention of naturalists, and to induce such observations as may help us to a clue to the special causes, which, under the law of natural selection, have brought about these remarkable results.

ART. LV.—*On the Brown Trout introduced into Otago.*—Paper No. 2.

By W. ARTHUR, C.E.

[*Read before the Otago Institute, 13th November, 1883.*]

Plates XLIII. and XLIV.

THE first paper of this series I read to this Institute in 1878,* and the results of my observations continued since then I now propose to lay before you. My chief object in so doing is to record the effects (if any) consequent on the acclimatization of trout (*Salmo fario*) in our waters; on their growth, habits, and structure, as bearing on the theory of the variation of species. Dr. Francis Day, late Inspector-General of Fisheries for India, has made public his investigations on trout in England,—carried out about the same time as my first observations,—and which bear out, to a great extent, the fact that the anatomical distinctions laid down by Dr. Günther in his catalogue, between some of the species of Salmonidæ, are not altogether to be depended on. Professor Huxley also has recently commenced an examination into the distinguishing marks of the young of the British Salmonidæ,—

* See Trans. N.Z. Inst., vol. xi., art. xxiv.

a difficult problem to settle satisfactorily. It thus appears that the need for careful revision of those distinctions is recognized by these two eminent authorities on ichthyology.

My subject naturally suggests for its elucidation such considerations and facts as explain the distribution, growth, habits, and structure of our trout. Besides many trout which I have handled and observed as to external markings during the past five years, the evidence I shall give (particularly on their structure) is more strictly confined to my examination of seventy-five specimens, taken from nineteen different rivers and waters, including one interesting trout from a Canterbury stream. The fish were of both sexes, and varied in weight from ¾ lb. to 17 lbs. In the appendix to this paper I shall give some particulars of each fish as noted on examination of a certain number.

I.—*Distribution.*

Absolute precision in ascertaining the facts in the life-history of our trout in their *wild state*, so as to deduce from these the general laws to which they are subject, would necessitate so much positive labour, inspired by enthusiasm, that I despair of its attainment in New Zealand. Neither am I aware that such has been attempted in older countries, as England, Germany, and North America, where the social advantages are more favourable towards supplying the necessary leisure and means. For these observations include such as refer to the *geological formation surrounding a river or lake*, the *chemical constitution of the water*, the *supply and variety of food*, and the *meteorological conditions of the atmosphere*, with the *marking, recapture, and examination of the trout*, also their *natural enemies*. Many different rivers also would require to be included, owing to their varying characters, and the observations should extend over many years. Many may think this programme of work superfluous, and may here ask, have we not the experience of aquaria and of fish-hatching establishments to guide us? Quite so, but it must be remembered that the habits of fish so situated are of fish in *confinement*, where it is impossible to afford them the advantages of nature, so that their habits must, to a considerable extent, be forced and unnatural, and therefore misleading. Such being the position of matters, the best that one can do at present is to lay under contribution such information as may be at command, imperfect though it may be. What then are the circumstances of our rivers and lakes, and what the effects so far on introduced trout?

Geological formation.—Nearly all our rivers originate among mountains of gneiss and conglomerate, which drain the country from the Waitaki River on the northern boundary of Otago, southwards to a line drawn from Balclutha on the Clutha River, to the Mataura River passing over Popotunoa

Hill. From this line, southwards to the coast, the rivers rise among older or trap formation, and flow more or less through a wooded country. Among the former, as a rule, the higher parts of the rivers are rock-bound, while the lower reaches and mid portions pass over alluvial flats, the shingle and gravel in their channels being the *débris* of their parent rocks with more or less quartz pebbles and fine sand. Among the latter class the gravel is almost wholly trap with a little quartz, while very few streams among either have beds entirely of clay or loam. A great number, especially of our smaller rivers, are rock-bound in their entire course, and so, having a scanty supply of gravel, are deficient in breeding capabilities; but perhaps two-thirds of all the rivers are well adapted for spawning, so far as gravel and sand can contribute to that end. One curious exception, however, must not be overlooked here, viz., the Water of Leith, which, possessing a rocky channel full of volcanic boulders, particularly in its lower course, and a scanty supply of gravel, yet for several years subsequent to 1874, when it was opened to anglers, produced an astonishing number of trout. It has not maintained this character, but that is due to excessive fishing and poaching. Rivers to the west of the Mataura are not included in the above references, as the stocking of these has not been kept up; and I have only examined one trout taken there, viz., from the Oreti, a snow-fed water.

The banks of the rivers are very much yet in their natural state, covered by native grasses, and in some cases, bush; but cultivation has overtaken all the lower plains of the main streams to within a few yards of the water. Cultivation no doubt affects the character of the food-supply, and quantity also; so do grass fires around the upper waters, while both lower the mean flow of water in the rivers, directly and indirectly, also causing floods to become much more violent, high and mischievous, although shorter in duration than they used to be. During a residence of twenty years in Otago I have seen quite enough evidence of the latter of these facts, as for example in Shag Valley.

The mouths of the principal rivers which enter the sea directly have estuaries, protected by sandy bars. In the case of the Kakanui, Shag, and Waikouaiti Rivers the tide has a course of a mile and a half or more, upwards from the sea; while the tidal way of the Mataura may be estimated at five miles at the very least. Some of our best trout streams do not discharge directly into the sea, but are feeders of larger rivers, having tidal estuaries. So much then for a general definition of the geological conditions of our trout rivers that relate to distribution.

It only remains in this connection to mention that the lakes into which trout have been placed are the Wakatipu, Wanaka, Hayes Lake, Waihola, and Tuakitoto. The surroundings of the three former of these lakes are decidedly alpine. Gneiss, slate, and volcanic rocks hem them in; they are very deep, abysmal in fact, and have very few shoals, such as exist being the *débris* of slate or shingle. The Wakatipu and Wanaka are exclusively snow-fed waters, the supply being the drainage of the nearest ranges of the Southern Alps. Hayes Lake receives very little snow-water. All three lakes are situated about 1,000 feet above sea-level, and bottom has been found in the Wakatipu by Dr. Hector at 1,300 feet, and by Mr. Connell in the Wanaka at 600 to 1,000 feet. On the other hand, the Waihola and Tuakitoto Lakes are of a totally opposite character. They occupy the middle of alluvial flats nowhere 50 feet above sea-level, in fact they are affected by the tides; their bottoms are mud or silt, and they have nowhere a greater depth than 12 or 15 feet of water, if so much.

Chemical Constitution of the Water.—This is the next consideration bearing on the well-doing and distribution of our trout. But I regret that as yet it is a field for inquiry almost wholly neglected. Dr. Black, of the Otago University, has very kindly analyzed several waters for me, viz., waters from the Opoho Creek where our local fish-rearing ponds are placed, from the Wakatipu Lake, Rowell's Spring, and from the Wallacetown salmon ponds; but beyond these I do not think that the water of any of our rivers has been examined, so that for the present we are tied down to the general and negaive evidence that where the trout do well the water must be suitable in chemical constituents, other things being equal. I may, however, repeat here the Wakatipu analysis, which I have already given in a former paper on fish culture* as it has a direct connection with facts I shall have occasion to mention when I come to describe the habits of our trout. It is this:—

Organic matter in solution.	Degrees of hardness.	Table salt.
Wakatipu water, ·5 grs. per gal.	3·1	Scarcely a trace.

The absence of salt in this water is not conducive to health in trout. I hope some day to be in a position to get these desiderata; meantime the only other fact of a chemical nature which suggests itself is, that our rivers divide themselves into two classes—those still in their condition of native purity, and those more or less polluted by the mud and silt from our gold mines.

Meteorological Conditions of our Rivers.—By this I mean such influences as affect our waters through their connection with rainfall and snow, frost and heat, winds and atmospheric pressure. And here the *snow-fed* rivers at once stand out with more or less distinctness as apart from non-snow-fed rivers; just as the muddy gold-mining waters differ from the clear streams. With one exception (that of the Oreti River) all the snow-fed rivers of Otago, both within and beyond the limits I

* Trans. N.Z. Institute, vol. xiv., p. 200.

have already assigned to my enquiries, have their sources in large inland lakes, and include the Waitaki, Clutha, and Waiau Rivers. At the same time I think that the Pomahaka and Mataura Rivers may be said to be partially snow-fed; but the other rivers and streams from the Mataura to the Waitaki may very properly be regarded as not coming within that designation. The lakes also of the interior, lying at altitudes above sea-level of 1,000 to 1,400 feet, and surrounded by steep snow-clad mountains from 5,000 to 9,000 feet in height, in the spring and early summer become charged with an excess of snow-water, which raises the rivers which are the effluents of these lakes to the greatest height they attain during the year. And warm rain, with a north-west wind under such conditions invariably causes very heavy floods, sometimes disastrously so. Perhaps scarcely less important in their bearings on trout are droughts with warm low water in summer, and frosts in winter, but these latter I consider do not affect our rivers much. The greater proportion of the Otago rivers are not affected by snow during the spring, summer, and autumn months, and so are all the better adapted for affording a food supply, as well as more suitable water for the growth of the young trout fry.

Added to the above considerations the winds, temperature of the water, and atmospheric pressure also combine to exercise their influence on the breeding, food-supply, growth, and habits of our trout. For example, a clear rapid snow-fed river produces, with a light-coloured bottom, silvery trout, while the food cannot be very abundant or varied, and the chances of the ova hatching out are not great. Very cold water, with too rapid a current and shifting shingle, is eminently unfavourable to the reproduction of food and growth of fishes. Such a river is the Clutha in its upper waters. On the other hand such trout as it could support would probably escape fungoid growths. Of an opposite class is the Waiwera or Waipahi—with an average flow of water, dark bottomed, good pools and reaches, with plenty of shelter under the banks, and much vegetation on these banks, abundance of food from the land, from aquatic plants, and from the gravel and rocks, also at a certain season from the sea even—where we find trout fairly plentiful, brown coloured, with golden bellies and scarlet spots, of immense strength and most excellent flavour.

At this point I might be asked to explain more fully what on earth trout have to do with gneiss and conglomerate, with the chemistry of water, with the temperature of water, or with the particular compass-bearing of the wind that may blow over the water? And yet these things not only affect them directly through their organs of breathing and secretion, but what is even of greater importance, indirectly through their stomachs. Well aerated water is very necessary to a trout's vitality, but that is of no use unless it has plenty to eat. But my difficulty is, within reasonable bounds, in such a paper as this, to do justice to what I have sketched out in my preceding remarks. And not only so, but without a knowledge of what I have yet to say, and which overlaps in many ways the former, these former statements themselves would be practically unintelligible. I may, however, here describe as shortly as possible these relationships between inert matter and trout life, and leave further and fuller details to what has to follow when they become necessary in dealing with the growth and habits of our trout.

The *geological* formation of a river's water-shed, then, is the basis or origin of nearly all loose rocks, stones, gravel, sand, clay, and loam, which form the banks or bed of that river. According to the nature of the soil in the vicinity of a river, so is its fertility or otherwise—altitude, climate, and exposure being also factors. The fertility determines the abundance of vegetation, on the land and in the water, and that the supply of insect life, of molluscs, crustaceans, etc., all the staple food of our trout.

Again, the *meteorological* influences at work are by no means contemptible. Heavy floods in the spring or winter before the ova begin to hatch out are believed to tear up and wash away the spawning beds or "redds." Lowness of rivers, with frost, after spawning, is also fatal to ova, but that is not likely to affect many of our waters. Floods, however, must also wash away and kill the eggs or larvæ of aquatic insects, as well as of the Ephemera and Diptera (the flies of our summers), so injuring the food supply of the future. On the other hand, droughts during summer in very warm weather, result in the growth of low organisms, Fungi, and Algæ, especially, but not necessarily, where there is bed-rock. Anglers know too well here the ugly green weed they name "blanket weed," which entangles their lines at every cast; and although it may contribute to the production of minute species of fish food, it must sicken and cannot improve the health of our trout. Wind, too, by its agitation of long deep pools, causes a muddiness of water, and drives all surface food to leeward, killing it at the same time. Certain winds on some waters have a marked effect in contributing to the feeding or the prevention of feeding in trout.

In like manner much might be written on the consequences of changes in atmospheric pressure, which there is reason for thinking have a good deal to do with the times when trouts are on the move. So, also, as to the essential health-preserving qualities of water which contains plenty of air in solution, and of common salt. But I must now proceed from these considerations, to gather together and lay before you the actual position of the trout experiment in our waters at the present time under these conditions.

Growth.

It is of the first importance, at this stage, to be sure of the real species of trout which has been introduced into Otago—the progeny of the original lot got for us in Tasmania by Mr. G. P. Clifford, in 1868. Now, Mr. Clifford has told me there could be no crossing with *S. salar* or *S. trutta* at the breeding ponds on the Plenty, in Tasmania, as the trout there were carefully kept separate, and in ponds by themselves. So far, good; and as I stated in my previous paper, the original ova from England were taken from three rivers, the Weycombe, Buckinghamshire, and the Wey, by Mr. Francis Francis; and from the Itchen, by Mr. Frank Buckland. The Salmon Commissioners of Tasmania, however, so far as I could find out, have not placed on record the precautions taken, if any, to keep the lots separate in the hatching-boxes, or to say what proportion of each were reared and produced ova. All I have been able to learn is that many ova died, and that it is impossible to determine which English river or rivers may be represented by the progeny. However, taking Dr. Günther's arrangement of species as my guide, it determines the trout from any of the above-named rivers to be *S. fario ausonii*, or the southern form, which I take to be the same as the Thames trout. It is capable of growing to a large size in its native streams, or may be called a large-framed trout, and is believed by good authorities to drop down into brackish water sometimes, or even as far as the sea itself. While it may be admitted readily that this trout does sometimes migrate in this manner, I must remark that I have never seen any absolute demonstration of the fact adduced by any author. But I shall have occasion again to offer my own observations on this point, and so shall leave it alone now.

The period of *hatching* at our Opoho hatchery may be seen from the following examples:—

Year and Locality Trout Ova got in.	Last Ovum Hatched.	Time of Hatching in days.	Temp. of Water. Fah.
1868 Ponds at Plenty, Tasmania	October 30th	About 70	
1869 " " "	" 14th	" 70	
1878 Otago Rivers	..	" 78	42°—52°
1879 "	" 23rd	78—88	41°—50½°
1880 "	" 30th	80—95	40°—57°
1881 "	" 20th	64—75—77	41°—53°
1882 "	" 30th	70—80	39°—50°

The Tasmanian ova may properly be omitted in determining the ordinary time taken for hatching, as they were subjected to unusual vicissitudes before reaching Otago. The mean time of the other lots taken from trout in Otago waters is 78 days, or, leaving out the manifestly abnormal durations of 64 and 95 days, we get a range of 70 to 88 days, or, on an average, 78 days, which is very nearly the same as an average of all the days from 1878 to 1882, including these abnormal numbers. Among the 1880 ova, the lot which took 95 days to hatch are thus referred to by Mr. Deans, the local society's manager :—" They were impregnated on July 27th, and on October 30th I preserved a few eggs, which were still unhatched ;" while his note on the other abnormal case in 1881 is this :—" Boxes 9 and 12 impregnated August 17th, hatched out on October 20th, 64 days." The first of the season's ova were impregnated July 12th, 1881, from which date to August 17th, the water in the hatching-boxes showed an average of 43° by Fah. thermometer ; while from August 17th to October 20th, the thermal readings, I have gone carefully over, and find that they also give an average of 43° exactly ; so we may conclude that the temperature of the water had nothing whatever to do with the rapidity of this particular hatching. Much more complete observations would have been required than have ever been kept, to detect the real reason of this, but the parent fish of this 64 days' lot were late spawners. Mr. Deans has found that 1½° Fah. difference of temperature makes 10 days' difference in the time of hatching at Opoho in the creek water.

It is of interest to compare the time of development from impregnation to hatching in England with the above. In a report on the Cray Fishery, Kent, I find the time given at from 70 to 84 days,* practically the same as our experience in Otago has proved it to be. But this does not show what the time has been in other English hatcheries, and is much longer than that given by Yarrell as the result of an experiment in Germany, where it was found to be only 35 days. We find, however, that temperature affects the time very much, and probably late spawners too. Among all the authorities on fish within my reach, there are but two others who make mention of the period of trout hatching, viz., Rev. W. Houghton, in " British Fresh Water Fishes," 1879, where he gives it as 60 days, and the temperature 40° to 45° ; and Mr. Francis Francis, in the " Practical Management of Fisheries," 1883, where 63 days is, as nearly as I can make out, the mean time recorded. From the above cases, it would seem that the average duration in Europe is somewhat shorter than in Otago by about three weeks, but whether this is corroborated by the experience of fish-culturists generally at Home is more than can be readily found out. The three English examples quoted, however, show a mean of 67 days, or 10 days shorter than we have it here ; and there is no alteration in the time observable during the past five years in our Opoho hatching-boxes, from what it was prior to 1878. But our trout can only properly be compared with their

* " Illustrated Sporting and Dramatic News," February 24th, 1883.

immediate ancestors in England; and as Mr. Francis, in above treatise, tells us that Thames trout spawn early, or in November, and are correspondingly early in getting into edible condition in the following spring, I presume I am correct in taking 63 days as the average duration for the hatching of these, and November as their spawning month. If this is so, then this same trout species in Otago takes 78 days to hatch out, and spawns from the middle of June to the end of September, according to locality—the coast streams from June 1st to end of August, and the Wakatipu streams in September. In other words, the same species of trout here is about two months later in spawning, and the ova ten days to a fortnight longer in hatching than in England.

Growth in the Shag River, Leith, Lee, Deep Stream, and Upper Taieri, 1875 *to* 1883.

The weight, as a measure of the growth of our trout, must next receive some attention, and the first question one naturally wants answered is, Have the trout maintained their previous rate of growth during the last five years? Well, in my first paper, bringing down observations to 1878, five rivers are mentioned, with their heaviest recorded trout as:—Shag River, female trout 16½lbs., yearly growth 2¾lbs.; Water of Leith, male 12½lbs., yearly growth 1½lbs.; Lee Stream, 5lbs., yearly growth 1lb.; Deep Stream, 8lbs., yearly growth 1⅓lbs.; and Upper Taieri, female 6lbs. 6oz., yearly growth 1lb. Now it is extremely difficult to compare with the foregoing the growth of trout in the same waters during the past five years. This arises from the principle that it would be hardly correct to assume that the heaviest fish weighed since 1878, were part of the original stock put into those rivers in 1869, unless their extraordinary size should render that supposition probable. The only other possible solution is one which has not been tried, at least not on a scale sufficient to give any results, and that is such proof as may be got by marking a great number of fish, returning these to the water after being weighed, and re-weighing the same fish years after when again caught. This is the best and most unquestionable test, but until it is made we are constrained to appeal to such approximations as may be got from the average weight of fish per day taken by anglers for each year. From one angler's diary I can give this; only, however, as regards the Lee and Deep Streams. Before doing so I may as well mention the weight of the heaviest single fish killed in each of above rivers from 1878 to March 1883; also the mean weight of a number of the heaviest, from actual notes of the fish weighed, and in one or two cases from memory. They are these:—Heaviest trout, Shag River, 14lbs., in 1879; Leith, 17lbs., in 1880; Lee, 10lbs., in 1882; Deep Stream, 10lbs. (seen but not caught), in 1882; and Upper Taieri River, 20lbs., in 1880, caught by Mr. Grieve. The yearly increase in weight of these, supposing them to be 1869 fish, will be, deducting half a pound for 1868:—1·22, 1·41, 0·71, 0·71, and 1·66 lbs. respectively. This is a decrease in the rate of growth for each of these rivers, except the Upper Taieri, since 1878, while the actual weight of the fish under consideration has increased, excepting in that of the largest from the Shag River. At the same time I think these rates too low, as the most of the trout in all likelihood were not of those turned out in 1869. Then the mean or average weight of all the heaviest trout for the period 1878 to 1883 I find to be as follows:—Shag River, 11·4 lbs.; Leith, 14·6 lbs.; Lee, 5·6 lbs.; Deep Stream, 6 lbs.; and Upper Taieri (one fish), 20 lbs. Now, the evidence of each of the three preceding results is as a whole, that the weight of the *largest* trout has increased, while I may add their numbers have undoubtedly decreased in these rivers. This agrees generally with the belief of anglers who have fished the same waters.

The average weight of *all* trout taken per day together with their numbers, in the Lee and Deep Streams, may now be examined. This, as before explained, I can only give from the angling diary of one fisher, as those of others are very incomplete. From 1875 to 1883, then, the average number and weight of all trout caught per day for the two periods or divisions was:—

Lee Stream.	*Deep Stream.*
1875 to 1878, trout per day, 2·67; average weight, 1·25 lbs.	Trout per day, 3·66; average weight, 1·20 lbs.
1878 to 1883, trout per day, 1·50; average weight, 1·52 lbs.	Trout per day, 2·56; average weight, 1·86 lbs.

This example is so far confirmatory of above evidence, and shows that the stock of trout in these two streams has certainly become fewer in number, but heavier in average weight, during the latter period.

It will be remarked by anyone examining carefully the weights of trout I have given, that the heaviest were taken in the Shag River, Water of Leith, and Upper Taieri River. The two former of these waters differ greatly from one another in the geological character of their channels, and also from the latter river; but they also appear to possess a more abundant and varied supply of food than it; nevertheless, the heaviest fish have been both seen and caught in the Upper Taieri River, which raises a curious question as to the food-supply of that river. The upper waters, by a rapid descent to the Serpentine Flat, drain the slopes of the Rock and Pillar and Lammerlaw Mountains. Trap and gneiss may be taken as the rock formation of these ranges, their flat tops being also distinguished by immense bogs and morasses. The Serpentine Flat is about 10 miles long, with a heavy loamy soil, in some parts marshy, and has a fall of only 4 feet to the mile. The river-bed consists of clay, overhanging banks, and a gravelly bottom, and in its course is extremely tortuous. It has also plenty of fine weed-beds, as nurseries for fish-food. The water is deep and has very little current and no stream, consequently there is an extraordinary range of water. It is discoloured sometimes by gold-mining works slightly. This is the Upper Taieri, where most of the great trout are, and it has an altitude of 1,800 feet above sea-level. The food-supply is not as yet well ascertained. It certainly does not include our smelts and whitebait (*Retropinna richardsonii* and *Galaxias attenuatus*), which are anadromous, and only found within a certain distance from the ocean; but I believe I am correct in saying that it consists of crayfish, fresh-water molluscs (*Limnæa*), flies with their larvæ, beetles, grasshoppers, and of fish, bullies and minnows (*Eleotris gobioides* and *Galaxias fasciatus*). So far as my own knowledge goes, I am satisfied there is not by any means a great number of these two latter fishes in the Upper Taieri, and bottom feed generally is not superabundant. The great weight attained by the trout must evidently then be the consequence of a fair supply of food, both surface and bottom food, but more particularly the unusual range of water and the excellent shelter afforded by the river's banks. The Shag River, in its upper waters, flows over slate formation, being a good deal affected by silt from gold-mining operations; and in its lower waters over shingle, gravel, and sand, with good pools and plenty of range; while the whole course of the Water of Leith is over trap boulders, and it has few pools, with little shelter except from bush, and no range of water. The food in both is generally similar to that in the Upper Taieri; but besides that they have the great advantage of an endless supply of the migratory fish, the smelts and whitebait. The Shag River fish, living within the limits of migration, therefore, of these little visitors, are fat and well-formed and still fairly plentiful, the largest trout being near the tidal way, and small trout numerous above. The larger trout, however, are not now found in the Leith except during the spawning-time. Fishing has fallen off very much during summer; and this winter, for example, although Mr. Deans searched the Leith several times carefully, he found no large fish till a big flood had come down. This proof is of course negative, yet when the smallness of the stream, and want of water and shelter are considered, it seems reasonable to believe that as large trout are not now seen in the Leith except during winter, they must live in the brackish water at its mouth or in the bay itself, for nine months out of the twelve. And this is further borne out by the fact of many large fish being netted by fishermen in the bay, with the characters more or less of the brown trout.

Fishing has not been much practised in the Upper Taieri, owing to its inaccessibility, so the progress or falling off in its stock of trout cannot well be compared with what it was previous to 1878. At the same time both large and small fish have been seen about Patearoa, which is ten miles below where any were liberated. These were in considerable numbers and in weight from 1 lb. to 10 lbs. Also the numbers and weight through the Serpentine Flat keep up well. But the Lee and Deep Streams have been regularly fished, untill 1882–3, when they were nearly forsaken by anglers, owing to the lamentable decrease in the number of fish and the consequently poor fishing. Now these streams are to a great extent alpine and rock-bound, and the water of the Deep Stream is greatly affected by snow water till the end of November, so that they cannot contain a very great food supply, so far as bottom feeding goes, while the surface food has diminished to an extraordinary extent by the almost total disappearance of the previously innumerable hosts of grasshoppers. The bottom food of these two streams consists mainly of larvæ, fresh water whelks (*Limnæa*) and crayfish, and the great numbers of these which must have been devoured by the trout, during the first few years after these waters were stocked with trout, must inevitably have reduced the breeding numbers on which the succeeding food supply depended. The disappearance of the grasshoppers may be the result of grass fires and the presence of starlings, but there is no great certainty about the matter, as grass fires were just as common before as after angling commenced, and I have never seen starlings feeding among the native grasses. There are other causes in operation which I believe have had their effect too. Neither stream seems to contain good breeding ground, although there is plenty of gravel in their upper waters, and the local Society has made a mistake in turning out the thousands of young trout too small and helpless (half inch to three quarters in length). It was only last summer that Mr. Deans, watching a number of these baby trout he had just put into a stream in the Oamaru District, actually saw the native bullies seize and eat or rather swallow some of them! The first trout ever liberated in these streams were strong and well-grown, from two to three inches long, and they as we know thrived admirably, as in six years they became numerous and had attained a weight in some individuals of 5 and 6 lbs. Pollutions from gold-mining have occasionally spoiled the angling, and probably the hatching of the ova too. Then we have shags or cormorants haunting the Lee and Deep Streams, as well as almost all our other waters. These birds live solely on fish, and as the two streams I am at present referring to have few native fish, and no migratory smelts at all, the wholesale destruction of trout up to a pound in weight is a sad certainty. I have never myself convicted any of these villains from positive proof, unless on one occasion, when one of them actually seized my artificial minnow under the water when quietly spinning it in a deep pool in the Lee Gorge! But others, as Mr. Peat and Mr. Clifford, have told me they have seen them at work, or actually cut the trout out of their stomachs, as many as fourteen in one bird being found by Mr. Peat. It is a curious fact, also, that the only places where young trout can be seen at all plentiful are close above and below the accommodation houses on the Lee and the Deep Streams. The reason of that is, I have little doubt, the constant presence and passing of human beings at these places tending to scare the shags from the immediate vicinity, so that at these parts the trout enjoy comparative protection. The destruction of trout by only fifty shags during a year on one river, allowing each bird five young trout per day, a very moderate allowance, would amount to 91,250. I do not, as a matter of fact, believe they are quite so successful in plundering, but it gives their capabilities an alarming reality to consider these figures. Lastly, this variety (*S. fario ausonii*) evidently requires more range of water, and a greater food supply than these two streams afford it; for it has been matter of observation for years that the bulk of the trout have been working down stream. Almost every good basket for the last three years has been taken in the lower gorges, while very few fish have either been caught or seen in the upper waters. There can be no doubt also, that constant fishing has reduced the stock, for in angling everyone here has found that the biggest fish in a pool "rule the roost," and these are to a certainty the fish which take fly or bait first. For example, I killed in one pool in the Deep Stream, with grasshopper, first a three and a half pounder, and then, within a few minutes, two trout, one pound each, or about that weight. So that when a large trout is killed in a pool, it not only takes longer to supply its place by the natural growth of another which might be smaller, but there is also the loss of the greater number of ova that a large trout can produce beyond what a smaller one can, if a female.

A careful consideration of the facts I have just mentioned has led me to the following conclusions: The Shag River has plenty good spawning beds, abundance of range in its pools, and a good supply of bottom feed, supplemented from October to April by immense shoals of smelts and whitebait. Although not quite so large as formerly, its trout remain fairly plentiful, the small ones very plentiful, and are very fat and in good condition, and very silvery in appearance. During the last fishing season, the "takes" were not nearly so good as in the preceding years, still I regard the Shag as one of our best trout rivers and one not likely to be soon fished out. Some idea of the best takes of trout in the Shag may be gained from two days' fishing by Captain Fullarton, in the season 1880–81. On one of these days, at Rich's Ford, he killed four trout with minnow, weighing respectively 12lbs., 10lbs., 3lbs., and 1lb., and the other day, up at Hunter's, he got nine trout from 2lbs. to 7lbs. in weight. But as regards the Water of Leith the case is very different, for year after year the fishing has fallen off, and so have the weight and numbers of trout taken during the fishing or summer season. Running as it does through the city of Dunedin, and fished every day by dozens of anglers, so small a stream possessing such indifferent cover and range of water is bound to suffer, and indeed it is hardly now worth fishing in. It is only during the spawning time that the great trout now appear (as I have already stated) and this winter we took out of it for stripping very fine fish of all weights from 2lbs. up to 16lbs. There is not enough food even including whitebait to maintain such heavy fish, so they must frequent the tidal and salt water, where the food supply is much more plentiful. That is the only explanation I can offer to account for their great weight. Many thousands of young trout are put into the Leith yearly, so the falling off in its productiveness I do not doubt is mainly due to excessive fishing and also poaching during the spawning season, of which latter fact there is no lack of proof. The Upper Taieri River I need hardly almost refer to again, as I have already said that its wonderfully big trout are consequences of great range of water and a fair supply of food. It is a trout stream, however, sure to suffer from the depredations of shags, which are too numerous on the rocks at different points on its banks. The Lee and Deep Streams not having the benefit of fresh shoals of migratory smelts every season, have deteriorated so as to be very inferior as trout producers to what they were five years ago. For their natural food supply being limited, while anglers and shags have both fished them incessantly, the stock of trout is not equal to the struggle (at present at all events), hence their disappearance to a great extent. Both streams have also been much polluted at times by gold-mining, which must destroy the ova as well as fish food. The rate of increase in weight of the trout in the above waters yearly is still greater than in England, but as a whole it is falling off. Mr. F. Francis says that a three-year-old Thames trout will weigh one pound. This must suffice for the present regarding the distribution and growth of trout in the Shag, Water of Leith, Upper Taieri, Lee and Deep Streams, during the past five years as compared with the preceding ten years.

Growth in other Otago Waters, 1878 *to* 1883.

I must now proceed as shortly as possible to record similar facts about other Otago waters not dealt with in my first paper, and from which we will see how the trout have fared in these since 1878 down to the present year. I shall take the rivers from the north end of the province down to the south end in succession.

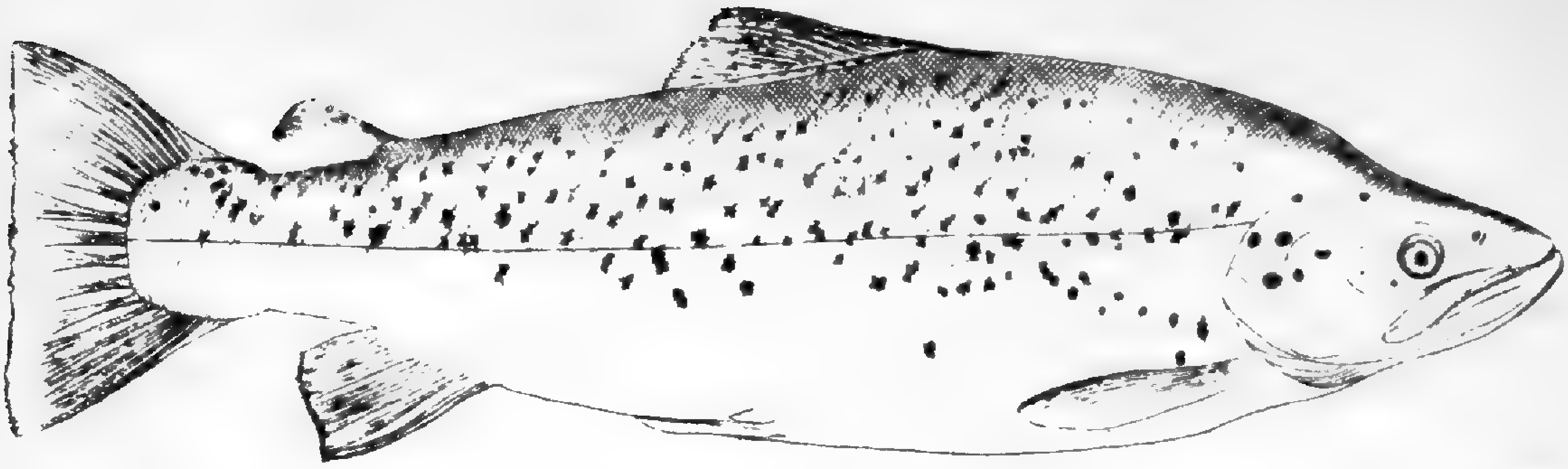

Fig 1

Shag River — male 4½ lbs., length 20⁷⁄₁₀ in.

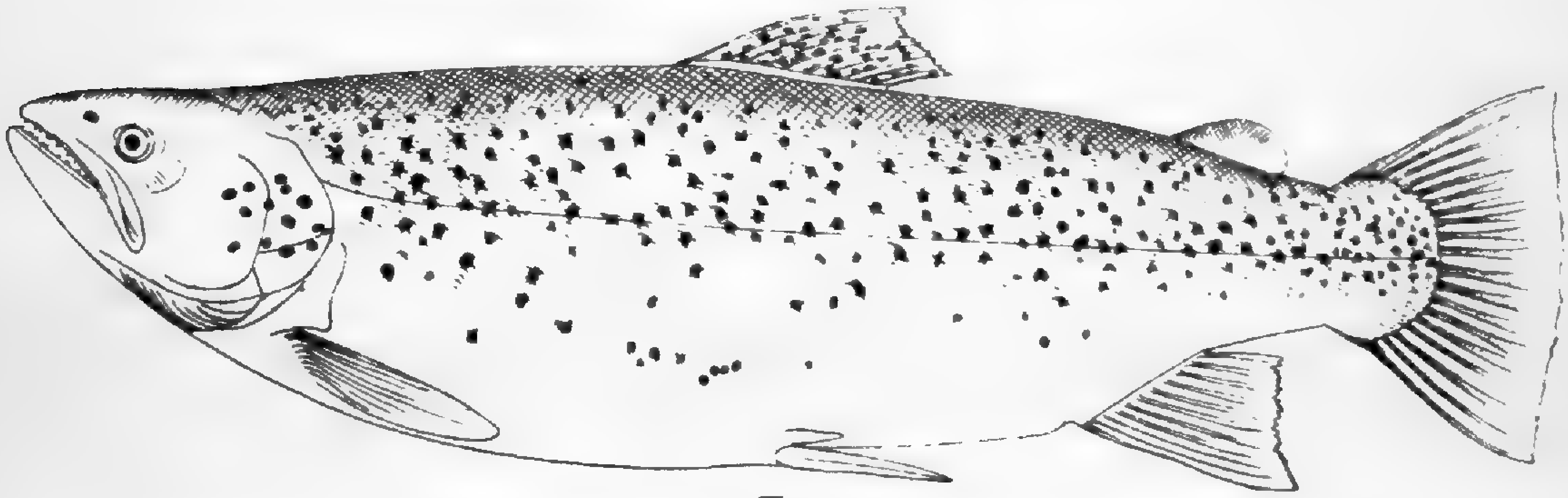

Fig 2

Waikouaiti River female 13 lbs 11 oz., length 28½ in.

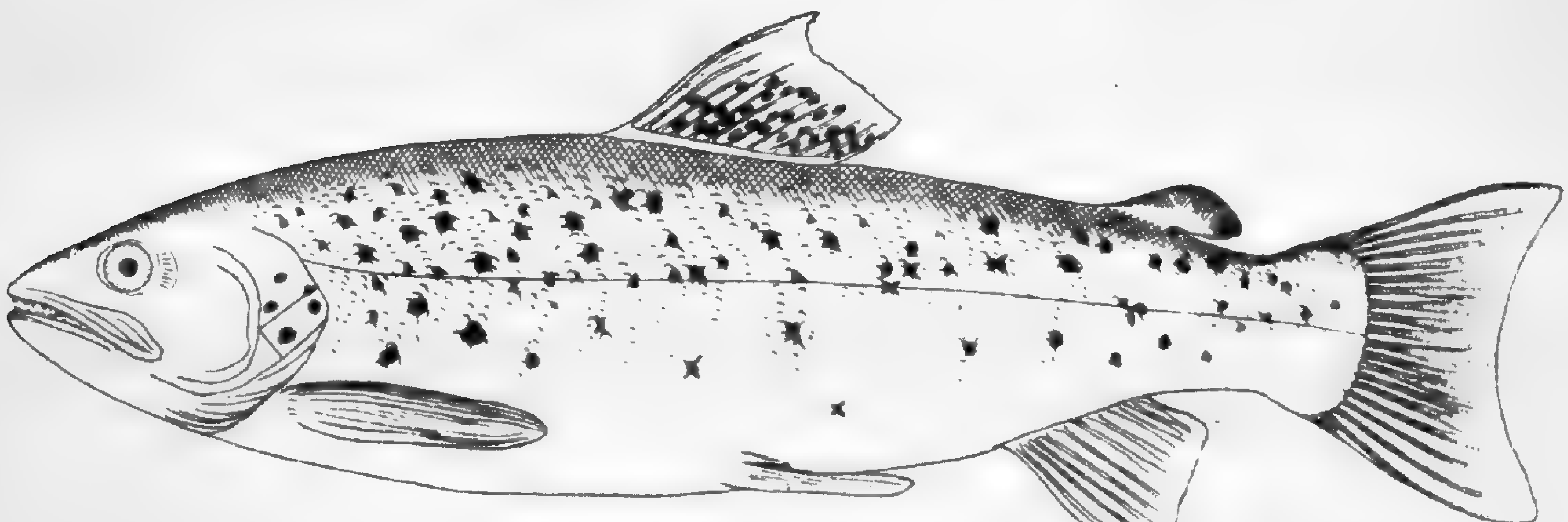

Fig 3

Lee Stream 1 lb 6 oz., length 13⅓ in.

Fig 4

Waiwera female 2 lbs 13 oz length 18 in

OTAGO TROUT (S. fario Ausonii) from different rivers.

A. del.

The *Omarama River*, a tributary of the Ahuriri, was first fished by Mr. J. A. Connell, in December, 1879, and the following is the result of several day's good sport, but subsequent trials were not so successful. During one day, two evenings, and an afternoon, he caught 14 trout, weighing 27½lbs., or an average weight of 1·96lbs., heaviest fish 7lbs. During the same month I fished the Omarama also, two and a half days, and killed 5 trout, weighing 13¼lbs., or an average of 2·7lbs. each. I also lost a trout after playing him out, which I believe, from his size (having seen it) and its strength, must have been 8lbs. Mr. Connell's take would average altogether, including his clean days, about three fish a day, so far as I can now judge; while mine was two trout per day. This river is shingly and snow-fed during part of summer, and lies about 1,400 feet above sea-level. Its banks are covered only with native grass, and its trout were remarkably strong and very fat, giving abundance of play. As trout were first placed in this river in 1875 their yearly growth is about 2lbs. increase in weight. The food-supply is very likely identical with other inland streams, but I have no precise information about it. Lately Captain Fullarton, of Palmerston, has told me of many large trout being seen in this river during last season, as well as in the Ahuriri and Waitaki. Mr. Begg reports small trout as very numerous.

The *Otekaike River*, another feeder of the Waitaki, was fished by Mr. A. C. Begg in February, 1881, when he caught two trout, total weight 5¼lbs. This river flows over slate formation in its upper waters and shingle in its lower waters. It is partly snow-fed, like the Omarama, but in summer lower parts disappear under the gravel.

The *Kakanui River* has for years been unprofitable so far as angling goes, but Dr. de Lautour, of Oamaru, and Mr. Statham Lowe, during last summer, had some wonderful sport in it with minnow, both natural and artificial. The former, fishing at night with natural minnow, had the following luck:—December 3, 1882, two trout, weights 12¼lbs. and 3lbs.; and on the next night five trout, weights 13lbs., 8lbs., 7½lbs., 3lbs., and 3lbs.; being 7 trout altogether, weighing 50lbs., or the very extraordinary average of fully 7lbs. each! The night of the 4th December was very dark when the doctor was fishing, and the locality was a mile and a half above Maheno. He informed me that the trout were rising in all directions, and when he hooked his fish it took him from twenty minutes to an hour and a half to land them—hooking his first at 9.15 p.m., and landing his last at 1.30 a.m. Of course anglers imagine the time very long when holding on to a big trout; the excitement and anxiety causing one's mind to measure the minutes by the intensity of their feelings; a thing which is, I fear, rather misleading. The fish were all very fat and handsome looking, but the doctor found very little in their stomachs, only a few bullies and shrimps, and he thinks they must have disgorged considerably from the length of time he had to take playing them with a very light rod. I have frequently observed, however, that the fattest trout when caught have very little or nothing in their stomachs, and it is a circumstance hard to explain. I have likewise pretty often found a trout's mouth full on landing it, and its stomach also. When a trout, further, is hooked by the tongue or any fleshy part of the mouth, it seems to close its jaws firmly as if in a vice, for I have seen their jaws almost locked on landing them. On the other hand, when the hook gets among the branchial arches, or made fast to the gullet, I should expect vomiting to result, and I have seen it repeatedly in such circumstances. As to deducing any average per day of the number of trout and of the weight from these two nights' fishing in the Kakanui, I feel convinced it is unnecessary, as the take was evidently very exceptional. Neither can the yearly increase of weight in the trout be fairly ascertained, for the first were put in in 1869, and with the abundance of smelts, whitebait, and other food obtainable, also plenty range of water, which are the conditions of this river, they have had every advantage of growing more than at the rate of only one pound per annum. The higher parts of this stream lie among fearfully rocky gorges of slate and gneiss, and the lower parts on shingly, gravelly flats, amid limestone formation and rich soil. It is a river also not much affected by snow water I should think. I am informed that the settlers destroy many very large trout by poaching, which, if not put an end to, will deplete the river entirely of its stock.

The *Waikouaiti River* also has been a very unsuccessful water as yet. The first trout were put into it in 1869, and a great many thousands during the last five years, yet they do not seem to make head as a stock, there being only a few very large fish in a certain number of pools about Cherry Farm. Anglers from Dunedin have repeatedly fished it without getting or even seeing a single trout. Mr. Orbell and Mr. Buckland, however, two seasons back killed some very large trout, night fishing. One of these fish, a beautiful female of about 14 lbs., was kindly sent me by Mr. Orbell in February, 1882. It was remarkably fat, and the belly protruded so as to distort the cleft of the mouth to an angle of nearly forty-five degrees with the vertical. It was very silvery, and, although within easy access of the sea, did not appear to have migrated, its fins being all dark or olive colour, and its spots black and round or square. The stomach was empty. When boiled this fish ate exceedingly well. The mouth of this river, also of the Kakanui, is tidal, but its upper waters are often polluted by gold-mining works.

The *Waitati River* has not been in much repute for years, having fallen off in productiveness. The best day's fishing I know of got in it, was in November, 1879, by Mr. S. Thompson. On that occasion he caught 22 trout, weighing 23½ lbs., or an average of 1·06 lbs. each. The water was low and he fished with fly and maggot. It was first stocked in 1869, and again in 1874, so taking Mr. Thompson's largest trout, which was 5¾ lbs., as one put in during the latter year, its yearly rate of growth would be 1·15 lbs. In Blueskin Bay, into which the Waitati flows, there are frequently trout seen and netted which may probably have come out of this river. It has a good supply in the season of smelts and whitebait, and its bed consists of trap boulders; its banks are covered with bush.

Fulton's Creek is a small stream, the upper part of which descends rapidly from the mountains through bush, and its lower waters flow gently through the alluvial plain of the Taieri in deep long reaches. It has a good stock of trout, and very large ones frequent its lower waters. Trout were first put into it in 1869, none since then, and in July, 1881, Mr. Deans caught two beautiful females, 18 lbs. weight each, on which occasion he reported very few males to be seen. The least possible annual growth of these two fish would therefore be 1·5 lbs. It has fine gravel beds, and seems to be a good breeding water, small trout being numerous.

The *Tokomairiro River* has not as yet got up a good stock of trout, although more than 9,000 have been liberated in the north branch alone since 1869. In November, 1882, Mr. Burt caught one of 7¼ lbs., in fairish condition. It has a long reach of ten miles tidal water from its mouth, so it should have an excellent supply of food of the migratory kind.

Lovell's Creek, which empties itself into the Tuakitoto Lake, is a small river, but remarkable for containing a considerable number of large trout. A good number of these have been caught, and in July, 1882, one of 15 lbs. was found dead in it. It was a female and was very fat, and must have grown yearly 1·66 lbs., as the first trout was put into this stream in 1873. I have no doubt this stream contains an abundant supply of the migratory fishes which visit all waters so near the sea or so accessible from it. After spawning the large trout in all probability descend to the lake to recuperate themselves.

Kaihiku River is the first stream within the trap-rock region between the Clutha and Mataura Rivers, and, like the most of them, it has a more or less northern course, facing the sun. Judging from the baskets of trout taken from it, I should consider it a very well stocked little river. It is very full at present of small trout. I have, however, only one angler's record available for reference, which gives for two days' fishing, 28 trout, of a total weight of 17 lbs. This is equal to 14 trout per day of an average weight of 0·6 lbs., or a little over half a pound each. I have no information as to the heaviest trout in it, but I believe they have been caught nearly 6 lbs. in weight. As it flows into the Clutha River below the Waiwera, it must be visited by smelts and whitebait. Here I ought to notice in passing that Mr. M'Kinnon, hotel-keeper, in March, 1883, killed with native minnow in the *Puerua* a trout of 22 lbs. As trout were first turned into this little river in 1873, the least possible yearly growth of this fish would be 2·2 lbs.

The *Waiwera River* is four times as large as the Kaihiku, and was in great repute among anglers for the size and excellence of its trout a few years ago; but, owing to the hotel on its banks having stopped business, not many have fished it during the two last summers. It is situated a few miles west of the Kaihiku, and flows over a similar formation. There is good shelter, plenty range, with rocky reefs crossing the stream in many places. There are also plenty of weeds in the reaches, which become long and affect the surface. Several takes by anglers I know of, which are these:—

1879, one angler fishing two days; result, 2·5 fish per day; average weight, 2·65 lbs.

1879 to 1881, another fishing nine days; result, 1·77 fish per day; average weight, 1·56 lbs.

1882, a third fishing a day and a half; result, 8·0 fish per day; average weight, 2·41 lbs.

Previous to last season I know of no trout over 6 lbs. being caught, but on January 18th, 1883, two magnificent female trout were exhibited in Melville, the fishmonger's window, Dunedin, said to have been taken by a Mr. Miller in the Waiwera, which weighed 14¼ lbs. and 10¾ lbs. respectively, and of these dimensions:—Length, larger, 28½ inches, depth 8¾ inches, girth 20½ inches; smaller 27½ inches in length, depth 7½ inches, and girth 15½ inches. These trout were in colour dark along back, shaded off into a yellow and then white towards the belly, fins all dark, and spots black, large and round like most Waiwera fish. They were so small in the head and also so deep in the side, being about one-third of total lengths, as to have quite the shape of perch, but were not correspondingly thick across the back. In fact their unusual depth of side was evidently attained at the expense of their thickness, for neither fish had as great a girth as an ordinary well-filled-up plump trout, and which I have found to be as nearly as possible two and a half times the depth. For all that, they were the finest-looking specimens of brown trout I have seen in Otago, and the growth of the larger one could not be less than 1·45 lbs. yearly, as trout were first put in Waiwera in 1873. The stomachs of such trout as I have opened from this stream contained crayfish, fresh-water whelks (*Limnæa*), algæ, flies, and larvæ; but much of the food consists of smelts and whitebait, which swarm in it during the summer. For edible qualities the Waiwera trout stand deservedly high.

The *Kuriwao River* is a small branch of the Waiwera, which, after passing through the Popotunoa Gorge, joins the latter river on the plain 7 miles below. It is a very stony water, but has excellent shelter and plenty of food, including smelts and whetebait; indeed, the same food-supply as the Waiwera, and the same trap formation. About the end of 1878, one day Mr. Statham Lowe fished it for curiosity, when waiting for the train at Clinton, and had such wonderful luck with the fly as to remain a week. But now it has sadly degenerated in the number and size of its trout. Unfortunately, I have lost his letter, but speaking from memory, I believe his best take was seven trout, weighing in all 15 lbs., and ranging from 1¼ lbs. to 5 lbs. In 1881 Mr. Lowe and another in one day killed twelve trout, which weighed 12 lbs.; Mr. Lange, half a day, seven trout, weighing 6 lbs. 10 ozs.; Mr. McCulloch, one day, five trout, weighing 5 lbs.; Mr. Lange, one day, fifteen trout, weighing 9 lbs. 11 ozs.; and Mr. A. C. Begg, three days, twenty-one trout, weighing 12 lbs. 8 ozs. In 1882 the latter angler caught one, 6 lbs., above the Popotunoa Gorge, and several other good fish. Five years ago the yearly increase in weight of the trout I found to be 1½ lbs. Poaching and excessive fishing have not only reduced the stock of trout, but caused many anglers to forsake this stream altogether. I have heard of boxes of trout, illegally caught, being sent by coach to Dunedin. The above figures show a steady decrease in the average weight of trout yearly. I have only examined the contents of the stomach of one trout from this water, and found these to be the larvæ of aquatic insects, and fresh-water whelks, but the stream is also full of whitebait. This same trout ate exceedingly well when cooked.

The *Waipahi River* is undoubtedly a very beautiful trouting stream, as it has abundance of shelter and plenty of range of water; reefs of rock and weeds also. It is situated about 8 miles west by rail from the Kuriwao, and flows over a similar trap formation, has a good supply of the ordinary river food, with thousands of smelts and whitebait also in the season. It has few good spawning-beds, is not affected by snow water, is low-lying in its course, and is an early river, like the two last-mentioned. In the middle of October many of its trout are in fine condition, and generally they have the golden and brown tints of the typical brown trout; the spots also being mostly round. In the season 1881–82, Mr. Begg, in six days' fishing, killed fifteen trout, weighing 24¼ lbs, the heaviest being 8 lbs. The largest trout I have known caught in this river was nearly 9 lbs., and was taken at night in February, 1882, with natural minnow, by Mr. Bull, of Auckland. It was excellent eating. During two half-days in November, 1882, I killed four trout, of a gross weight of 10 lbs. 10 oz., the largest being 4 lbs. 8½ ozs. Mr. Statham Lowe, one day, five trout, weighing 16lbs. But the fairest idea of the productiveness of this river may be gathered from Mr. W. Mark Elliott's fishing during last season, of which this is the result:—He had seventeen and a half blank days, twenty-eight days when he caught fish, seventy-six trout taken, and a total weight of 210½ lbs., the largest being 6½ lbs. Taking all his fishing-days together (45½), gives an average catch of 1·7 trout per day, weighing 2·76 lbs. each, all trout under ½ lb. being returned to the river. He fished mostly with fly during the first half of the season, but with cricket and minnow during the latter half. The first trout placed in the Waipahi were only seventy-six in number in the year 1873, but 300 the following year. Taking the 9 lb. trout as possibly one liberated during the latter year, would give its yearly growth as 1 lb.; but, from the abundance of food in this river, I am pretty sure the actual yearly growth of its trout is more like 2 lbs. The flesh of the trout for the table can generally be depended on as of the finest quality which are caught in the Waipahi. I have found in the stomachs of Waipahi trout, fresh-water algæ, larvæ of insects, whelks, flies, and insects, one minnow (*G. fasciatus*), and, in the case of one trout, no less than thirty-eight whitebait! Gravel also I have found. In appearance the trout are well-shaped and yellow-sided.

The *Otaria Stream* is a small tributary of the Waipahi, and, like it, has many bars or reefs of trap rock crossing its bed transversely. It has excellent banks and good shelter, but from actual observation I cannot give the varieties of its food-supply. I have no doubt at the same time that it corresponds to that found in the Waipahi. One day at the latter end of March, 1883, Mr. Elliott fished it with no success till evening, when, with minnow, he caught five trout of a total weight of 15 lbs., the largest being, I believe, 5 lbs. As trout were first put into it in 1875, the yearly growth of this largest fish was ¾lb. Poaching of a very undisguised kind is much practised in this stream. The quality of its trout for the table is unusually excellent.

The *Mimihau*, a feeder of the Mataura River, flows mostly past and through bush and over trap rock. I do not know the precise nature of the food-supply, but necessarily the flies and grubs must be very abundant and its trout for the table are said to be unsurpassed. In March of this year, Mr. Maitland killed in one day 6 trout weighing 17½ lbs., the heaviest being 4 lbs. Two years ago, in 1880, Mr. Thornhill killed one 5 lbs. weight, which must have increased yearly in weight at least three-quarters of a pound, as trout were first put in it in 1875.

The *Pomahaka River* is a very large tributary of the Clutha River, rising in the snowy ranges of the Umbrella Mountains and flowing in a south-easterly direction. It is, therefore, without the trap region, unless towards its mouth, and is partly snow-fed during the summer, besides being frequently muddy from the gold-mining operations on its upper waters. Possessing numerous gravelly reaches it is a good breeding water, but it is a late river, and its fish take a long time to get up in condition in the summer. Occasionally the trout in it are of good quality, but as a rule they are not to be compared in that respect with those of the Waiwera or Waipahi. In colour they are light and silvery. Night fishing with minnow is very successful, but any lure may be used during the day. The stomachs of those trout which I have opened I found contained larvæ, creepers, beetles, whelks, minnows, crayfish, and small stones, but the whitebait are very plentiful also in this river. There are quite a number of records of fishing in my possession, but one may suffice to mention, that of Mr. Elliott. During the summer and autumn of 1882–83 he had three blank days, 23 good days, and caught 135 trout, weiging 236½ lbs., or 5·2 trout daily of an average weight of 1·75 lbs. The largest trout that I know of was 7 lbs. and caught by an angler in 1882, but one of 6½ lbs., taken in 1879, gives a yearly rate of growth of 1·08 lbs., which is probably as much as can be expected in the Pomahaka.

Of the interior streams and lakes where fish have been taken the Waitahuna, Teviot, Manuherikia, Butel's Creek, Lochy, and Wakatipu Lake, also the Oreti River merit a little notice.

The *Waitahuna* can only be fished in its upper parts owing to pollutions from gold-mining. It flows from the Lammerlaw Mountains behind the town of Lawrence over a slate and gneiss formation in a south-east and then a south-west direction till it joins the Clutha. It has good spawning beds, trout are numerous but not large, rather poor in condition, but take fly readily, and are good eating. The result of two half days in November, 1881, when I fished it, the water being in splendid order, was 15 trout, weighing 8¾ lbs. gross, no trout being over a pound or so. This is a fair sample of its fishing capabilities, but the largest fish taken was one of 4½lbs. by Mr. Coghill in October, 1879, and I have heard of other large ones being seen. As trout were first put into the Waitahuna in 1875, the yearly growth of Mr. Coghill's fish would be 1·12 lbs. Stomachs opened by me showed flies, shellfish, larvæ, creepers, crayfish, and small stones as their contents. In colour these trout are silvery.

The *Teviot River* is a small tributary of the Clutha River which rises in the Lammerlaw Mountains and after flowing in a westerly course through rocky gorges joins the Clutha at Roxburgh. Its rocky bed is formed of slate and gneiss, it has not many good spawning beds but seems to have a good flow of water during the first half of summer. Its trout are mostly small, but they take the fly readily, and are possessed of good edible qualities. They are brown on back and golden on the sides, with black and crimson spots. In December, 1880, I had a day's fishing in it above the washpool hut, and killed with fly 17 trout weighing 11½ lbs. I lost more than half-a-dozen, including several fish over 2 lbs., but of those I caught 8 weighed about 1 lb. each. I had no opportunity of examining the stomachs of these trout, but probably their food consists of shellfish, larvæ, and flies.

In March, 1879, two anglers fishing the *Manuherikia River* at Hawkdun Station killed 8 trout from 1 lb. to 2 lbs. in weight. They were fat silvery fish and proved very good eating. Below the station the pollutions from gold-mining render this river useless for trout, but above it is beautifully clear, and has plenty of good spawning beds. This part of the river is about 1,500 feet above sea-level, and in spring must carry off a large amount of snow water. I heard of a trout of 7 lbs. weight being caught in it, during this same year, so that its yearly growth would be fully 1 lb., as the stream was first stocked in 1873. I have no information as to its food supply.

Butel's Creek, which feeds Hayes Lake is a very small stream, but it is well stocked, especially below the waterfall, which is impassable for trout, being nearly 200 feet high. Hayes Lake is very full of trout, some being supposed to be over 20 lbs. in weight, and these having for their spawning ground only the mile and a half from the lake to the waterfall of this creek, it gets very crowded during the spawning season. I have heard of one trout poached out of this stream in 1882 which weighed 28 lbs., and these great fish are known to have been actually caught, and removed in cart loads, being afterwards salted and sold among the surrounding gold diggings. The Lake Society has done almost nothing to prevent the poaching. Now, trout having first been put into the streams about the Wakatipu in 1874, this very large trout must have grown yearly at the astonishing rate of 3½ lbs.! The trout in the creek are mostly small, running from ½ lb. to 1½ lb., although they have been taken with the rod up to 5 lbs. It is only during winter that the very large fish push their way up. Mr. Paterson, a neighbouring settler, has told me he has seen the stream as "thick as porridge" owing to the numerous spawning fish turning up the same redds successively! The bed of this stream is very gravelly and sandy, and it is the only water entering the lake fit for spawning in. Such trout as I have seen taken out of it are very silvery in appearance. In November, 1880, Mr. A. C. Begg killed 15 trout in this creek in one day, their total weight being 8 lbs. From observation I cannot say what the food-supply is on which the trout feed, in the creek or the lake, but it must be unusually good and abundant, especially in the lake, where the trout are said to be numerous and large. I have not yet known of any angler succeeding in catching a single trout fairly with rod and line in Hayes Lake. They are manifestly too well fed to care for artificial baits.

The *Wakatipu Lake* has a stock of trout from 2 lbs. to 20 lbs. in weight; I estimate the weight from seeing them. These large trout frequent certain parts on the margin of the lake in shoals, as Queenstown Bay, near the Town Creek, the Peninsula Reef, Frankton Arm, and generally the vicinity of the mouths of the streams into which young trout fry were originally put by the late Mr. Worthington. Until lately, they have not been caught by rod and line; but during March, 1883, some were with minnow, and very long lines being run out from the boats. The trout are very fat, but what their food consists of beyond *Galaxias* I have not yet found out; the stomachs of four which I examined being empty. In one case only two small fish and insect remains were found in the stomach by me. In colour these trout are mostly dark on back and silvery towards the belly, some however are very silvery. Unfortunately there is much fungoid disease in the shoals at Queenstown Bay, and a considerable number have died from it. One female I found dying from fungus, I have previously described.* Mr. Worthington, in 1881, reported that he had only seen male fish affected with the disease. Probably the absence of salt from the Wakatipu water is one of the chief causes of the malady. It does not appear, however, to injure the edible qualities of the fish, which are most excellent. In November, 1880, a trout was caught at the head of the lake which weighed 16 lbs. 4 ozs.; and, as it may probably have been one of those liberated in 1874, its yearly growth would be 2·73 lbs. or $2\frac{3}{4}$ lbs. nearly. A number of trout have been taken weighing 11 lbs., 13 lbs., and 15 lbs.

In March, 1882, I got a most beautiful female trout from the *Oreti River*, weighing 5 lbs., which was in splendid condition, and was the finest fish of the kind to eat I ever partook of. It was almost as good as a fresh run sea-trout. In its stomach I found one minnow and a small grub. At the same time, I handled an ugly male trout from the same water, not fat, which weighed 10 lbs. Its average yearly growth would be $1\frac{1}{4}$ lbs., as trout were first liberated in the Oreti in 1874.

The *Canterbury* specimen I have previously made reference to was sent to me by the Christchurch Society in February, 1881, on the supposition that it might possibly be a Californian salmon; but in what river caught I was not informed. It was 2 lbs. in weight, silvery in appearance, with a few dark and red spots, mostly x-shaped, and had a very small head, less

* Trans. N.Z. Inst., vol. xv., p. 198.

than a fifth of the total length of the fish. The anal fin had ten rays, also two spines or rudimentary rays; the abdominal and anal fins were white. So extraordinarily fat was this fish, that the cleft of the mouth was distorted or drawn very much down, while the snout was very like that of the genus *Oncorhynchus*. The fin-rays and gill-covers, etc., however, convinced me that it was a brown trout (*S. fario*), while its general appearance was suggestive of some duration of residence in brackish water. The stomach contained a little mucus, but I took a native minnow three inches long out of its gullet. It was too much decomposed for me to examine the cæca, which I have observed decay sooner in hot weather than the other viscera; in fact they are very perishable.

The yearly rate of growth in the most of the streams above recorded, from 1878 to 1883, and which I cannot compare with their growth prior to 1878, from want of sufficient data, may be seen more readily from the following table:—

Yearly growth of Trout, 1878 *to* 1883.

	lbs.
Oamarama	2·00
Kakanui	1·00
Waikouaiti	1·07
Fulton's Creek	1·50
Lovell's Creek	1·66
Puerua	2·20
Waiwera	1·45
Waipahi	1·00
Otaria	0·75
Mimihau	1·00
Pomahaka	1·08
Waitahuna	1·12
Manuherikia	1·00
Hayes Lake	3·50
Wakatipu Lake	2·73

Of course I do not claim more for this table than that it shows what the least possible growth of the trout per annum may be. Likely in some cases it is more, although it would be difficult to find any growth of trout to exceed that in Hayes Lake. I cannot from exact information as yet decide the interesting question of what the Hayes Lake trout fatten on; and mere inferences, even when probably correct, should not be depended on.

As to the *edible qualities* of the trout in these rivers, a fair proportion of good eating trout can be got in most of them. The best I have partaken of was a single 5 lb. female trout from the Oreti River as already stated; a finer one could not be desired. Next to it I have found the Waipahi and

Waiwera fish the best; but I have heard that the Otaria and Mimihau fish are better still. The Wakatipu trout are also particularly fine, perhaps the best. Of course the single example from the Oreti cannot be held as proof that its trout will all be as good; and, indeed, the 10 lb. male which was got at the same time was not fit to eat, I was informed by the gentleman who had it cooked for dinner. It is likewise difficult, I find, to predict from its appearance how a trout will eat in Otago. We have them both pink, red, orange, and white in the flesh-colour. Most anglers think a fat trout is sure to be good, and, as a general rule, I will not dispute it may be so. I certainly find that, when the pyloric cæca are covered with much fat, the trout may be depended on as good, unless it happens to have been grubbing among clay or moss for larvæ, when it will have an earthy taste. But I remember on one occasion getting a 4½ lb. male trout from Shag River, which was very fat, sent me by a settler, and which ate nearly as well as a sea trout, while an exactly similar fat trout, sent by the same settler, at the very same time, from the Shag River to a friend of mine in town, proved quite earthy in flavour when boiled, and anything but palatable. My fish, I found when examining it, had four large native minnows in its stomach. In October, 1880, I killed a female trout in the Lee Stream of 1 lb. 9 oz. (not sexually developed so far as I could make out) which was very fat, and had its stomach very full of flies, also five large grubs or creepers, with remains of others. This fish was equally good to eat with the one sent me from Shag River. Now, the Shag River fish, both fat, with access to the same food probably, viz., minnows and whitebait, differed entirely as to quality; while the Lee trout, also fat, but feeding on widely different food, proved the finest of eating, just as one only of the two Shag River fish did! In addition to fat around the cæca, I find that thin skins and deciduous scales, also orange-coloured flesh, are pretty good indications of quality in trout. On the other hand, I must not forget to mention that I have known cases of trout only half-fat, which were excellent, and, indeed, this is characteristic of the Teviot trout, and also those of Waitahuna River. So much for the quality of our trout in connection with the kind of food and the external appearance of the fish.

The general superiority of the trout in the Waiwera, Waipahi, Otaria, and Mimihau over those say of the Pomahaka and many other rivers, must have some other cause than such as I may have previously hinted at. These rivers are all situated within the trap district, defined by me at the commencement of this paper, are low-lying, and, excepting the Mimihau, flow towards the sun, and so get their waters well exposed. The banks are good, and well covered by vegetation, as grass, flax, scrub, or even bush. Also they may be regarded as early rivers, for Messrs. A. C. Begg,

W. Mark Elliott, and J. A. Connell have found in the beginning and middle of October that the trout were fat and in good condition in the Waiwera and Waipahi. It seems to me then that the trap formation is eminently suitable to the abundant growth of insects and other minute food, and that, from situation and exposure to the sun in early spring, the eggs and larvæ of these insects must hatch sooner than in snow-fed waters of Otago. This early supply of the finest of food must, together with the excellent shelter of the banks of these rivers and warmth of the water, be the explanation of the goodness of the trout and their appearing in condition in spring so soon. The Pomahaka's trout, on the other hand, are long of getting into condition, and poor then with some exceptions; the river itself, besides being snow-fed half the summer perhaps, is frequently polluted by gold-mining works, and has a very shingly bottom. It has plenty of the coarser food, as the whitebait; but its water comes from a cold region, and flows away from the sun. I can recollect very well in Scotland I have found the same rule; the best trout were those I caught in streams flowing over trap and old red sandstone; the worst in the shingly, slaty, mountain streams.

Generally our low-lying streams and those freest from snow-water are the ones where trout are soonest in edible condition. Still, even for these, the fishing season begins too soon and ends too late, being from October 1st to March 31st. It is true that, in some years, owing to a mild winter, the trout may be fairly fat by middle of October, but not as a rule; while, by the middle of March they are black, lazy, and gravid. This season, 1883, they are in poor condition, even in November. The fishing season should be shortened by six weeks.

The *food* of our trout may properly here claim a few remarks in connection with growth. Since 1878, I have examined the contents of the stomachs of 62 trout. Frequently I found those of very fat trout quite empty, saving a quantity of white sticky mucus. This was more noticeable in Shag River and Wakatipu fish than in those from other waters. Three or four Wakatipu fish, which were very fat, and almost the only ones I have looked at, had nothing in their stomachs. So, also, with a large trout taken from the Leith, and another from the mouth of that stream in Otago Harbour during the spawning season. But among the other trout I found flies and their larvæ in great abundance, algæ very common, beetles, grasshoppers, crickets, shell-fish, crayfish, bullies or bullheads, native minnows, whitebait, small stones, and grass. I have never found any earthworms; neither in large male trout, even when lean and poor, a single case of a small trout having been swallowed. In those streams furthest removed from tidal estuaries, and consequently from a supply of whitebait, I commonly find a large quantity of shell-fish (*Limnæa*) in the stomachs of the trout; and many of our rivers are teeming with these curious little molluscs. That the milky-like and sometimes yellow mud from gold diggings is unwholesome for trout, and destructive to a great extent of insect larvæ, I have no doubt. The upper waters of the Shag, the Waitahuna, and Pomahaka are more or less so affected; and there the trout are comparatively poor in condition, particularly at the beginning of summer; notably also on the Deep Stream, for half a mile or so below where some Chinamen were digging five years ago or more, the trout all disappeared, and I question whether any have come back again; I have seen none at all events. At the same time, I am aware that there are trout in the muddy parts of the Taieri River; but these are large fish which, I think, have gone there not from choice, but seeking heavier water and more range than existed in the streams they had left. Trout of half a pound, I find, can swallow other fish, as whitebait and crayfish, and feed on them just as comfortably as fish of 5 lbs. or 10 lbs. weight. As to smaller trout than half a pound here, I have never investigated the contents of their stomachs. As no food has yet been found by me in most Wakatipu trout opened, the mystery of their fat condition and excellent taste cannot easily be made out, and its solution must be deferred.

It is difficult to say what *proportion between the sexes* of our trout exists; the question, however, has been forced on my attention owing to the males which I have caught being so few compared with the females. During one season I estimate the males taken by me did not exceed a quarter of the females! For the last two or three years, therefore, I have made special notes of the sexes; but while this is comparatively easily done as regards trout over 2 lbs. in weight from their external markings, those of half a pound to a pound I very often found puzzling, and when dissected even, had not sufficient sexual development to make the sex certain. On two occasions in the Deep Stream I killed one male and five female trout, but six days scattered over 1880–81–82 gave 11 males and 17 females. In the Lee Stream also, in four days, from 1879 to 1882, the results were also 11 males and 17 females. On the other hand, when I have fished the Shag River at night the trout taken were always males, so far as I recollect. Mr. W. S. Pillans, when taking spawning fish in Lovell's Creek in 1882, got 7 males and only 3 females! Mr. Deans explains this latter case by the circumstance of the females always going away from the redds when spawned, while the males hang about long afterwards. Whatever may be generally the rule here, at present I am of opinion that the females greatly outnumber the other sex. The effect of the disproportion, in whichever way it really lies, on the stock in a river would probably be the same, that is, damaging. For where there are few males, the females would naturally, one would expect, look for their mates near the redds. The same redds, as a consequence, would get ploughed up and disturbed a good many times, to the destruction of the ova by exposure to light, to the hungry stomachs of the males, and in other ways ; while with too many males there would be a greater devouring by these of the ova, and more deaths among the same sex through fighting. Excessively lean and attenuated male trout caught sometimes in our rivers are very likely such as have contracted constitutional maladies during spawning. These may be parasites, or fever induced by injuries from fighting with other males. At all events the main evidences of disease are wasting away of the tissues of their bodies and a voracious appetite, while their colours remain as bright as during the spawning season.

II.—*Habits.*

Of the *spawning* season and time of incubation of our trout I have already treated, showing the latter to be 78 days—the same as I found it prior to 1878. The number of eggs we find to be 800 to 900 for every pound weight of the spawner. During our stripping in August of this year the eggs of fish 1½ lbs. to 2 lbs. were straw-coloured and small, while those of the larger females up to 16lbs. were dark pink and much larger. In 1880 one trout yielded about 30 eggs double the size of all the other eggs she passed, and they hatched out just the same as the rest. The late Mr. Worthington informed me that the ova of trout in Queenstown Creek in 1881 were very light straw-colour, almost white, but those from Butel's Creek, ten miles off, were pink as usual. One season he found the ova in the former stream light straw-colour, light brown, and pink. A female of 12 lbs. weight, which he caught while it was attempting to ascend this creek, was stripped by him. The eggs all went white, and became bad. Long after spawning I have sometimes found empty eggs in the cavity of the body in clusters in the same fish, and often a few single ova. But the most extraordinary state of a female trout which has ever come under my notice was that of a 6 lb. fish sent to me by Mr. Lowe from the Waipahi, on October 25th, 1882. It was in good condition, and the cæca were surrounded by plenty of fat, yet it had about three-fourths of its old ova still in the ovaries, while the next season's eggs, about the size of turnip seed, were spread all through and around the old eggs. The latter, the old ones, were mostly empty and of different colours—red, yellow, and white. The left ovary sac was ruptured, and twenty old collapsed ova were in the abdominal cavity. The only other abnormal appearance was the excessive thickness and toughness of the coverings of the air-bladder and the dorsal artery.

I have already given my ideas on the effects of excessive sludge from gold-mining on trout and their food-supply, so that here it is only necessary to observe that it must retard, if it does not also extinguish the vitality of the ova, where much exposed to its influence.

There is some reason to think that we have a proportion of both older and younger trout which do not spawn, at least not every year. In the Lee, for example, which is not an early river, I have known very fat trout taken in October, and these may have fed all winter through not spawning. Also, I have opened a number of trout half-a-pound to a pound, if not larger, from different rivers, which had neither milt nor ova in them. But, beyond this, I have no evidence to adduce in support of the theory except great similarity in the snouts of the sexes in the case of these barren fish.

The *feeding times* of our trout, however, are more abundantly evident, and in my first paper I gave some particulars of these in our rivers: as that during the day, the middle portion in particular, when the sun is brightest and everything apparently against the angler, he finds by far the most trout come to his lures. I have also mentioned the effects of meteorological disturbances. Trout at Home are usually very shy and knowing, and I assume that the Thames trout or southern form is equally so with his more northerly cousin, which I know best. As a general rule they are shy here too (or lazy it may be), in the morning and evening. Also, towards the end of March, as they begin to get blackish in colour and into spawning condition, they do not rise to feed unless the day be such as suits their fancies—warm and bright, with a fair supply of surface food. I have remarked that at the end of the fishing season, when they do not move during the day, they wake up for an hour or so about sunset, and then may be seen rising all over the river. Excepting, then, in such rivers as the Kakanui, the Shag, and Water of Leith, which are well stocked with whitebait, and which yield good sport all night, as well as day sport, there is no doubt the chief feeding time in all our streams is during broad daylight. Also, when really on the "take," our trout, big and little, seem to abandon all caution, and come boldly at a fly or bait if not very clumsily presented to them; the largest trout in a pool exercising its prerogative, and coming first. They have often followed the fly or grasshopper to within a few feet of the angler, and will sometimes take a bait a second time, after being hooked and running for a while previously. In the Lee Gorge one day I hooked, with a big green grasshopper, in the head of a pool of back-water which was slightly discoloured, as I thought from seeing it a 3 lb. trout. It was on for some time, and I could see it plainly as it struggled about the pool till it got off. Very much disheartened, I gave it a rest for a little, and finding it would not again look at the big sort, I put on two lively little grasshoppers and cast well up into the stream, letting them gradually sink as they were borne towards its lair. It took them at once for I felt the line tighten; so I gave it plenty of time and then struck well, when the running began in earnest. Being a strong fish, and in a pool with bad stones and boulders, I had much trouble in playing it, but at last managed to net it, and found it a great deal heavier than I had thought, as it weighed 5 lbs. 6 ozs.! On another occasion in the same water, while fishing close to the bank in some broken streams, I hooked up above me a good trout, which got off. Several casts in succession thereafter failing to start it, I gave it up as a hopeless case, and started to walk up the bank past the trout, within three yards of where it lay. In doing so, however, I let the bait drop in and float down, when he took it at once, and I killed the fish, which weighed over 2lbs. Just one other instance (and I have more I could mention), must suffice, as illustrative of the boldness of these trout. This occurred in the Lee Gorge also, to a friend of mine, on a day when the water was very clear, with not a ripple on it. In a broad smooth pool a good trout was rising in the middle. Walking down to the edge, this fisher cast with a cricket right over the fish, which took it at once, and when killed it was found to weigh over three pounds. The trout were not at all on the take that day. On the other hand their shyness or laziness is just as extraordinary as their boldness. I remember, for example, in the Deep Stream, when the fish would not move, fishing down stream behind another angler, who fished pretty carefully, but, as I noticed, missed a yard or two of the very shallowest parts at the top of streams, which are usually thought to be barren spots. He also raised nothing at a deep corner of Pillan's Pool. In both places I gave the water time to rest, or rather the fish, if any, and then fished very carefully the aforesaid shallow parts with cricket, and also the deep corner. After repeated throws, and sinking the bait well in the shallow, I killed a good trout in each, weighing 3 lbs. 6 ozs., and 2 lbs. 10 ozs. respectively. This was in February, 1882.

There is another thing worthy of remark in the feeding habits, which is, that not only do the trout change their feed, so to speak, on different days, but even during the same day. In October, 1877, in the Lee Stream, water in good order, and the forenoon warm, but after a night's snow, with a strong west and north-west wind blowing, I fished down below Snow's with small phantom minnow, about 50 yards behind Mr. A. Campbell, who had on fly. This was before noon, and Mr. Campbell killed several trout of a pound weight before I got any. Then, in the very same places, one above, and the other in the Ledge Pool, which he had cast over without raising anything, I got two with the minnow, weighing 2¼ lbs. and 2½ lbs. After

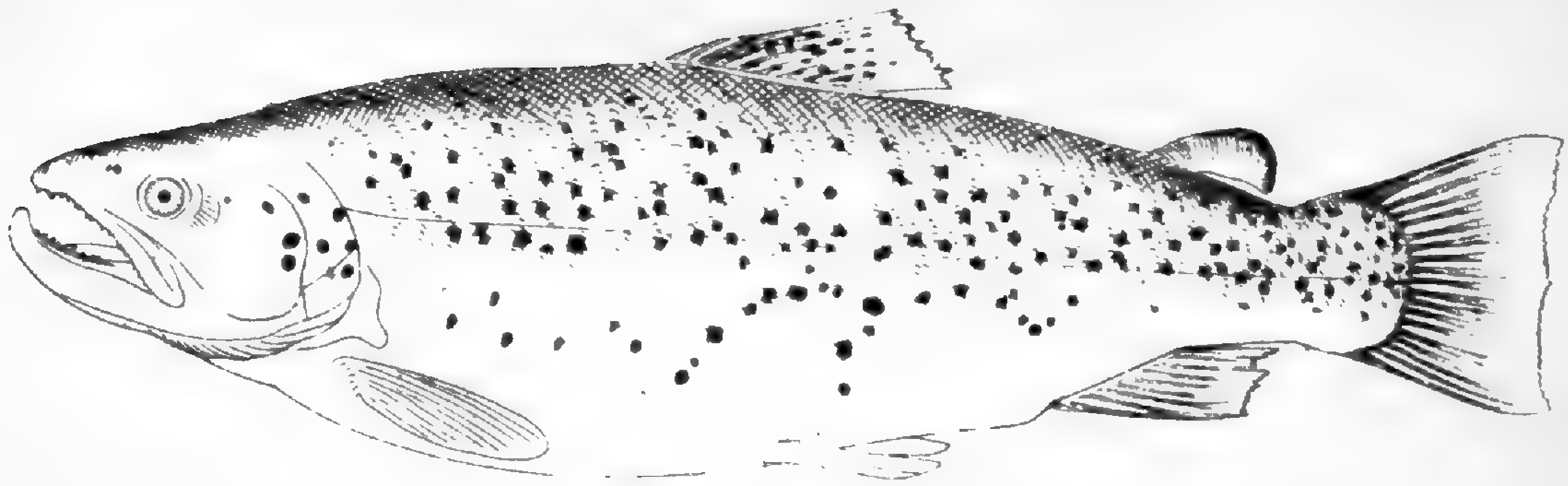

Fig 5
WAIPAHI — male 8 lbs. 10 oz., length 24 3/4 in.

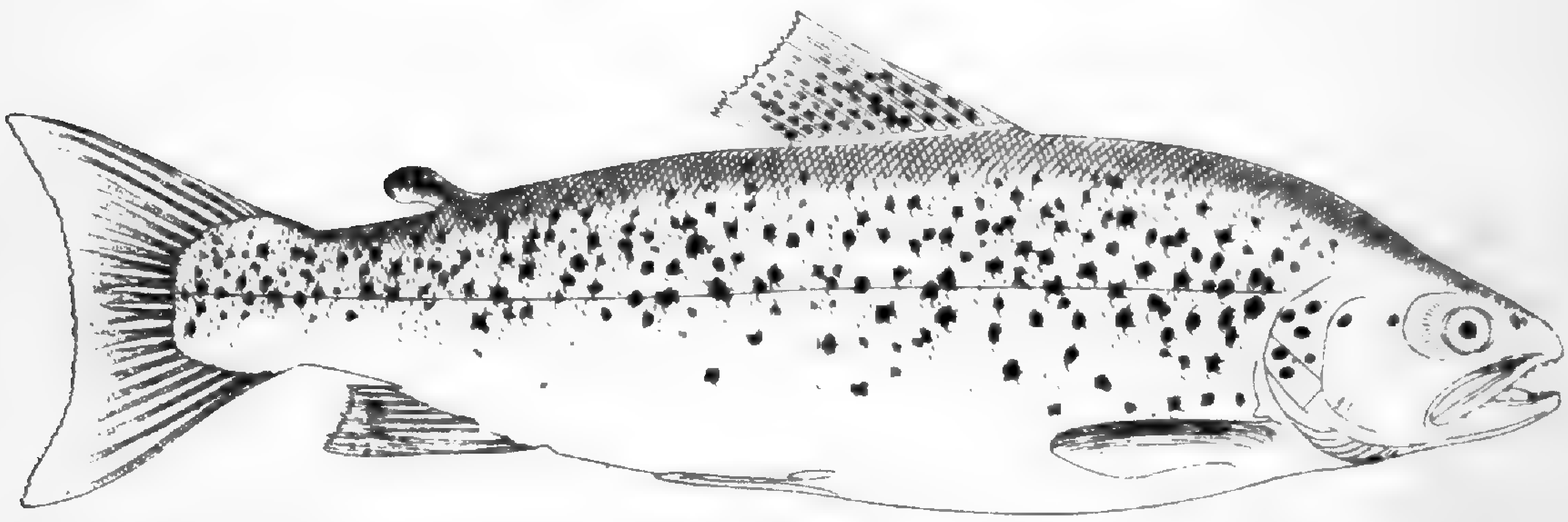

Fig 6
WAIPAHI — female 2 lbs., length 16 inches

Fig 7
POMAHAKA female 3 lbs 2 oz., length 19 1/2 inches.

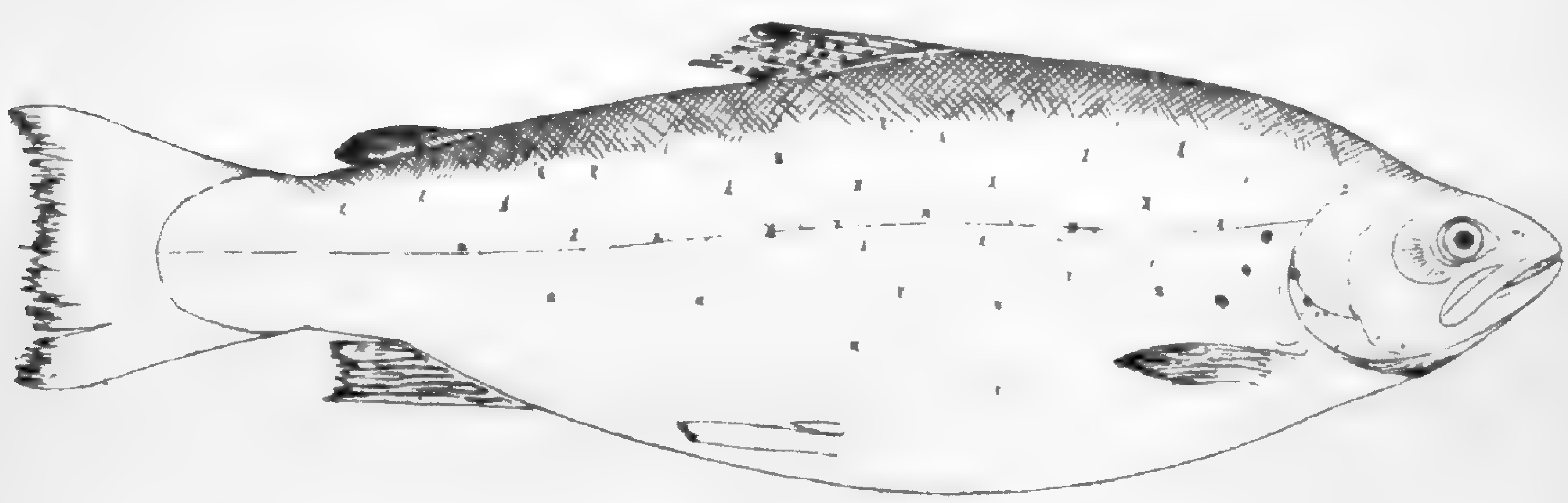

Fig 8
CANTERBURY TROUT — female 2 lbs., length 15 6/10 in

OTAGO TROUT (S. fario Ausonii) from different rivers.

W.A. del.

one o'clock the trout would not look at minnow, but I killed a large fish, $4\frac{1}{2}$ lbs., with fly, and also some smaller ones. I remember, subsequently, in the Deep Stream, above the Strath crossing, plenty of water and a north-west gale blowing, fishing two days, or rather, parts of two days. On both days I used exactly the same fly, cast with three flies on. The stretcher had on it a creeper, first dropper, which was black hackle, a gentle, and top dropper bare. The one day I killed seven trout, all with the hackle and gentle, and but one, a 2 lb. fish, which was on the creeper. The other day I got five trout, every one on the creeper, and which weighed nearly 15 lbs. gross, the water being rather clearer.

The alteration in the time of daily feeding, from that observed at Home among the trout is puzzling, and angling alone may not disclose all the facts. Still, a very superficial observer of nature must admit that as yet our streams possess a much greater food-supply, and more variety in it, than the streams of the Old Country do. The more open winters we experience will likewise permit a certain amount of insect life to come within reach of feeding trout, and so prevent these getting much reduced in condition. These two circumstances are sufficient to show, that, possessing more available food than their ancestral stock, our trout do not require to be so constantly feeding, and when so engaged have the extra temptation of variety, to make them as capricious as we find them. So, therefore, they choose their own time for satisfying their hunger, and select different food at short intervals. But why mid-day should be preferred by them as their banqueting hour is not so readily explained as their not feeding in early morning or in the evening, which I have proved to be mainly owing to the coldness of the air at these times. It is probable, however, that as most insect life will be on the water during the warmest part of the day, it is then, of course, that feeding trout show most on the surface, while at other times they may be busy grubbing on the bottom for larvæ and shellfish, in the absence of the more dainty surface diet. That the air immediately in contact with the stream must have had a certain quantity of heat and light imparted to it from the morning sun before trout will rise, I have seen attested, by the trout beginning to take hours sooner on an open part of the river than they did on a portion shut in by rocky gorges from the sun's rays. Repeated examples of this have convinced me of the fact. These remarks must be understood to apply to ordinary states of most of our rivers. When in flood, our trout do not take readily, nor, indeed, till the river has fallen to a certain state. It is very likely at such times the fish are partly driven from their haunts by the strength of the stream, and partly, are feeding on the bottom on insect larvæ, which the disturbance of the gravel there has revealed to their keen eyesight.

The *positions* in a large pool taken up by trout are only to be found out by experience of the fish, and of the particular river. For while small trout, of half-a-pound weight and less, locate themselves in every part, the heavier fish, from 2 lbs. upwards, select particular sites for their lairs. Some of these sites are the very last an angler would anticipate, as exposed shallows above the head and at the tail of a pool, and bends of dead backwater, almost stagnant. Sometimes, also, a heavy fish will rest in very strict running water above a pool, and when hooked by a fisherman it often seems as if the line were fast to a rock, so closely does the fish hug the bottom. Then, when fairly "struck," the astonished angler finds his supposed rock dart with alarming velocity into the depths of the main pool below. I have often lost my chance of good fish by not fishing the very last yard or two of a long reach, for, on taking to the bank, I have seen, when too late, a big trout sail away quietly up stream, from below my feet almost, making waves like a steamboat. These remarks, again, are correct as to the state of the case when our rivers are low; but when in spate, the trout are everywhere, and their ordinary habits are not observed. So, also, at night in such waters as the Shag and Kakanui, when a few old stagers keep to their beats, but the multitude of fishes spread over every part, and wake the stillness by splashing out of the water in all directions, and each fish almost simultaneously,—then a quiet spell succeeds for a quarter of an hour, to be followed by another chorus of splashes, and so on, until the moment the first symptoms of dawn are felt, when all become quiet, and will look at no bait, natural or invented, for hours afterwards.

When a river is low and clear, I have often known trout to be disturbed by the vibrations in the water caused by the angler wading, and so make off long before he himself was visible to the fish. This applies to up-stream fishing, as well as to down-stream fishing.

The shelter of flax-bushes, Veronicas, or even a good rock, are appreciated, and much used by our trout; but as yet there are not enough of fish to occupy every sheltered retreat. Hence, where small creeks join the main stream, trout are not so commonly seen as one would expect.

Another very marked evidence of the trout's appreciation of sunlight and warmth is, that black, rocky, dark pools in the Lee Gorge and other streams, have no trout in them at all. I and others have, again and again, thrashed such pools, and never seen a fin in one of them.

Cannibalism among our trout is a practice denounced by many fish-men in language expressing the axiom "the big trout eat the little ones." I have frequently listened to such common cant, and when I have asked for proof, the best reply to be got was,—"Oh, it is a well-known fact." Now having taken some pains to test this opinion, by a reference to the fish themselves, I do not find, as yet, that they have so far corroborated the libel as to justify so sweeping an assertion. In confinement, or in barren water where food is scarce, a big trout may very likely grab at its own youngsters, or even larger ones if he be starving, as we have found them do here; but let him have a good lair in a river with plenty of food, and I don't believe he will touch them. An examination of the stomachs of more than seventy trout of both sexes, taken out of a score of different waters, and in size ranging from $\frac{1}{2}$ lb. to 14 lbs., has resulted in not a single young trout being found by me in any of them. The only case I know of is a doubtful one, and it was on the 14th February, 1881, when Mrs. Walsh, at the Deep Stream, told me she had found a trout 4 inches long in the stomach of a 4 lb. trout. As I do not recollect having seen this 4-inch unfortunate trout, I may be allowed to suggest that it possibly was a cock-i-bully! At all events, granting it to have been a veritable trout, still there are 70 to 1 trout in our streams which decline at present to be convicted as cannibals!

Migration appears to be the refuge of trout in Otago when planted in a stream deficient in size and range of water, and of food. Hence the disappearance of the largest trout from the Water of Leith, except during the spawning season. They evidently resort to the salt-water of Otago Harbour in search of more water and more food than can be got in the Leith. For trout of the common *S. fario* species are being constantly caught in fishermen's nets in the bay. These show a tendency to acquire a sea-trout appearance, as they are usually very silvery, and the black spots are often, but not always, x-shaped. The belly fins also become very white, and the head gets sharp and fine. Of course I give this as an opinion, because unless the fish themselves are marked for identification, and examined again after capture in the sea, there can be no absolute proof. I may at the same time say, that other trout taken in the nets are so similar in markings to sea-trout, that I consider they are of that species. These are, however, becoming scarcer year by year. For years past in the experience of anglers, the large trout have been found more towards the mouths of the Deep Stream and Lee Stream. This, with the simultaneous appearance of large trout in the Taieri River below the mouths of the above two streams, may be regarded as additional corroboration of my statement. In Queenstown Bay, Lake Wakatipu, the trout are not migratory, but hang about the creek mouth and Peninsula Reef. This is, at least, partly because they have plenty of water; and although I have not as yet found food in the stomachs of more than one of these trout, their prime condition indicates abundant nourishment of some kind in the waters of the Lake. I might quote other cases of migration towards heavier water, but space will not admit of this.

I come now to notice the *vagaries* of trout, if such an expression can be permitted in connection with fish. There are two or three trout in the ponds in the Botanical Gardens, Dunedin, from 2 to 3 lbs. in weight, which live there from year to year, among ducks, swans and other fishes, and seem to get past the spawning season without any inconvenience. They have, also, lost much of their natural shyness and are comparatively tame. The trout, also, in Mr. Pillans's private ponds are so tame as to come quite close to him when feeding them. Mr. Connell, Mr. Digby Smith and Mr. Maitland have each mentioned instances to me of a large trout following close behind a good trout, when hooked and before landing it—no timidity shown but the greatest boldness. Very likely the two fish were mates. One day in December, 1881, Captain Fullarton and I were fishing below Rich's Ford in Shag River. I was trying to catch mullet with fly and maggot, when I saw the mullet scatter repeatedly when near my hooks, as if scared. Presently a large trout became visible swimming round in circles, and, as it came nearer the surface each turn, I cast over it in the vain hope of seeing it take the fly. This it did not do, but it seemed once inclined to take my companion's natural minnow. Gradually it came closer to the bank and began to get its head above water as it swam round, seemingly in distress and wanting more air. It could see us plainly, and indeed appeared to invite our assistance, for it came so near us gasping for breath, that at last Captain Fullarton gaffed it. It was a 5 lb. female trout, fat, with plenty of curd, and ate well when boiled. There was no trace of fungus on any part of the fish, and its viscera were quite healthy, only the gills were too highly coloured; but on the lateral line on both sides on the tail portion, between the anal and caudal fins, a patch of scales of the size of a shilling had been rubbed off apparently, and had small black hairs growing about $\frac{1}{20}$ inch long. These, under the microscope, had a root-like or star-like structure, branching out from a centre, and were brownish in colour, probably parasites. As the weather for days had been very warm, and the water was low and heated, we both concluded that this trout was suffering from the heat, and was either sick or fevered.

The *enemies* of the trout in our streams may here be summarized. There are native bullheads which attack the young fry, and eels, as both these fish have been proved to eat trout. Large smelts, also, are probably offenders. Among birds—kingfishers (where bush is plentiful), gulls, and shags or cormorants. The cormorants are by far the most destructive, and do more harm to a stream in a season than all the anglers who may fish it. Their favourite stations are a rock in mid-stream, or cliffs overhanging a pool. Instances have been told me where at least a dozen trout have been taken out of their stomachs, as related by me above, and they are known or supposed to have killed and eaten trout about 2 lbs. in weight. The ordinary shag of our rivers is about as big as a tame duck, but much thinner in body having a long sinewy neck and a dreadful bill with a hook at the point.

Disease at our Opoho hatchery among the ova is unknown. Dead eggs have been found to be unimpregnated, and no loss has resulted from silt, of which there is always a good deal. Deaths among the young fish have been consequent on a dropsical affection of the umbilical sac, and of monstrosities. Having already made some remarks on very thin male trout which appeared to be "dying by inches," in consequence of their flesh and fat consuming away, I will not add more than the suggestion that fever would account for the symptoms or effects of their ailment. Several specimens of trout found dead in our rivers have come under my notice. Dissection showed that some internal organ as the intestine was ruptured, but how occasioned it would be hard to say. For several years Mr. Nelson has seen trout in Lovell's Creek which were quite blind. This he proved repeatedly by trials; yet when a worm or bait was thrown into the water they took it at once. These trout were of both sexes, 4–5 lbs. in weight, not by a long way the largest trout in the stream, and their eyes had white opaque spots on each. In the case of females, the ova were found at the spawning season to be bad, although the fish were in good condition. No cause has been found out for this singular eye affection, but probably its origin is parasitic. *Fungus*, unfortunately, is not unknown in Otago waters. It was noticed first on trout in confinement at the Wallacetown ponds, by Mr. Howard, about 1874 or 1875. During spawning it has been seen on trout in Fulton's Creek; but in Queenstown Bay, Lake Wakatipu, it is very prevalent among the shoals of trout there, as formerly described by me.* The pathology (to borrow a medical expression) of this disease has not yet been worked out exhaustively, and it is surrounded by many difficulties. At the same time I may be pardoned if I again give my opinion, that all the exciting causes of the affection may be narrowed down to two conditions, viz.:—the absence of sufficient salt in the water inhabited by the fish, and of sufficient oxygen in the blood of the fish itself. Salt has been found to be a wonderful health promoter among the Salmonidæ; and oxygen, in the necessary proportions in the blood of the fish, is indispensable to secure it from fungoid attacks. Trout in Shag River have died, as supposed, because of excessive heat.

III.—*Structure.*

Although external *colour and markings* can scarcely be referred to structure, yet these come more naturally under that heading than any other. Specimens of trout from High Wycombe, Bucks, are thus described by Mr.

* Trans. N.Z. Inst., 1882, vol. xv., p. 198.

Francis Francis :—"They are more like salmon than the common brown trout, and are brilliantly silver in colour, very short and thick in make, and weigh heavier for their length than almost any fish I know." Otago trout, of the same species as those referred to by Francis, show great variations in colours, and that not confined to age or sex; yet these variations appear to be limited. At the same time, they evidently depend on the colour of the water and river bottom, mainly; but very little, if at all, on the nature of the food-supply. A general feature, and the most noteworthy, is that the females, of any age and from any stream, are silvery with black spots, red ones seldom present or numerous, while the males are darker, with a tendency to yellow on sides and belly, at times very golden, and they have always, or nearly always, red spots, sometimes large and numerous. The shape of the black spots, always round on the gill covers, shoulders, dorsal, and adipose fins, varies on the body from round to rectangular and x-shaped towards the tail. The theory that residence in salt water is shown by the black spots assuming the x shape, is not altogether borne out by facts. For example, trout of both sexes, in such water as the Shag river, Pomahaka, and Wakatipu Lake, where there is clear or white water and a light bottom, are silvery, and have black spots mostly x-shaped; indeed I have often seen bright silvery females with fine heads and x spots that might easily be taken for sea-trout; while the Waiwera and Waipahi Rivers, which have dark bottoms, produce trout of the golden variety, with most of the black spots rounded in form. The food in these four rivers is much the same. Brown trout taken in Otago Harbour show a tendency to acquire x-shaped spots, and take on a sea-trout appearance, but not always. On July 2nd, 1883, among the trout taken out of the Leith for stripping, we had a beautiful silvery female of about 16lbs., which I have no doubt had been resident in the harbour; yet the black spots on it, which were large and numerous, were of a *rectangular* shape. During the spawning season the males show much brighter colours, and extra red spots appear faintly which at other times might not be discernible; white the deciduous scales give place to thick fleshy ones. The females, also, at that season, and when young, show reddish spots, which might be very hard to distinguish during the summer, or when older. The red and some of the dark spots are sometimes beautifully ocellated, or surrounded by a lighter ring of colour. The fins, too, vary apparently with age and water within certain limits. The adipose nearly always has a pink edge or margin; the pectoral fin is generally olive brown in adults and olive yellow in young specimens, while the ventral and anal fins are of the same hue but lighter, and sometimes almost white. In dark individuals the anal and ventral fins have occasionally a white anterior margin.

The *form* of the head, body, and tail fin is subject to considerable modifications. In females, more particularly adults, the head is smaller and finer in shape than in males. In females the head is usually in adults one-fifth of total length, and in males, one-third to one-fourth, among my specimens. It is very difficult in young trout up to half a pound in weight, to tell the sex from the head and spots. Even dissection sometimes has shown me no sexual development sufficient to determine the question. But usually, in trout from half a pound upwards, it may be seen from the size of the head, form of mandible, and presence or absence of red spots. The male is most commonly to be recognized by its large head and fins, the hook on the lower jaw, and the red spots on its body. In one or two rare examples I have found a male of 2lbs. to 4lbs. with very little of a hook at all, while I have seen a female of similar size with quite as large a hook on its mandible. These cases are, however, very exceptional among Otago trout.* The form of the maxillary is not very constant, being broad and fine or coarse, narrow and fine or coarse, always however, in adults having its posterior end in line of, or behind line of, a vertical from posterior margin of orbit. The opercula seem inconstant in shape within certain limits. The preoperculum in our trout has always, contrary to his description of non-migratory trout, what Dr. Günther calls a "lower limb," generally very pronounced in outline, and with three or more striæ on the surface of the bone. The suboperculum of our Otago trout is *generally* of a trapezoidal form, as in fig. 1 in the attached woodcut, with the exterior angle more or less circular, or it might be called roughly rectangular. Fig. 2 is a case of a young female trout from the Waipahi, in which the rectangular form is very decided. It approaches nearer to Mr. Yarrell's typical form (fig. 4) than in any other trout yet seen by me; although one other trout I have examined had nearly the same form of this bone. But fig. 3 is a very common shape in the old male trout. There is sometimes, but not often, a slight difference in outline between the subopercles on either side of the head in the same fish. In young examples the margins of the opercula are rounded and graceful, but in old fish

* In such specimens the head is small like a female, and no development of either melt or roe of a decided character.

they are found by me to become angular in the subopercle, and sinuous in the operculum and preoperculum. A careful comparison of trout heads preserved by me, shows that sex has no influence on the form of the subopercle; or that the particular form does not indicate the sex. Neither does residence in brackish or salt water appear to affect the shape of that bone; but I have not as yet had more than a few specimens to examine, taken in salt water.

The branchiostegal rays which I have carefully counted in many of our trout are pretty constant at 10 in number. They vary, however, sometimes from 9 to 11, and it is a common occurrence to find one more on the left side than the right or *vice versâ.*

The *eye* in females is relatively nearer to the snout than in males.

The *teeth* of the vomer have been regarded by Dr. Günther and others as a good character to fix the *S. fario* species as distinct from the *S. trutta species.* That is, while the vomerine teeth in the latter are deciduous, those of *S. fario* are described by Dr. Günther as "persistent through life." Now, whatever the case may be in the trout of Home rivers, I have abundant proof in my notes, made when examining the teeth of Otago trout, that they are very far from being persistent on the vomer. On the head of the vomer (excepting in the case of a trout from the Wakatipu, got in January, 1880) I have always found the teeth present. But, on the shaft of that bone, the gradual disappearance, year after year, of the teeth, is from behind forwards, and appears to be mainly a consequence of the increased age of the individual trout.

The *body* of the trout in outline is much more varied than one would suppose, and this is, I venture to think, the explanation of the difficulty anglers find in guessing correctly the weight. Thus, taking the case only of trout when in good or fair condition, the back is sometimes so slightly arched as to be nearly straight, the belly in such a case being very deep and full (see fig. 2, pl. xliii.); so much so, indeed, as (with exceedingly fat fish) to distort the mouth, and throw the ventrals nearer the tail. Then our best-shaped trout are hog-backed from the head to the dorsal fin—both back and belly being properly balanced in their curves. There are also two distinct forms when viewing trout transversely: the one is narrow and deep in section, the other broad across the back, and not at all deep in section. As already mentioned, I find in good fat fish the minimum ratio of depth to girth should be as 1–2½. I have not much to say about the form of the fins, excepting that as regards the tail, or, as I should perhaps name it, the caudal fin, I find it forked in our young trout; in mature fish of 2 lbs. it often is forked also; but, in heavier and presumably older fish, it varies from slightly emarginate to straight, and sometimes even truncate. I have also frequently seen the upper lobe larger than the under one. The least depth of the tail is pretty constant, being from a tenth to a twelfth of the total length of the trout, or about that ratio.

But, as the *size of the fins* is thought by naturalists to have a direct relation to the depth of water and nature of the bottom, it may be well to see what evidence my specimens can give on that point. Dr. Günther says:—"Those individuals which live in rapid streams, being in almost constant motion, and wearing off the delicate extremities of the fins, have the fin-rays comparatively shorter and stouter, and the fins of a more rounded form, particularly at the corners, than individuals inhabiting ponds or lakes." * The number of trout I have measured with particular reference to this question is not, in my opinion, sufficient to test the case fairly in Otago waters. Out of 13 rivers, I have had 19 males and 6 females under measurement, also 2 males from Lake Wakatipu; these are all. I have classified them, however, distinguishing fish from rapid and rocky streams, as separated from those frequenting larger and stiller water; and I find that the evidence is very puzzling and contradictory, so that different theories might easily be based on particular cases. I have therefore prepared a large table, showing the ratio which each fin bears to the total length of the fish—measuring the base of the single or median fins and the longest ray of the double fins, as representing the lengths. The result on the whole, and taking it for what it may be worth, is corroborative of the above quotation from Günther. Three of the fins, viz., the dorsal, pectoral, and ventral, I find shorter in the rough, quick-running rivers, than in the stiller, heavier streams, or in the lake; but the anal is doubtful. While, therefore, my experiments on this point are not so complete as could be desired, they have brought out other facts curious and interesting, and which are not so open to dubiety. Thus I find the females have all smaller fins than the males, excepting the anal, which is larger. Then, among the females, the range of difference or variation in the size of fins is very great as between different individuals, and also between the different fins of the body themselves. But, among the males, the range is not nearly so great; neither is there the great difference of size between the body fins themselves. These latter facts will appear more clearly from this short table:—

Range in ratio of fins to total length of trout.

	D	P	V	A
Females ..	1·48 ..	1·93 ..	2·10 ..	4·86
Males ..	0·93 ..	0·91 ..	1·44 ..	0·94

* Study of Fishes, p. 634.

This table means that among females the least variation is among the dorsal fins, which variation goes on increasing to a maximum in the anal fins. Among males the variation is nearly the same among all the fins but the ventral, and not at all to be compared in amount with that of the females as before stated.

In the fin rays, nothing in the way of change has been seen by me during the past five years, so that I can but repeat that I find the dorsal and pectoral fin rays vary by one or two in number; the ventral and the caudal appear to be constant, while the anal differs by one ray at times. Thus 12–14 D; 13–14 P; 9 V; 10–11 A; and 19 C, will be the fin ray formula; and I may explain the numbers in the dorsal and anal fins include simple spines, but those of the caudal do not, there being usually four to six spines additional on either side supporting the base of the fin. The caudal seems absolutely invariable as to number of bony and feathered rays, 19 being constantly found by me. Then the ventral is almost as constant, as I have never seen more than one or two cases where the rays differed from 9, and then only by one ray. The dorsal and pectorals may be taken as invariable within the limits of one to four rays; and, in short, within these limits all the fin rays appear to be fixed in number. It is also to be remarked that a comparison of the fin ray formula above with those given by Yarrell, Günther, and others, shows no practical difference. Neither is the difference greater when compared with the formula of the *S. salar* and *S. trutta*, so that the number of fin rays is really of no specific value as a distinction among these closely-allied species.

Scales.—The most constant in number are those in a row from adipose fin back, or forwards to lateral line—probably, however, apparently so only, because they are more easily counted—those taken along whole length and breadth of body being very hard to see at head and tail, and along back and belly. Twenty-three female trout and nine males I found to have 14 to 18 scales from the adipose back to lateral line. Lat. L. 117 to 128, and Trans. L. 48 to 66. The trout having these scales were from 14ozs. to 14lbs., taken from fourteen different rivers or waters. Neither sex nor age showed any real difference in the numbers.

The *Vertebræ* of our trout, so far as I can make them out, are fixed in number; that is, they only vary from 56 to 60. As, however, I have found great difficulty in deciphering the terminal bones at the head and tail, I cannot claim greater accuracy than to within one or two. Out of sixteen trout examined, one had 56 vertebræ, three 57, two 58, seven 59, and three 60. There does not appear to be any correlation between the sexes and the number of vertebræ; thus the mean number among eleven females was 58·5, and among five males, which are all I have a record of, was 58·4.

Neither as yet have I discovered any cases of two or any bones of the vertebræ coalescing or subdividing. Whether young trout have fewer vertebræ than older ones, has not been examined into by me, but I suspect it may be so.

The *Pyloric cæca* situated at the end of the stomach where it forms a second bend in joining the great intestine or gut, appear to possess the functions of assisting in absorbing and assimilating the food from the stomach, and of secreting fat. In external colour they possess a rosy flesh tint, when the trout is in good health and on its natural food, and in form are exactly like miniature sausages. But I recently examined the intestines of a trout taken from a pond, where the trout had been fed largely on curdled milk, and where they were fat, strong, and in good condition, when I found the cæca perfectly white, while the other organs were more or less of the same colour. The interior of the cæca, I have often remarked, contains an opaque fluid or juice, of an orange, red, or paler hue as the case may be, and very much the same as is present in the intestine itself; while the exterior is covered by more or less fat, at times indeed smothered in fat, which is tied and laced in a most intricate and secure fashion to the stomach and cæca by strong fibrous tissues like threads. The fat is whitish in colour. From twenty-one female and seven male trout examined, and which were taken from nine different rivers, a lake, and from Otago Harbour (two from each of the latter), the number of cæca was found among the females to range from 33–61, the mean number being 47·3; while among the males the range was from 37–55, with a mean of 48·7. This shows that while the range in number is great (but among males not so much so as among females, just as with the fins), the mean number does not seem to vary much over the whole, or as between the sexes. But undoubtedly as a means of distinction between the *fario and its nearly related species*, a comparison of the above figures with those given in Günther's "Catalogue of Fishes," will prove to anyone curious on the subject that they are of no use whatever. I except, of course, the Loch Leven trout from this category.

Ichthyologists say, and with apparent reason, that marine fishes are furnished with more cæca than fresh-water forms as a general rule, because they have a wider field to range over for their food, and are in so doing exposed to more numerous and varied enemies than in fresh waters; and that this necessitates the rapid digestion of food, and quick locomotion. Applying this rule to such a restricted field as our trout supply—or rather, I should say, applying to our trout for such contribution as their limited circumstances can afford to our knowledge on this point—I cannot find that the theory is supported as yet, our brown trout having nearly as many cæca as sea-trout. Neither is there evidence that the superabundance of food here has resulted in a rise in the average number of cæca during the past five years or previously. By referring to my first paper of 1878, it will be seen that the mean number for all the trout examined, was 48·3 while now the number is, as above given, for females, 47·3, and for males, 48·7. Thus it is plain the normal average number of cæca is neither on the increase nor the decrease in our waters, whatever may be said of their range varying. Then, as the same variety of *fario* in England is said to have from 38–47 cæca (although the average is not stated, see Dr. Day on the *Salmonidæ*), it would seem at first sight as if our trout had suddenly developed an increased number of these organs, or in other words, had experienced a rise from 42·5 to 48. But the comparison cannot be held to be satisfactory unless all the particulars as to age, weight, sex, stream, and feeding are also known. And just as the parr marks, scarlet spots, and teeth are affected by age, may not the cæca be subject to a similar law? Of course it is impossible to tell to a year or two the age of trout taken in a wild state; at least I do not know any rule at present that can give us this. So in the absence of any better guide, I have taken the weights of the trout as the index of their age, and I find this:—Among eight female trout from various rivers, in weight from 1lb. to 2½lbs., the cæca ranged from 33–55, with a mean of 42·5 in number; and among fourteen female trout, from 3lbs. to 10lbs. in weight, the cæca ranged from 44–61, with a mean number of 50·5. Now Günther's largest trout was 15 inches, which at Home means a trout of about the same age as my 2½lbs. trout; while the approximate mean number (42·5) of the cæca observed by him is exactly the same as the mean here, for trout of the corresponding age. I have not enough examples from males to warrant me as yet in saying how the case is with them; but what I have just now stated, proves that variation in the number of the cæca may be quite as much due to age (the number increasing with age), as to change of habitat from England to Otago, with, in our case, great increase in the food-supply. And there is another principle which seems to have something to do with the number of these organs. The cæca of the trout which had 61 were unusually small, not over one inch in length, while those of trout having 40 and 46 were large, in the latter ranging from half-an-inch to two and a half inches long. If subsequent researches bear me out in these facts, then it will be tolerably evident that while their numbers and size are exceedingly variable, there probably may be a fixed relation between the extent of the absorbing surface of the pylorics, and the weight or age of the trout itself.

Our heavier still rivers do not appear, with their grand stock of smelts and whitebait, etc., to cause any increase in the number of the pyloric cæca, over those of trout in our rougher and poorer streams. This I have proved from a careful examination of a fair number of specimens. And, it is also curious, that a sea-trout caught in Sawyer's Bay, which I opened, had only 40 cæca, while it must have had the finest possible range of feeding ground.

What I have now said regarding these organs in our trout amounts to this:—The actual number of cæca observed in Otago is greater than Günther's recorded number of them at Home; but the evidence I have adduced shows that this increase in number is not owing to an additional demand on the cæca to work, necessitated by the presence of more food, but in all probability to a difference in age of the fish examined. Or, more plainly, there has really been no alteration in the number of the pyloric cæca, or in the extent of their absorbing surface.

There remain but one or two observations which I have to make on structure before finishing my paper, which has expanded into dimensions I did not anticipate, so much so that I may have to reduce the appendix I thought of, if I do not omit it altogether. The first is, that in nearly every female with developed ovaries the left lobe is much longer than the right lobe. And, as to the theory of the thickness of coating in stomachs of trout, (as the Gillaroo trout of Ireland), being a consequence of the food being shellfish, this I must say—that most of our rivers contain a wonderful number of the previously mentioned *Limnæa*, an active little mollusc, which I have found in our trouts' stomachs in incredible numbers. At the same time there are parts of some rivers where they are absent, and where of course the trout cannot get them to eat. I have not paid particular attention to the action of any food on trouts' stomachs as yet; at the same time, had there been any difference between those of trout from either feeding grounds, it is probable that I should have noticed it. And, I certainly have not seen either a thickening or hardening of the walls of the stomach.*

Remarks on Variations.

1. The first variation is a decided one in the spawning season, being two months later, and the duration of hatching a fortnight longer, than in England. But what may be the cause of this I cannot explain.

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* Since writing above, I have found this shellfish at the head of the stomach, and near the vent in great intestine of a one-pound trout from Waipahi River, and in both cases the living animal was digested out of the shells, while these were not broken or affected in any other way.

2. The great increase in the yearly growth of our trout, compared to that of trout in a wild state at Home, is neither a new nor so very wonderful a variation. It seems to me to be due entirely to new and abundant food, and it may to some extent be to new water, also to the constitution or stock of trout. The same has occurred in Scotland, and with a warning note too to us in New Zealand. Mr. J. A. Harvie Brown, of Dunipace, stocked a loch in the north of Scotland, which had no trout in it at all. In two years they multiplied and attained a weight of 4½ lbs. So soon, however, as the trouts' numbers exceeded the food supply, or in two years, they fell off in condition, colour, etc., and latterly were not worth catching. Like cases have occurred elsewhere at home.

3. The colour and markings seem to be controlled, to some extent, by the nature of the water and bottom, among trout of equal age and the same sex, and to be partly an individual quality. But, as to food affecting the colours, I cannot at present offer a very decided opinion; but will mention this—that the Shag River trout are all silvery, while those of the Waipahi are mostly dark and golden, the food being the same, but the geological formation and water very different in these two rivers. I have seen a like variation in colour in two different parts of the *same* river (the Endrick) in Scotland, with presumably one and the same sort of food.

4. There does appear to be a considerable difference in the form of the suboperculum between our trout and Yarrell's typical specimen; but it is not by any means certain that the latter was of the same species. Also, while the form, with our trout, of this bone varies greatly, one or two examples (fig. 2, p. 503), got by me within the last year or two, show a decided tendency to revert to Yarrell's form. On the other hand, his drawing of *S. fario ausonii*, p. 261, vol. i., shows this bone very much as it may be seen in the great majority of our trout; so that there is hardly any ground for believing that a new form or shape of bone has been induced by a change to the antipodes.

5. There is no alteration in the number of fin rays of any moment; but whether the variation in size of the fins is the same as at Home, is a matter which I have scarcely the means of deciding.

6. The scales appear to be more plentiful than in trout described by Dr. Günther, but I can only repeat that probably no two observers would find the same number, owing to their disappearance on the outlines of the body.

7. The vertebræ are not practically different in number from those recorded of the progenitors of our trout.

8. Neither is there any real variation in the pyloric cæca, excepting in the range of numbers; if my explanations given above are borne out by future research.

The numbers of our trout are increasing in such good breeding waters as the Shag, Kaihiku, and Waiwera Rivers, but they are not so heavy by a great deal as in former years. Poaching and fishing are no doubt largely the cause of this; but some other rivers show a diminution in the numbers, with a rise in the average weight of the trout caught. Bad spawning and plundering of shags are no doubt the prime causes.

APPENDIX.

Table of numbers of Scales, Pyloric Cæca, and Vertebræ of Otago Trout, 1883.

LOCALITY.	SEX.	Wght. lb. oz.	SCALES. Adipose to lateral line.			Pyloric C'ca.	Vertebræ.	REMARKS.
			Adipose to lateral line.	Lat l.	Tr. l.			
Kakanui River ..	F	8	..	124	65	49	58	Caught by Mr. S. Lowe.
Shag River ..	F	3	17	..	..	54		
" ..	M	4·8	15	124	..	..	..	Sent by Mr. J. Muir.
" ..	F	2·4	..	117	48	36	54	
" ..	F	1·14½	17	120	60	45	57	
" ..	F	2·8	..	..	..	40	53?	Large cæca.
Waikouaiti River ..	F	14	17					
Water of Leith ..	F	6	15	..	..	50	54	
Lee Stream ..	F	2	15					
" ..	F	1·1½	..	..	..	33	59	
" ..	F	1·4	16					
" ..	F	1·1	..	..	..	46	60	
" ..	F	4·8	14	..	..	46		
" ..	F	3·10	17	..	..	44	56	
" ..	F	4·8	17	..	..	50		
" ..	F	1·9	17	..	..	55		
" ..	M	1·6½	..	..	..	54	59	
" ..	M	2·12	..	119	55	44	59	
Deep Stream ..	M	3	14	..	..	53		
" ..	M	3·4	..	..	..	..	59	
Tokomairiro River	F	7·4	..	121	53	61	59	Very short and thin cæca.
Waiwera River ..	F	2·13	16	128	66			
" ..	F	5	17	..	..	50		
Waipahi River ..	M	4·2	17	..	..	..	..	Sent by Captain Fullarton.
" ..	M	4·8	..	..	..	37	57	" "
" ..	M	5·8	14	..	..	..	..	" "
" ..	M	8·10	16	..	..	..	..	Caught by Mr. Bull.
" ..	F	1·8	..	..	..	39		
" ..	F	6·1½	18	120	55	50		
" ..	F	3·2½	..	..	..	54		
" ..	M	4·8	16	120	60	55	58	
" ..	M	1·7	..	..	..	49		
Kuriwao River ..	F	1·12	14	..	..	46		
Kaihiku River ..	F	5·5	..	..	..	46	..	Large cæca, ½ to 2½ inches.
Otago Harbour ..	F	5	16	124	55	52	57	
Wakatipu Lake ..	M	11	..	117	53	47	..	Sent by Mr. Dalgleish.—Large cæca ¾ to 2¼ in. long, and 1·10 to ¼ in. thick.
" ..	M	10	..	..	..	49	..	
" ..	M	12	15	..	..	36	..	
" ..	M	9·4	..	..	..	..	59	

Table of Lengths of Fins in Inches of Otago Trout, 1883.

Locality.	Sex.	Wght. in lbs. & ozs.	D.	P.	V.	A.	Total Lngth.	Least depth of tail.	Remarks.
Kakanui River ..	F	8	3·3	3·5	2·6	2·4	24·5	2·2	Caught by Mr. S. Lowe.
Shag River ..	F	4·12	3·0	3·0	2·6	..	23·0	2·0	„ at Rich's.
„ ..	M	4·8	2·8	3·0	2·2	1·8	20·7	1·8	„ at Muir's.
„ ..	F	5	3·0	3·0	2·5	2·0	22·0	..	„ at Rich's.
„ ..	F	2·4	2·2	2·6	2·1	1·7	18·0	1·5	„ at Kitchener's.
„ ..	F	2	2·0	2·3	1·8	1·4	16·5	1·5	„ „
Waikouaiti River	F	14	3·75	4·5	3·4	2·7	28·5	2·5	„ by Mr. H. Orbell.
Water of Leith ..	F	17	3·75	4·0	3·25	4·0	33·0		
„ ..	F	5	2·5	2·8	2·2	2·0	21·25	1·7	Harbour, mouth of Leith.
Lee Stream ..	F	1·9	2·0	2·3	1·9	2·2	15·5	..	Gorge water.
„ ..	F	3·10	2·8	2·8	2·3	2·5	20·5	..	„
„ ..	M	2·12	2·4	3·0	2·2	1·6	18·5	1·6	„
Tokomairiro River	F	7·4	3·6	3·5	2·8	2·7	26·5	2·2	Caught by Mr. J. Burt.
Waiwera River ..	F	2·13	2·2	2·2	2·2	2·6	18·0	1·6	
Teviot River ..	F	0·14	1·7	2·1	1·6	1·3	14·0	1·3	
Boat Harbour Creek	F	3·4	2·5	2·9	2·0	2·0	20·5	1·75	Found dead.
Pomahaka River	F	2·6	2·3	2·5	2·0	1·6	18·0	1·6	
„ ..	F	3·2	2·4	3·0	2·3	2·0	19·5	1·75	
Waipahi River ..	M	4·2	2·8	3·0	2·5	2·0	21·25	1·75	
„ ..	M	5·8	3·0	3·7	3·0	2·2	24·0	2·0	
„ ..	M	8·10	3·5	3·75	3·0	2·3	24·75	2·2	Caught by Mr. Bull.
„ ..	F	6·1	3·25	3·5	2·75	2·25	24·5	2·25	
„ ..	M	4·8	3·0	3·4	2·7	2·0	21·05	2·0	
Kaihiku River ..	F	5·5	3·25	3·25	2·7	2·25	24·25	2·0	
Oreti River ..	F	5·0	2·75	3·0	2·2	2·0	20·75	1·9	
Wakatipu Lake ..	M	8·4	3·2	3·8	2·7	2·4	25·5	2·3	
„ ..	M	9·4	3·8	4·0	3·0	2·8	26·0	2·6	
„ ..	M	12·0	3·75	4·0	3·1	2·5	26·5	2·5	Sent by Mr. Dalgleish.
(Canterbury fish)	F	2·0	2·0	2·1	1·6	1·8	15·5	1·6	„ Mr. S. C. Farr.

Note.—The proportion or ratio which the length of any fin bears to total length of the fish as expressed by L÷D, L÷P, etc., has been used by me for ascertaining the differences in the length of the fins between individual fish and between the sexes, and may be readily deduced from above table.

Art. LVI.—Sorghum *Experiment*, 1882–83. By Mr. Justice Gillies.

[Read before the Auckland Institute, 20th August, 1883.]

Having no land of my own fit for growing *Sorghum* this year, Mr. W. F. Buckland kindly undertook to grow half an acre for me on his property at Remuera. The land is a strong volcanic loam, had been under crop for several years, and had a good deal of sorrel in it. Mr. Buckland manured the land with one and a half cwt. of bone dust. On the 20th of October, 1882, he planted exactly half an acre with "Early Amber" *Sorghum* seed supplied by me. The seed was planted in rows 3 feet apart, and about three seeds

* See Trans. N.Z. Inst., vol. xiv., p. 373, and vol. xv., p. 261.

2 feet 6 inches apart in the rows. The land was kept free from weeds by one hand-hoeing and two scarifyings during the season. In a few days the plants showed above ground, but, as usual, were very weakly at first, and did not make much growth for about six weeks, when they shot up with extraordinary vigour. There were a few misses in the rows, in which fresh seed was planted, but it never caught up to the first sown, and got smothered out when the rapid growth set in. The crop, when fit to cut, was about 11 feet high, and contained, by estimation (founded on one ton cut and weighed), at least eight tons of cane. By the 7th March the cane, or at least a considerable portion of it, seemed ripe enough for cutting. I, therefore, had about half a ton cut, topped, stripped, and carted to my mill on that date. On the morning of the 8th we commenced crushing (the cutting being continued) till we had one ton weighed of cane, which was crushed in about seven hours, yielding about 84 to 90 gallons of juice. The juice showed a slightly acid reaction on litmus. I heated it in a copper boiler to 160° F., and added cream of lime till the acid was neutralized, without showing any alkaline reaction, and then brought it to boiling point. After a few minutes boiling, allowed it to settle, and, when sufficiently settled, we drew off between 60–65 gallons of fine clear amber coloured juice into the evaporator. (We had not time to strain the remainder of about 20 gallons.) I used no sulphurous acid on this occasion, there appearing to be no excess of lime. We then evaporated the juice carefully in the open evaporator. Fearing to burn the syrup, we drew it off before it showed sufficient signs of crystallization. The nett result was about 10 gallons of beautiful golden syrup. This we poured into shallow wooden vessels to cool, but after leaving it in these for several days, and finding but little signs of crystallization, I put it into glazed earthenware jars, taking some samples in glass jars for further experiments. After a few weeks I found a considerable amount of sugar crystallized in the jars. One of the samples taken I further evaporated, which, when cooled, crystallized, giving, when drained under pressure, 8 ozs. sugar of fine grain of a pale straw colour, leaving 6 ozs. of rich treacle. Mr. Buckland also experimented with a similar sample. He informed me that he carefully boiled the syrup for about half an hour, when he found it give the proper test for crystallization. He then poured the syrup back into the bottle, and in a few days it had crystallized. He had some difficulty in separating the sugar from the treacle, but eventually succeeded in producing the sugar, fully 6 ozs., now exhibited in bottle No. 1. Bottle No. 2 contains the treacle left. The greater weight produced from my sample arises probably from it not having been so well dried as Mr. Buckland's.

Mr. Buckland further experimented with a jar of the syrup containing about one gallon. After it had stood for some months, he boiled the syrup as before until it stood the proper test. He then poured it into soup-plates. A week having elapsed without any sign of crystallization, he poured it from the plates into five glass salt jars. In a few days he found it had all crystallized, but when he went to treat it further, he found that the contents of two of the jars had reverted to syrup. He then treated the three that were in order so as to extract the sugar.

On pouring out the contents of one of the jars, which had reverted to syrup, it at once crystallized, and he extracted the sugar. The remaining jar has since crystallized, but has not been further treated. He thinks that these two obstinate jars got more of the thin top of the syrup than the others in pouring it from the soup-plates. He obtained from this second experiment about 1½ lbs. of the sugar you see in those two glass jars, Nos. 2 and 3.

Of course these somewhat roughly-made experiments give no data for estimating the proportion of sugar which can be extracted from the syrup. In dealing with these small quantities there is a constant loss, as every time the material is poured from one vessel to another, a considerable portion sticks to the vessel. What is proved, is, that in the syrup there is a large amount of good sugar crystallizable and extractable even by the roughest processes. If vacuum pans were used for concentrating with certainty the syrup to crystallizing point without risk of burning, and centrifugal machines used for extracting the sugar, as is now successfully practised in America, then, alone, could the exact proportion of sugar to syrup be determined. A much better quality of sugar is also thus prepared, fetching 8 cents. per lb. in the market in America, whilst that prepared in open pans fetches only 4½–5 cents.

The following results I claim to have established:—1st. That the Early Amber *Sorghum* is well suited for our soil and climate, from the Bay of Plenty northwards. 2nd. That on average soils, from 12–16 tons per acre of cane may be grown at an expenditure not greater than for a crop of maize. 3rd. That 40–50 per cent. of weight of cane, equal to 90 gallons per ton, may be expressed as juice. 4th. That the juice properly treated will produce one-sixth of its bulk, or 15 gallons of a rich syrup, far superior to ordinary molasses, which will keep unaltered by fermentation for many months.

What I expect to see in the future is this: that our northern farmers will grow *Sorghum*, crush, and concentrate the juice to syrup, not attempting to make sugar themselves, but sending their syrup to the sugar-refining works now in course of erection near Auckland, where it will be properly treated, and the sugar produced by the most approved processes. As the concentrated syrup weighs 14½ lbs. to the gallon, it would, if sold at the absurdly low price of 1d. per lb. (in America it sells for 7 cents. per lb.—or 3½d.), produce a gross return of £14 10s. per acre, a sum sufficient to yield a fair profit per acre; as I calculate that with a two-horse mill crushing 80 gallons of juice, or 1 ton of cane per hour, the total expense of crushing and evaporating should not cost, (within reasonable distance of coal,) over 10s. per ton, or £6 per acre. This is, of course, only calculation, as the actual cost in my experiments, employing special labour, came to about £1 per ton, or £16 per acre. But even this would leave a good profit with syrup at 2d. per lb. On a farm no labour would be required other than the ordinary labour of the farm, and the leaves and seed would be an important and valuable item in the feeding of stock and poultry.

I have now finished my experiments, as my increasing public duties will prevent my further prosecuting them. It remains for some intelligent farmer to take up the matter, and test the results I have obtained. To such an one I shall be happy to hand over my crushing-mill, boiler, and other apparatus, as well as afford him every advice and assistance in my power. I feel thoroughly convinced that, at no distant date, the growth of *Sorghum* will be found to be one of the most paying crops that the northern farmer can produce.

Supplementary Paper on Sorghum. By Mr. JUSTICE GILLIES.

[Read before the Auckland Institute, 17th September, 1883.]

SINCE reading my paper on *Sorghum* at last meeting I have received from Dr. Hector the results of the Colonial Laboratory analysis of a one gallon jar of syrup sent him some four months after it was made. These results and the data they afford as to the commercial value of growing *Sorghum* for sugar production are of the utmost value. The following is the report:—

	lbs.	oz.
Syrup for proportion of cane and grape sugar—		
Weight of syrup separated from crystallized sugar	12	3
Weight of crystallized sugar therein	0	12½
Total	12	15½

At a temperature of 60°, specific gravity 1·406 water at 1·000, the syrup contained 71·60 per cent. of cane sugar. The syrup and sugar gave 7·15 per cent. of grape sugar.

	lbs.	oz.
71·6 per cent. upon 12lbs. 3oz. of syrup gives of sugar	8	11¼
Sugar crystallized spontaneously	0	12½
Total cane sugar	9	8

These results astound me, and prove *Sorghum* as a sugar producing crop to be valuable beyond my wildest imaginations. I proceed to the proof.

Three years' experiments have proved beyond a doubt that, on average soils, in an average season, with ordinarily decent cultivation, as for maize, the Early Amber *Sorghum* will, in the northern part of New Zealand, that is, from the Bay of Plenty (perhaps even from Napier) northwards, produce a crop of from 12 to 16 tons of cane per acre. Two years' experiments prove that from each ton of cane from 80 to 90 gallons of juice can be expressed by very inferior machinery. Two years' experiments prove that, if that juice is evaporated in an open evaporator down to 13–15 gallons (that is to say one sixth), a rich syrup results, which will remain unaltered by fermentation for many months. The analysis of the Colonial Laboratory proves that each gallon of this syrup, weighing about 13 lbs., contains 9½ lbs. of cane-sugar, besides 7·15 per cent of grape-sugar or glucose. That means that each ton of cane produces 9½ lbs. $\times$ 13 gallons (taking the lowest quantity) $=$ 123½ lbs. cane-sugar; and that means that every acre produces (taking the lowest average of 12 tons cane) 1,482 lbs. cane-sugar, besides grape-sugar and other what may be called waste products, such as the leaves and seed—valuable for cattle- and fowl-feed. The value of this product of sugar, at £30 per ton, is nearly £20 per acre. This, it will be observed, is taking all the products at the lowest quantities actually produced. Probably the amount of sugar to syrup, 71·6, shown by analysis to be present, might not practically be secured; but, even allowing a large margin, the result is extraordinary. When I compare this with the latest American results taken from the *St. Louis Republican* of 30th November, 1882, kindly furnished me by Mr. Consul Griffin, it will be seen that the Early Amber *Sorghum* produces here a greater weight of cane and developes nearly double the quantity of sugar that it does in Illinois, where the Sugar Company at Champaign pays 10 per cent. The following is the extract referred to:—

"A company at Champaign, Illinois, which has recently made thorough experiments in the manufacture of *Sorghum* sugar, professes to have reached results in the highest degree satisfactory and convincing. The company's experiments were made on the cane grown on 200 acres, cultivated by itself, and that grown on 50 acres more by farmers in the neighbourhood. The latter was bought at $2 to $2 50 a ton. It has made 125,000 lbs. of fair sugar, worth 8¼ cents a pound, and 22,500 gallons of molasses worth 44 cents a gallon. This shows an average gross product of $80 per acre. What the nett product is we cannot tell without knowing the cost of the whole. A very accurate account of the outcome from 12½ acres of orange-cane was kept, which stands as follows :—

"*Product.*

" 9,600 lbs. sugar at 8 cents	$768 00
" 1,450 gallons molasses at 40 cents	580 00
" Total value of product	$1,348 00
" Total expense, including cost of cane at $2 50 per ton, labour, superintendence, fuel, sugar and molasses barrels, interest on capital, and wear of machinery	704 54
" Nett profit	$633 46
" Profit per acre	50 67

" This crop of twelve and one-half acres of early orange yielded 12¼ tons of cane to the acre, which at $2 50 per ton, paid the grower $31 25 per acre for the crop. Twelve tons of early orange, and ten of early amber, are regarded as a fair crop. These yields are certainly encouraging, for they show that *Sorghum* cane will pay a farmer better than wheat; but they are not equal to the product of a well cultivated crop of sugar cane in Louisiana. The Champaign Company has paid out of the profits of its first year's business 10 per cent. on the cost of its buildings and machinery, 8 per cent. on its active capital, and laid aside $3,000 besides; and it is so greatly encouraged that it has determined to increase its capital stock from $25,000 to $50,000, expend from $8,000 to $10,000 for additional machinery, and cultivate 1,000 acres of land in cane next season.

" The Champaign experiment tends to prove, if it does not actually prove, that *Sorghum*-cane growing and sugar making may be made profitable industries in Illinois—not quite as profitable as sugar making from tropical cane in Louisiana, but still lucrative enough to become a permanent feature in western agriculture."

After this I shall cease pitying a northern farmer who complains that he cannot make farming pay by raising wheat or potatoes or rearing beef and mutton, in all which the southern farmer can beat him, instead of taking to *Sorghum* and other crops more suitable to his soil and climate with which the south cannot compete.

Art. LVIII.—*The Law of Gavelkind.* By Coleman Phillips.

(A Reply to Messrs. Wallace and George.)

[*Read before the Wellington Philosophical Society, 14th November,* 1883.]

The accompanying brief paper purposes to explain the Law of Gavelkind, as opposed to the System of Nationalization of Land advocated by late writers, such as Messrs. Wallace and George, and apparently adopted in New Zealand. The question, being a philosophical one, I have much pleasure in presenting it for discussion to this Society.

The law of gavelkind, before A.D. 1066, was the general custom of England; the feudal law of primogeniture succeeding it. The word is "derived from the Saxon word '*gafol*,' or, as it is otherwise written '*gavel*,' which signifies rent, or a *customary performance of husbandry works*;" and, therefore, the land which yielded this kind of service, in contra-distinction to knight-service land, was called "gavelkind," that is "land of the kind that yields rent."*

Such is our best present authority for the word, but Lord Coke held a different opinion. I am inclined to follow Lord Coke, although, perhaps, in the opinion of feudal lawyers, the definition is a right one. It will be necessary hereafter to enquire more fully into its origin. For present purposes the explanation is sufficient. What I wish you to understand is, that the custom of gavelkind means *the compulsory subdivision of the land.*

As to descent. "Gavelkind land descends in the right line to all the sons equally, being an exception to the law of primogeniture. In default of sons, it descends to the daughters in the ordinary manner."

"It is to be remarked, that though females, claiming in their own right, are postponed to males, yet they may inherit, together with males, by representation. If a man leave three sons, and purchase lands held in gavelkind, and one of the sons dies in the lifetime of his father, leaving a daughter, she will inherit the share of her father; yet she is not within the words of the custom, *inter hæredes masculos partibilis*; for she is no male, but the daughter of a male, coming in his stead *jure representationis.*"

"This custom extends also to the collateral line, for it has been resolved, that where one brother dies without issue, all the other brothers shall inherit from him; and, in default of brothers, their respective issue shall take *jure representationis.* But, where the nephews succeed with an uncle, the descent is *per stirpes* and not *per capita*; and so from the nature of the thing it must be, where the sons of several brothers succeed, no uncle surviving, for though in equal degree, they stand in the place of their respective fathers."†

* Wharton's Law Lexicon. † Ibid.

Primâ facie all the land in Kent is gavelkind, except such as is disgavelled by particular statute. How the custom came to survive the Norman Conquest it is difficult to say, for no lands in England were treated so rigorously as those in Kent, not a single tenant-in-chief being left by William. We can only now suppose that the English sub-tenants of Odo, Lanfranc, and other Norman nobles, held their lands, after the Conquest, as their forefathers held them. I am inclined to doubt Archbishop Stigand's stipulation on behalf of the men of Kent, but nevertheless he may have made the stipulation.

The custom also appears to have ruled in Wales before 34 and 35, Henry VIII., c. 26.

In France, since the Revolution, a great number of small estates in land are held under a similar custom. All the children inherit. There are, I believe, five million landowners in France. Public opinion in that country tenaciously adheres to this compulsory division of land, which was adopted, as John Stuart Mill tells us, to break down the law of primogeniture, and "*counteract the tendency of inherited property to collect in large masses.**

In Norway this custom still holds good. Our Scanian ancestors doubtless brought the law of gavelkind with them to England, about five centuries before the Norman Conquest.

In Belgium, too, some lands are held under this custom. Wherever it is in force the custom appears rigorously to divide the land according to the population, and while preserving the independence of each individual, it prevents the accumulation of land into large estates. Under such a custom as the law of gavelkind it is quite possible to cut up New Zealand into five acre allotments, if population should ever grow so dense.

The custom, apparently, arose in this way. Each individual man of the Teutonic and Scanian tribes grew to feel himself so independent, that he insisted upon holding the *folkland* as *bocland* (bookland, that is land held by document). The *mark* was laid out upon the communal system, exactly the same as the Maori held his land before he began to individualize it:—so much corn land; so much forest; and so much pasturage; although the Maori only used the two first divisions. If we were to ask our Maori friends, I think the vast majority of them would prefer the individual title, but the chiefs naturally object, as the individualization destroys their *mana*.

The atrocious *lala* custom in Fiji is kept up solely in consequence of the communal title, with the result that the common people are slaves.

The Teuton or Scanian originally became so personally independent, owing to his mode of life on land and sea, that we find he carried this feeling so far as non-submission to chieftainship. He elected his chief for war

* Polit. Econ., B. ii., cap. ii., sec. 4.

and for peace. This election of chieftains is a strange exception to the ordinary custom of hereditary chieftainship. It is to be regretted that Mr. Stubbs did not live and write in the days of our Stuart Kings and the men who maintained the doctrine of "Divine Right."

Before converting the *folkland* into *bocland*, in order to keep his family around him for purposes of defence, he (the Teuton) doubtless divided his communal strip of cultivated land among his sons, share and share alike. And when he individualized his title, the custom still ran. In some such manner we may presume that the custom arose.

Taken as a whole, I may say that the north-western nations of Europe adopted this mode of inheritance in preference to the Asiatic communal customs, which their ancestors had brought with them from Asia Minor during the course of the original migrations. The law of gavelkind is the great opponent to any system of nationalization of land. It also flies directly in the face of Leviticus, cap. xxv., 23:—"The land shall not be sold for ever; for the land is mine: Ye are but strangers and sojourners with me."

I would ask members to carefully read the Mosaic land laws as laid down in Leviticus. It will be noticed that the peoples of Western Asia apparently adopted a six-year rotation of crops. By the 50th Jubilee Year too, all mortgaged property was to be returned to the mortgagor. A curious mode of equalizing wealth, which of course failed.

While thanking Mr. Wallace, therefore, for having directed our attention to the state of the land question in England, Ireland, and Scotland, we must not overlook the fact that the Bible places these words in the mouth of the Deity: "The land shall not be sold for ever," and that the actions of the north-western nations of Europe have run contrary to this command.

We may therefore now accept as a fact, that this custom of gavelkind, this division among the sons, ran concurrently with the individualization of landed property. But while this was taking place, William the Norman conquered England, and imposed his law of primogeniture, under which all the land evils of Great Britain have arisen and grown: the law of primogeniture, the law of primogeniture alone.

William was a land nationalizator pure and simple. He compelled every man to whom he had granted lands, to meet him upon Salisbury Plain, within twenty years of his conquest, and swear to him that they held their lands from him alone. Fifty-nine thousand men solemnly took this oath. William had determined that every acre of land should be held from his Crown. Strange to say, it is not until every vestige of this law, this conquest has been swept away, and we return to the customs of Saxon

England, that we may hope to progress, and to check poverty and crime. The feudal land law may be regarded as a great curse, which enslaved the free English people.

Herein Mr. George's* reading of history and my own entirely disagree. Mr. George, an able writer and an accomplished writer, advocates that the land must be held as common property. I need only point to the fact that the north-western nations of Europe broke away from the communal custom, and they determined to individualize their title.

The reason why we attach so much importance to our "Crown grant" is, that previous to William the Norman's time, land was held some by custom, other by direct grant from different kings. William determined that every acre should be held from him alone, and by his grant, although in the Domesday Survey all such grants as those made by Edward the Confessor were duly recognized. This simplified matters greatly, and because our ancestors each had to plead his Crown grant, therefore we have learnt to value it.

The reason why William determined to take this step was, that the Church of Rome at that time determined, not only that the occupant of the Papal chair should be the spiritual lord of Europe, but also the temporal lord. If the king of every feudal state was supreme lord of every acre of land in that state, or a proper gradation of sub-lords established, then it would be easy for the Roman Pontiff to over-lord the eight or ten kings, and thereby restore, in a higher degree, the vanished splendour of the Augustan Cæsars. This policy was tried, but after a few centuries it completely failed. It left, however, the law of primogeniture firmly established.

The fact of William reserving a rent under all his grants, since lost by the Crown, and appropriated by the English landlord, a matter specially relied upon by Mr. George, who advocates a policy of re-confiscation, can be dismissed with the remark that William had no right to subjugate the free English people and impose this rent. We cannot allow Mr. George to plead the benefit from a wrong. Previous to William's coming, and the imposition of the feudal laws, the lands of England were rapidly becoming individualized among a free independent people. Our duty now is to return to the custom of gavelkind, and endeavour to sweep away any vestige of the feudal laws.

Mr. Wallace too relies upon this feudal reservation of rent in his advocacy of State nationalization. Randolph Flambard certainly never dreamt that he would have such strong supporters so many centuries after his death. But herein Mr. Wallace has not treated us fairly. Travelling in Malaysia,

* Progress and Poverty.

becoming acquainted with the Indian Archipelago, he also became acquainted with the Chinese land law. Quit rent and tenant right is, I believe, the land law of China. Mr. Wallace was doubtless also aware that the land of India is held under a State proprietary. I think both Mr. George and Mr. Wallace should have given us these precedents. They have not done so. Were they afraid to quote precedents for their own argument?

Looking then to the continents from out of which our ancestors migrated, we find that China, India, portions of Turkey, and Egypt are countries wherein the land is nationalized, *and in all these countries the people are a degraded people.* In the face of the communal system, the north-western nations of Europe individualized their land, although it does not appear clear that they intended the law of gavelkind as any check against the accumulation of large estates. I advocate it now as a check to accumulation, as I do not wish to see the peoples of the Anglo-Saxon race become such degraded beings as the Indians, Chinese, or the Egyptian *fellahs.* I take it that perpetual leasehold property will sap and undermine the strength and independence of any nation, as it is impossible for a man to prove himself so free and independent a citizen under the leasehold as under the freehold title.

It will be observed that the nationalization of land has not, in times past, prevented the accumulation of land, nor has it divided the land according to the population. Thus, if New Zealand were divided into 640-acre blocks, or 320-acre blocks, to-morrow, and each given to one man, we could not, by legislative enactment, get back any of this land for the purpose of settling upon it a future excess of population. We might pass laws to take it away, but those laws would be inoperative. On the other hand, we cannot be sure that, under the perpetual leasing system, land will not accumulate; for it may so happen that, nothwithstanding any act we may pass now against accumulation, yet, nevertheless, these two islands may become separate governments, or foreign war may arise, and then prominent and worthy citizens may be given large areas, or acquire them in other ways.

Is it not therefore preferable to place the subdivision of the land apart from the State, and apart from the people? To place the question upon the imperishable basis of a great custom, used for many centuries by the most independent nations of the globe, and still used and tenaciously clung to by the people of France: a custom whereby the area of the land becomes subdivided exactly in proportion to the population!

To prove this, let us refer to the history of the Roman Empire, and to the Agrarian Laws, although I must apologise for troubling you with historical events, with which you are all acquainted. Passing over then the history of Greece, and the fact of Lycurgus dividing Sparta into 9,000 lots, and Laconia into 30,000, together with the εμφυτευσις title, the model perhaps of feudalism, let us see what the Roman laws were.

You will remember that Rome gradually conquered the countries surrounding the Mediterranean Sea, and confiscated the whole of the lands. These lands became the spoil of the Imperial city, and she colonized them in various ways—by military colonies, and by direct grant to favoured citizens, leaving however to the inhabitants of the conquered countries as much land as they required. Every Roman citizen was supposed, as his birthright, to have a share in the public lands. They were granted upon the condition of paying a tithe rent, or a tenth of their produce, into the Public Treasury, and rough records of the different ownerships were kept, upon which perhaps the record of our own Domesday Survey was afterwards founded. Suffice it to say that the Italian, Punic, and Grecian wars ended by vastly increasing the landed estates of Roman citizens. These estates were mere tenancies-at-will as we may imagine. Time ran on. The public domain was taken up, although we should not consider the different private estates large now-a-days. The mere tenants-at-will, by long-undisturbed possession (I speak now of centuries of time), had converted their leaseholds into absolute ownership. The mere course of time produced such an effect. The lands changed hands, until it was difficult to tell which was public, which private property. The population of the capital, Rome itself, and of other great towns, increased in numbers, and Roman statesmen, in order to relieve the distressed poor, asked themselves why the poor citizens should not have a portion of the public estate? Servius Tullius tried to pass an agrarian law as it was called, but was defeated by the nobles and wealthy capitalists (in many cases commoners) who were monopolizing these lands. Spurius Cassius, the Consul, next tried, but his proposal met with no better fate, and he himself was beheaded. Then Licinius Stolo (about 367 B.C.) tried, and after a struggle of five years carried his Bill.

The Licinian Law was as follows:—Every Roman citizen should be entitled to occupy any portion of the unallotted State land, not exceeding 500 jugera (a jugera was about two-thirds of an acre), and to feed on the public pasture land any number of cattle not exceeding 100 head of large, or 500 head of small; paying in both cases the usual rates to the Public Treasury. Whatever portions of the public land, beyond 500 jugera, were occupied by individuals, should be taken from them, and distributed among the poorer citizens as absolute property, at the rate of seven jugera (about 5 acres) a-piece.

For two centuries and a half this law, and the military colonies drafting away emigrants, relieved distress; but, about 130 B.C., a redistribution of the public estate became absolutely necessary, and Tiberius Sempronius

Gracchus determined to enforce the Licinian law, which had fallen into abeyance. Thereupon he passed the following law, called after him the Sempronian Law:—"That every father of a family might occupy 500 jugera of the State land for himself, and 250 jugera additional for each of his sons; but, where this amount was exceeded, the State was to resume the surplus, paying, however, for the buildings erected thereon. And this surplus was to be distributed among the poorer citizens, a clause being inserted in the Bill to prevent their selling the land, as many of them would have done."

But the owners of the lands objected. They had taken them up or bought them from others, improved them, made them their homesteads. At this time, the *Latifundia* cannot be regarded as excessively large estates; and the owners naturally objected to a confiscation. In subsequent centuries the estates did increase in size under this system of State ownership, until the system thoroughly undermined the independence of the citizens. But, at the time of Tib. Semp. Gracchus, the estates were not excessively large; so when he stood again for the tribuneship, fierce party strife shook the State, and he and 300 others were slain. The Sempronian Law was constantly evaded and rendered inoperative. Tiberius Semp. Gracchus was a good, moderate, and conciliatory man.

We can fully imagine that the inhabitants of the towns stood no chance in a contest of this kind with the sturdy agriculturists fighting for their homesteads. It is a pity that the idea of a compulsory subdivision did not enter the plans of Tib. Gracchus. But that could not be, for at that time a father possessed the power of life and death over his children. The world had not then emerged from slavery.

Thus, then, in Rome we find that the State had little power, and the people became enslaved. (That is to say, the State had little power to deal with their own leaseholds after they had been once granted. This is the weak point in the Land Nationalization Scheme. It is easy to lease the public land once, but it is found almost impossible for the State to take re-possession and re-lease the land as a private owner would do). Yet we must not overlook the harsh debtor and creditor laws of Rome, which also conduced to this slavery. These had a greater effect than the land laws. Under our own Norman feudal laws, too, the free English people became villeins and serfs.

So that we see that while China, India, and Egypt are still pure State lands, the system in Greece and Rome failed, and that the north-western nations of Europe improved upon it, by individualization; carrying such improvement with them, subject to the feudal law of primogeniture, in their migrations to America and Australasia. Had they carried with them the Anglo-Saxon custom of gavelkind, in place of the feudal laws, I much doubt whether to-day there would be in New Zealand any attempt to restore a system of nationalization of land which, perhaps, best applies to tropical countries, where population is dense, and the rules of government require to be simple. (Nothing is so simple in the way of taxation as a land rent. But its very simplicity has the terrible effect of enslaving the nation. It places too much power in the hands of the Government, whereas a people should always reserve powers as much as possible, granting them out year by year, as in the case of the Mutiny Act).

Having stated this much, I may now lay down certain principles, drawn from the world's history, with respect to the land. I only submit them for your consideration.

1. The land laws of tropical countries do not apply to temperate zones.
2. We cannot trust the State.
3. We cannot trust the people with the leases.
4. It is absolutely necessary that the area of the land of a State should be divided in accordance with the density of the population.

In explanation of the first principle, it is sufficient to say that the north-western nations of Europe broke away from tropical or semi-tropical customs. For the simplification of ruling dense masses of people, there is no better means than nationalization of land and a land-tax. On the other hand, nationalization of land destroys individual independence. The highest aim of any government should be to render each man as free as possible within the State. A very simple form of collecting revenue may be found harmful to a State.

In explanation of the second principle, "that we cannot trust the State," it is only necessary to say that all modern writers, close students of history, agree in condemning Mr. Wallace's proposal upon this one ground. But, then, Mr. Wallace has apparently a very slight knowlege of history. Mr. George is a far more able man, but, living in so free a country as America, he is apparently unaware of the evils of trusting to State management. Would it, however, be well to trust the corrupt government of the United States, or the constantly changing government of France, with the sale and re-sale of the leaseholds? It would certainly not be found advisable, as "party" would then rule in a question with which it, at present, has nothing to do. "Party" is a power which has ruined many a State. We must keep it away from the land question. Directly a piece of land is sold, say in New Zealand, it passes clear away from Government interference. It is as far removed as our judges are supposed to be. All the need there is for State action is to declare in what manner the land shall pass at death, for herein the paramount and sole duties of Government step in,—the order and protection of life and property. We do not trust the State with a penny of money, as our ancestors, since the Rebellion, found it absolutely necessary to pass the estimates yearly. By placing this question apart from Government interference, we do not interfere with private right. "Although the right of bequest forms part of the idea of private property, the right of inheritance, as distinguished from bequest does not." Primogeniture gave the land to the eldest son. I simply wish to give it to all the sons.

In further explanation of the third principle, or maxim, "that we cannot trust the people," it is only necessary to say that this principle varies in degree. The Roman Senate found that those who held the leaseholds would not give them up, and in our own case here, in New Zealand, we shall find that, being a hilly country, the people will become independent and cling to their lands in spite of any laws the Government may pass to the contrary. Such are the Swiss and the "statesmen" of Cumberland and Westmoreland. It will, therefore, be found highly injudicious to attempt to withhold the free individual title from the people of this Colony; although, at present, there is little necessity for any interference at all with the land question. The people of New Zealand, too, must become a maritime nation, and maritime nations have a strange habit of growing very restive under any strict measure of Government control. The sale of the Crown lands then by way of lease and deferred payment, in order to encourage settlement, is, therefore good, and amply sufficient for our present wants. But, if we expect more than that, we shall find that we cannot trust the people. They will not peaceably resign their leaseholds. And should the Government attempt to use force, the Government would find itself defeated. The best way to treat the people of this colony appears to me to be to give them their lands under the free individual title, and if alteration is required, declare the custom of England previous to the Norman Conquest. The law of gavelkind is an inexorable law, by which we may trust the people, and yet divide the area of the lands exactly in accordance with the population. We recognize the justice of the principle every day, for when a person dies intestate we divide his property among his children.

As to the fourth principle "that the area of a state should be divided in accordance with the density of the population;" there are one or two exceptions to this. 1. Commerce and manufactures will support a town population; and, 2. A certain number of people can be supported by usury or the profit of money-lending. Thus, Manchester, Birmingham, and Sheffield support a fairly large population, and draw their food supplies from abroad. And the profit derived by England from the mere loan of money must amount to something like £100,000,000 per annum, which, of itself, means an enormous foreign food-supply. England at present is a gigantic money-lender, and the Stock Exchange is the London office. But both sources of these two exceptions are precarious, and it would be better for a state to depend upon its own food-supply. Therefore it follows that the land should be fairly divided among the people. The danger arises, too, of these great manufacturing towns breeding vast hordes of paupers, which in times of war, pestilence, famine, or other trouble, would put to the test not only the food-supply, but the whole machinery of law of whatever kind. In France, this custom of gavel-kind, and a slightly higher tone of civilization, checks the increase of population beyond the food-supply limit, and it is very doubtful whether we shall not have to educate the members of both sexes of the Anglo-Saxon race in this direction. I, of course, include the fish from the adjacent seas in the food-supply limit.

Mr. George ridicules Malthus. I simply desire to record my respect for the principle enunciated by Malthus, and if the limits of this paper would permit, I think I could show that Mr. George's own observations are open to numerous exceptions.

There is little doubt that England is in a precarious position, when she has to import so many hundreds of thousands of tons of corn and meat to feed her population. This is enough to prove to us here how utterly diverse are our circumstances from the circumstances of America. Furthermore that different land laws apply according to the density of the population. Thus there is more necessity for an alteration in the English land law of the present day than there is in Australasia or America. In the latter countries we may still go on as we are, but in order to prevent accumulation we may enact the custom of compulsory division, the same as France enacted it after the revolution. But in England more immediate and drastic measures are required, for from 20,000,000 of a population, in the course of a few years, the United Kingdom has sprung up into 35,000,000, and it is time to check the growth of this population which surpasses the food limit. A great population will test any land law. But then great populations of paupers should not arise.

Of course emigration of a superabundant home population is no cure for the root of the evil. Emigration only allows the matter from the ulcerous sore to escape as it were. The sore itself is not healed. The only cure is the compulsory subdivision of the land, whereby the population itself imposes the voluntary check to excessive increase. This is the cause found to be at work in France. The five million land proprietors do not care to further subdivide their small estates, and population becomes checked. Under any system of leaseholding whatever paupers would continue to breed paupers, Take the case of Ireland. That country suffered from bad seasons, a dense population, and American competition. The Government of England, led by Mr. Forster, thought that as the people could not possibly pay their rents the landlords should forgive them for a few years. But the law of contract is higher than passing humanitarian motives, and directly the Government began to intefere in the working of the law they stirred up the landlords. The mistake was in having a feudal class of landlords at all, as the only true remedy for Ireland is to divide the land among the population, as in France, and make the people their own landlords. The emigration of the people is a barbarous and temporary remedy. The custom of gavelkind would have long since abolished the "*great*" landlords of Ireland.

And as to this cure of pauperism and compulsory subdivision, I read history differently from John Stuart Mill, who would prefer "to restrict, not what any one might bequeath, but what any one should be permitted to acquire by bequest or inheritance." I prefer to leave the individual perfectly free in all his dealings, only applying the compulsory law at his death. Thus, for the present century, speaking of New Zealand lands, I would content myself with so regulating the law of bequest that a man's sons should inherit their father's land whatever it might be, share and share alike. But with this limitation, that in order to preserve parental *authority, the father may, by will, disinherit any one son, be that son an only one.* There is no necessity to divide the land among the female children of a family, as in a properly regulated State the males should support the females. There should not be so great a disparity in numbers as exists at the present time in England, where there is supposed to be one million more females than males. This is a further incident of the application of the unfortunate feudal laws, and the source of so much misery and crime.

So far as to landed property. As to personalty, I should not hesitate to declare even this divisible among all the children (with a fitting reservation to preserve parental authority), *if necessity arose.* The accumulation of capital leads to the accumulation of land, and it may be necessary for us to insist upon a compulsory subdivision of both. But at the present time I am only dealing with the land question. The subject of usury requires a separate paper. Yet, I am doubtful whether the question of usury should not occupy a higher place in our thoughts than the one of land.

It is necessary for any person desirous of making himself at all acquainted with the land question, to read Leviticus, cap. xxv., the histories of Greece, Rome, and England, and Adam Smith or John Stuart Mill, before reading Messrs. Wallace and George.

Before an Anglo-Saxon Colony or State adopts the principle of nationalization of land, it would be well for it to send a Commission to inquire into the working of the land laws of China and India. The Imperial Government would do well to publish a *précis* of these laws. In such a great Empire as China, there are many different land laws just as there are four or five in England; viz., freehold, copyhold, gavelkind, and borough-English.

"There is nothing new under the sun," especially with regard to this question of land ownership. I wish to see the people of New Zealand, at least, properly educated as to this question. "*Vox populi vox Dei*," says the proverb; but it is only when the people act upon the experiences of ages,—only when they are properly led,—only when they act with caution and not with impulse, that the voice of the people can be truly considered as the voice of God.

Having laid down four principles or maxims, I may be allowed to add one or two more—

5. That the population of a state should not exceed the limit of its home food-supply.
6. That the state has a perfect right to manipulate the rules of inheritance without injury to private property.
7. That different rules of inheritance apply according to the density of the population.

These three principles have already been explained.

In order that we may perceive how easily we may be led into error, it is only necessary to refer to the Rev. W. Blakely's Scheme of National Insurance as a cure for poverty and crime. This writer proposes a scheme which, like emigration, only cures the outcome of the evil, not the cause. Either Mr. Wallace or Mr. George would laugh at Mr. Blakely, and yet neither of those writers is to be depended upon; that is in regard to their scheme of nationalization of land as the cure. To check poverty and crime we must first teach the people that paupers should not breed paupers. The best teacher is the compulsory subdivision of the land, as in France, whereby the people themselves will see the inadvisability of too minutely subdividing their freeholds. A leasehold title of any kind will only continue existing evils. Neither emigration nor national insurance can possibly check paupers breeding paupers.

Pauperism is a question best left to the people to voluntarily relieve. The less a government interferes with a people the better, therefore a government should stand apart both from the land question and the relief of the poor. Under the compulsory subdivision of land there will be found no need for poor laws. Furthermore, should a person, by bequest, devise in charity, no tax ought to be levied upon such a bequest; and this to encourage the independent action of the people. But in the ordinary bequest of personalty, I see no objection to a much higher scale of stamp duties than exists at present. But the scale should be a graduated one, the largest amounts paying the heaviest duty.

It may be desirable hereafter to watch carefully the manner in which companies acquire large landed areas, but no immediate action is necessary. No association partaking of the character of Mortmain should be allowed to stand in the way of a compulsory subdivision of the land. Herein, too, I would point out the growing danger to the State of "capital," when administered by powerful companies. Justice, railroads, telegraphs, stocks, even the constitution itself of the United States, may almost be said to be at the mercy of powerful monetary combinations. Compulsory subdivision appears to be the only safeguard against accumulation, whether of land or money. The custom of gavelkind is advocated for the first; the second is hardly a matter for present consideration. Except, perhaps I may be allowed now to say, that the State has a perfect right to declare in what way property shall pass from the dead to a living possessor. By a proper manipulation of the laws of inheritance, the State possesses a lever of gigantic force. Never yet, in the world's history, has this Herculean instrument been applied, except by our Anglo-Saxon ancestors, in their custom of gavelkind. If I now uncover the baby giant from the dust of ages, it is for the good of my fellow men, and I trust to see its strength grow and grow, until the Anglo-Saxon world recognizes its power, and by its aid sweeps away much of the misery, crime, and poverty, and unequal distribution of wealth ruling amongst us. I think our Parliament should once and for ever declare what the common law of England was previous to the Norman Conquest (the custom of gavelkind), reserving the right of disinheriting one son.

As to the danger of the land, when subdivided, falling into the hands of the usurer, it is only necessary to point out that the law of compulsory division works inexorably. Of whatever land the usurer dies possessed, that land would have again to be divided. There is no escape.

I therefore think the ideas of both Mr. Wallace and Mr. George unworthy of our adoption. They are as unsound as the Rev. W. Blakely's. History, too, condemns them. And I would say, as my earnest opinion, that the nationalization of the land destroys personal independence. The tendency of humanity has been to free the individual. Property now belongs to the individual, not to the family, clan, or State. It would be a step backwards were we to say that it should belong to the State. The highest aim of Government should be to render the individual as free as possible within the Home borders. The more the Government interferes, the more the personal independence of the citizen suffers, and if the unit suffers, the State suffers accordingly. Has there not been too much State interference of late, both with regard to the child and the man. From slavery and from villein service we have developed into free individual action. "Our home is our castle," a noble maxim: Blackstone says from the centre of the earth to the sky. For this principle Earl Godwin fought, eight and a half centuries ago, and it is the highest principle a nation can cherish.

It will be observed, too, that the tendency of the age has been to free England from the feudal idea of nationalization of land. Primogeniture has gone, entail has gone, settlement is being swept away. The next step is to compulsorily divide the land as in France.

With respect to collateral relatives. I agree with Mill, that in cases of intestacy, and the failure of direct heirs, property should escheat to the State. But this is a minor point in the manipulation of the rules of inheritance.

If we really wish to check poverty and crime, and to progress as Mr. George wishes, our bounden duty is to teach parents the great obligation of "not bringing children into the world unless they can be maintained in comfort during childhood, and brought up with a likelihood of supporting themselves when of full age."* I know of no better means than the compulsory subdivision of the land. The great towns will not then become the receptacle of agricultural paupers, as the English towns are flooded at the present time by the Irish. The utter carelessness of the Irish population, in the neglect of this important matter, shows how necessary it is for us to strike at the root of the evil, and by subdividing the land to cause such a people to impose the voluntary check to excessive increase. Poor Ireland has terribly suffered from the incidence of the feudal laws. Time it is for us to divide the area of that country exactly according to the population.

A feature, too, with regard to the free individual fee-simple title as applied to the present circumstances of this colony merits our attention, and our duty is to act for the present. Leaving upon one side the drainage of great swamps, the irrigation of plains, the clearing of forests, or the destruction of pests, let us take the scant timber-supply of the South Island into consideration. Men will not be found to plant trees as readily under the leasehold title as under the freehold. A man will do anything, if he consider his title secure in perpetuity to himself and his offspring; but he will weigh every action if he holds a lease, be that lease called a perpetual lease or by any other title. Of course the State may, and perhaps should, undertake the conservation of the forests; but it is very doubtful whether the private individual will not carry out this work better, *when it pays him to*

* J. S. Mill.

do so. Thus in England, at the present time, there are large private plantations. I would much rather see the private individual surround his property with trees, than leave the State to conserve in different plantations. The supply of wood to the community would be larger and cheaper by individual effort than by State production. Still, by all means, let the State make a beginning. Personally, I have no faith in State interference with material objects of any kind whatsoever. The duties of government are best confined to the protection of life and property and immaterial requirements.

It is not my intention to refer to any of the minor objections to the leasehold title, numerous as they are, such as the exhaustion of the land by cropping, other bad treatment, the horde of officials necessary to form the "department" when in full work, etc., etc. I confine myself to the broad philosophical, or rather economical questions. These matters can best be left to our politicians. In China, the *beau ideal* land of quit-rent and tenant-right, there is a land board for every village, composed of the oldest inhabitants. If a man farm his land badly, he is publicly admonished. And if he still continue the malpractice, he is publicly whipped. Such, of course, must be the effect of the submersion of the free independent title to State ownership. There is also another curious law in that country, worthy the attention of our legislators, viz., the right of the mortgagor to offer his interest to so many members of his family before the mortgagee can take possession. Thus: A mortgages to B for 10,000 taels. The time expires, and B wishes to foreclose. A cannot pay, but he has the right, first to offer his interest to C,—his brother,—who can pay if he is willing and able, and take the property; or to D,—another brother,—or to E his uncle, and so on. As I have before remarked, any Anglo-Saxon State or Colony desirous of adopting the system proposed by Messrs. Wallace and George, would do well to study the land laws of China. At the same time, I think we might ask Sir James Fergusson, the present Governor of Bombay, who, I believe is a member of this Institute, to furnish us with some information touching the Indian land laws. I believe that gentleman would willingly do so.

NEW ZEALAND INSTITUTE

NEW ZEALAND INSTITUTE.

Fifteenth Annual Report.

The Board held meetings on the following dates:—8th August, 25th October, 1882; 15th January and 20th March, 1883.

The members elected under clause 7 of the Act are: The Hon. Mr. Rolleston, Mr. J. McKerrow, and Mr. Martin Chapman. The following gentlemen were elected honorary members of the New Zealand Institute: Sir William Thomson, F.R.S.; Dr. W. B. Carpenter, F.R.S., C.B.; and Mr. R. L. Ellery, F.R.S., — there now being twenty-seven honorary members.

The members now on the roll of the Institute are:

Honorary members	27
Ordinary members—	
Auckland Institute	320
Hawke's Bay Philosophical Society	108
Wellington Philosophical Society	289
Westland Institute	87
Philosophical Institute of Canterbury	163
Otago Institute	178
Southland Institute	62
	1,234

The printing of Volume XV. was commenced on the 10th January and finished early in April, the first issue of the volumes being made about the 17th May. The volume contains sixty-two articles, also Presidents' Addresses and abstracts of papers, which appear with the Proceedings and Appendix. There are 586 pages of letter-press and 40 plates.

The following is a division of the contents of the volume for comparison with that of last year:—

	1883. Pages.	1882. Pages.
Miscellaneous	90	200
Zoology	236	144
Botany	124	104
Chemistry	—	16
Geology	60	52
Proceedings	26	54
Appendix	50	40
	586	610

The volumes now in stock are: Vol I. (second edition), 400; vol. II., none; vol. III., none; vol. IV., none; vol. V., 48; vol. VI., 47; vol. VII., 146; vol. VIII., 18; vol. IX., 150; vol. X., 8; vol. XI., 60; vol. XII., 65; vol. XIII., 68; vol. XIV., 90; vol. XV., not yet fully distributed.

From the Hon. Treasurer's statement of accounts it will be seen that there is a balance in hand of £77 14s. 7d.

The annual reports of various Government departments connected with the objects of the Institute under the Manager's direction are appended.

James Hector,
Manager.

Approved by the Board, 3rd August, 1883.
Wm. F. Drummond Jervois,
Chairman.

Accounts of the New Zealand Institute, 1882–83.

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
To Balance in hand, 8th August, 1882	5	11	10	By Balance due for printing Vol. XIV.	19	18	2
Vote for 1882-83	500	0	0	Printing Vol. XV.	508	0	0
Contribution from Wellington Philosophical Society, one-sixth of annual revenue..	28	17	6	Binding	1	17	6
Sale of volumes	5	5	0	Purchase of second-hand volumes of Transactions, New Zealand Institute, 4 volumes	2	2	0
Draft from London agents, sale of volumes	80	0	0	Miscellaneous items, contingencies, etc.	10	2	1
				Balance	77	14	7
	£619	14	4		£619	14	4

Arthur Stock,
Hon. Treasurer.

3rd August, 1883.

Museum.

The estimated number of visitors to the Museum during the year is 36,180, of whom a large proportion visited the institution on Sunday afternoons.

Natural History Collections.

The whole of the collections of stuffed skins have been examined and thoroughly cleaned by the Taxidermist. No extensive additions have been made to this section, chiefly because it has now become impossible to display, or even to store, such collections properly, owing to the crowded state of the Museum.

Pisces.—Under this head it may be mentioned (1) that specimens of *Retropinna richardsoni* and *Agonostoma forsteri*, caught with a rod four miles up the Hutt River, were presented by the Hon. P. A. Buckley, M.L.C.;

(2) a specimen of *Agriopus leucocephalus*, presented by Mr. H. Hawke, of Picton; (3) a jar of fish, received from Mr. T. S. Sandeyer, of Tiritiri, Auckland; (4) a young specimen of the torpedo (*Torpedo fairchildi*) and the skipper (*Schombressox forsteri*), presented by Mr. C. H. Robson, of Napier.

Aves.—A fine specimen of the egg of the huia (*Heteralocha acutirostris*), presented by Mr. G. M. Hewson, and a specimen of the South Island thrush (*Turnagra crassirostris*), presented by Mr. Geddall, of the Government steamer "Stella," are the most noteworthy under this head. Collections of New Zealand birds have been forwarded to Mr. H. Wharton, England, and to the Australian Museum, Sydney, as exchanges.

Reptilia.—Several species, new to New Zealand, have been determined by the Museum Assistant, and a description of them will appear in Vol. XVI. of the Transactions of the New Zealand Institute. Collections of New Zealand lizards have been sent to Professor Pohlton, of Oxford, and Mr. H. Wharton, England.

Invertebrata.—Twenty-two species of Echinodermata and nine of Crustacea, presented by Professor von Haast, of Christchurch, have been added to the type collections. A cuttlefish (*Tremoctopus robsoni*), which adds a new genus and species to the New Zealand list, has been presented by Mr. C. H. Robson. The *Hectocotylus* was found in the pouch of the female, which adds to the value of the specimen. A collection of Mollusca, New Zealand and foreign, has been presented to Mrs. Whitaker, of Auckland, in exchange for some northern species. The New Zealand land shells belonging to the Museum have been rearranged and named by Professor Hutton, who, at the same time, has rendered the collection more complete by the addition of some of his new species.

Ethnological.

The most important addition to this section is a Malocolo skull, presented by Mr. F. J. Barnett. The skull is remarkable, showing as it does that there is a tribe in Fiji which, like the Caw-we-litcks Indians, flatten the top of the head in childhood.

Miscellaneous.

Extensive additions have been received under this head, among which may be mentioned forty-four samples of artistic earthenware, made and presented by Messrs. Austin and Kirk, of Christchurch; a black vase, glazed with New Zealand manganese, presented by Mr. Hart, of the *Press*, Christchurch; Japanese ware, presented by Captain Ito, of H.J.M.S. "Riujio;" iron, made from Onehunga ironsand, presented by Messrs. Chambers and Co.; olive oil, made from olives grown at Kawau, presented by Sir George Grey, K.C.B.; portrait of Sir David Monro, deposited by Mr. C. Monro; and Chinese ware, deposited by Mr. T. W. Kirk.

The collection illustrating industrial art in the colony has received further additions by a valuable donation of terra-cotta ware, made by Messrs. Boyd, of Auckland, the detailed list of which will appear in next year's report.

Amongst the articles sent from the Museum, either as presentations or exchanges, may be mentioned a collection of New Zealand auriferous quartz to the Perth Museum; a large collection of rocks, fossils, and casts to the Oamaru Museum; New Zealand tanning barks to Messrs. Lightband, Allen, and Co., Christchurch, and to Messrs. Krull and Co., Wellington.

Geological Survey.

During the past year the survey has been extended in various districts, and the result embodied in reports, illustrated with maps and sections, which are published, as is usual, in a separate form. A stay of some weeks in the interior of Otago, in connection with the observation of the transit of Venus, afforded me an opportunity of re-examining the auriferous gravels and the associated strata of the Manuherikia and Upper Clutha Plains. The result confirmed my first expressed opinion that the excavation of these wide valleys dates from a very early period, and prior to many important dislocations of the basement rocks. Further, that the deposits by which they have been filled up belong to various ages, and that the source of the alluvial gold is to be found in the earliest formed of these deposits—in which the gold is irregularly distributed, so that it can only be extracted by the process of hydraulic mining. That enormous quantities of alluvial gold still remain untouched in this form in the above district is beyond doubt, but experience shows that it is only under circumstances favourable for obtaining a sufficient supply of water and a good fall for the enormous volume of *débris*, or tailings, that the gold can be profitably extracted. At Tinker's Gully, Drybread, St. Bathans, and other places along the west side of the Manuherikia Plain, the older auriferous gravels have been tilted at high angles, and thus brought into a favourable position for being worked. In other places where they are below the general drainage level of the basin, although equally rich, they could not be profitably worked.

For hydraulic mining abundant water-supply is required, and could without much difficulty or expense be obtained from the Clutha River, which has a sufficiently rapid fall to afford power to raise part of its own water to an altitude that would command the terraces. Any expenditure for such a purpose would be of great ulterior advantage to the district, as there are very considerable tracts of land suitable for agricultural occupation if they were irrigated. The proof of this is to be seen in many parts of the district where water-races abandoned by the miners have been utilized for gardens and fields with the most gratifying results, even when the soil presents no marked superiority. The dry climate, and marked difference of the temperature of winter and summer, and day and night, which is so characteristic of this district, is all in favour of successful cultivation if irrigation were afforded; and the destructive effects of the high winds might easily be mitigated by the growth of plantations, as trees flourish vigorously wherever there is even a small trickle of moisture. The claim of the district for expenditure on water-supply therefore appears to me to be better founded than in many other districts, where it would have no ultimate advantage beyond the extraction of gold.

Other parts of the Otago District were visited during January and February with special objects, and the remainder of the season was spent in the Taupo and Rotorua Districts on business relating to the general examination of the district and particularly to the utilization of the thermal springs.

Mr. Cox was engaged during the months of October, November, and December on an examination of the district lying between Collingwood and Big River, along the coast-line, and bounded to the eastward by the Aorere River. He reports that the well-known black slates of the Perseverance Mine appear to be represented near the Golden Ridge Mine at Slaty River, Anatori, and at this latter locality he obtained specimens of *graptolites* which would place these beds as Silurian in age. The Golden Ridge Mine is worked in similar beds, and, notwithstanding the fact that very little systematic work has been carried on there, the reef has yielded much richly auriferous stone, and would, he thinks, prove of great value if worked on a wider basis. In the vicinity of Big River and the Turimawiwi he mapped the boundary of the granite, which extends from Rocks Point northwards, and, occurring nearly at the mouth of Big River, forms a narrow strip inland, which is not seen on the surface further than the Turimawiwi, where it ends, as a conical hill, at the head of Independent Creek. He further examined the coal measures, eliciting little further information than was previously known; but, from the limestones which overlie the calcareous sandstones of Kaipuhe cliffs, obtained bones of the giant fossil penguin, and he traced the boundaries of the different members of this Cretaceo-tertiary formation. The rocks in which the Golden Ridge Mine is worked appear to extend southwards through Friday and Independent Creeks, and form the greater part of the Wakamarama Mountains, being again met with on the Gouland Downs; it being from this district that Mr. Cox considers the auriferous cements were derived which have been worked on the quartz ranges near Collingwood, and which are probably contemporaneous in age with the Pliocene marls, which occupy a considerable area along the present course of the Aorere River and form the low hills along the coast-line between Takaka and

Pakawau. During January, February, and March he was engaged on an examination of the Upper Buller District, between Rotoiti and the Maruia River, in order to determine the extent of the coal measures in this direction and the thickness and value of the coal. He reports that they occur flanking the crystalline rocks which occur in Mount Murchison, and extend from there along the western flanks of the Spencer Mountains as far as the Matakitaki River, from which point foliated and talcose schists are found, also flanked to the westward by coal measures. The coal measures occupy the greater part of the area between the line indicated and the mouth of the Matakitaki River, at Hampden, being thrown into several sharp anticlinal and synclinal folds, lapping, at places, round bosses of granite; the coal seams hitherto discovered vary from 2 feet 6 inches to 4 feet in thickness, and are of very superior quality. The upper beds of the coal measures consist of heavy beds of conglomerate, on which rest marly beds, and it is probably from this conglomerate that a large proportion of the gold in the Mangles has been derived, and not from reefs in the vicinity. At the base of the foliated and talcose schists in the Alfred River, Maruia, Mr. Cox found white and blue crystalline limestones interstratified with blue calcareous slates and carbon-schists, which resemble the Lower Devonian beds at Reefton. During May Mr. Cox further examined the beds at the Whau, Auckland, in order to see if any prospects existed of coal being found there; but reported that nothing fresh had been discovered and there was no probability of coal being found.

Mr. McKay was engaged on Museum work until November, when he went to Oamaru, and was engaged until the latter end of December in making a collection of rocks and fossils, which were to form the nucleus of a museum at Oamaru, and examining the strata between there and the eastern slopes of the Kakanui Mountains. He endeavoured to prove the identity of the Shag Point and South Canterbury coal fields by means of their fossils, but failed to trace them farther south than the Kakanui River. He examined the chalk deposits at Cave Valley, and traced them south to Kakanui, opposite Mahemo, where they alternate with beds of Ototara stone and associated floes of basalt. Further south he examined the coal beds in the neighbourhood of Otepopo and the eastern slopes of the Kakanui Ranges to the Kurow River, and determined the rocks there as belonging to the Kakanui formation. Further west he examined the Otepopo slate quarries on the boundary of the Te Anau series, and thence proceeded to Moeraki and the district which has lately been bored, unsuccessfully, for coal, and on the western section where these beds crop out no trace of coal could be found. At Lyttelton he examined the deposits exposed in the cuttings for the new dock, and determined them as true loess, the proof being found in the occurrence of rootlets from the base of the beds upwards, while at Hillsborough the evidence was yet more conclusive. At Timaru and Oamaru he examined beds of similar origin, and found that in these localities the materials of which they are composed are not of local origin, as is evidenced by the presence of mica. At the mouth of the Kakanui River he traced the so-called gem-stones, which consist chiefly of pyrope, olivine, and augite, to their parent rock in the Waireka tufas, which it appears the Hon. Mr. Mantell had previously discovered as far back as 1850, when he called the cliffs on the south side of the Kakanui River the Ruby Cliffs. In the neighbourhood of Palmerston he examined the section across the Horse Range, finding the Port Chalmers breccia at the base of the Shag Point series, and occurring along the line of fault previously described by Mr. Cox. He collected specimens at Waihemo, Green Valley, and Pigroot, those from Green Valley being identical with the fossils of the coal beds in the Waitaki Valley. At Naseby he examined the shaft and surrounding country in Hogburn Creek, where the Deep Sinking Prospecting Company is situated; this shaft has proved nothing more than could be equally well seen from the surface. There is yet another hundred feet to sink before reaching the main bottom, where there is a good prospect of gold occurring. He examined the country from Clarke's to the Kyeburn Diggings, and found the rocks there to belong to the Te Anau series. In the neighbourhood of St. Bathans he found small patches of volcanic rocks in the Manuherikia Valley, breaking through the old lacustrine deposits of the district. He then made a further collection of fossils from Nugget Point, obtaining some important additions to the fossils of that district, including an ammonite about 18 inches in diameter across the chambered portion, which would give a diameter of about 3 feet for the perfect shell. In the neighbourhood of Catlin's River he examined the Mataura beds, in which boreholes had been put down for coal with unsatisfactory results. He found nothing which leads him to suppose that workable seams of coal will be found here, the conditions being similar to those at the Toitois and Hokonui Ranges. During May he visited the Wairarapa, and made an examination of the Cretaceous rocks along the coast, the most important discovery made being a series of volcanic rocks occurring as dykes, and sheets in them. In June he visited the Terawhiti Gold Field, and made a general examination of the district, paying special attention to the Golden Crown claim, in which the reefs appear to be very broken, but unquestionably containing a percentage of gold which will be remunerative if the reefs hold.

Collections.

During the intervals of field work Mr. Cox has been engaged on an examination of the New Zealand minerals, and has embodied the results of his work in two papers, read before the Wellington Philosophical Society, in which he has scheduled all the minerals which are yet known in New Zealand. The total number of varieties mentioned is 74 metallic and 134 non-metallic minerals, making 208 in all. He has since been engaged on an examination of the rocks, and is grouping and classifying them prior to description. He has also completed the classification of a fine collection of foreign minerals, including a valuable series presented some years ago by the Director of the Geological Survey of Canada, which has hitherto been inaccessible for reference. The examination of very large collections of New Zealand rocks has also been commenced, about fifty selected specimens of volcanic rocks having been sliced and prepared for microscopic analysis, and about a thousand specimens critically examined. During the past year collections of fossils have been made at twenty different localities, chiefly from Tertiary and Cretaceo-tertiary strata. The collections are not yet fully worked out, but the number of specimens added to the Geological Survey collections in the Mnseum cannot be short of 10,000 fossils. Nearly 9,000 of these came from a single locality. The remaining collections, not numbering more than 1,300 specimens, are, though small, very valuable additions to our knowledge of the fauna of the beds from whence they came.

Publications.

The Seventeenth Museum and Laboratory Report (68 pages 8vo.), and the Fifteenth Progress Report of the Geological Survey, have been distributed. The following are in the press: (1.) New Zealand Handbook, 3 Ed., Dr. Hector. A new geological map has been prepared to accompany this work, and printed in colours, in the General Survey Lithographic Department; and a copy of the map, together with explanatory letterpress, has been forwarded to the Agent-General for incorporation with a similar work which he is publishing in London. (2.) The Sixteenth Progress Report of the Geological Survey, 1882. By Dr. Hector. With maps and sections; and including Special Reports on the Norsewood Lignites (Cox); on the Gold Fields of Cape Colville Peninsula (Cox); on Deep Alluvial Gold Mines in Westland (Cox); on the Geology of Shag Valley (Cox); on the Malvern Hills Coal Mines (Cox); on the Collingwood District (Cox); on Motunau District (McKay); on the Antimony Lode, Carrick Ranges (McKay); on Langdon's Reef (McKay); on the Terawhiti Reefs (McKay); on the Antimony Lode, Reefton (McKay); on the Geology of the Reefton District (McKay). (3.) The Meteorological Reports for 1880–82 are being included in one volume, which is now in an advanced state of preparation, and will be illustrated by diagrams showing the changes for each month.

Libraries.

The libraries remain on the same footing as hitherto, and appear to be greatly appreciated. But, as in all other parts of the Museum, the want of sufficient space creates great inconvenience to the public.

New Zealand Institute Library.—There have been 275 volumes received this year, chiefly in exchange for the Transactions of the New Zealand Institute and the publications of the Museum and Geological Survey.

Public Library.—The number of persons using this library is steadily increasing. Twelve more, out of the large number of volumes missing when the library was removed to the Museum, have been recovered by the Librarian.

Patent Library.—It would seem that the vast amount of information contained in this library is becoming more generally known, as the number of persons referring to the volumes is much larger than last year. Twenty-one volumes have been added since last report.

Meteorology.

The meteorological observations now taken for statistical purposes are limited to stations at Auckland, Wellington, Lincoln, and Dunedin, but observations of rainfall, temperature, and wind-direction are received from the following third-class stations, twenty in number, viz., at Petone, Makara, Upper Hutt, Summit Station, Wellington, Masterton, Feilding, New Plymouth, Wanganui, Palmerston North, Christchurch, Puysegur Point, Cape Campbell, Oamaru, Timaru, The Brothers, Farewell Spit, Lee-field, Marlborough, Brighton, Otago, Taupo, and Invercargill. The results are published in most cases every month either in the *Gazette* or in the local newspapers, and are collected into the annual volume of the statistics of the colony published by the Registrar-General.

The system of intercolonial weather exchange has now been in operation for two years, and the expense has proved to be much under the estimate formed at the Conference. The diagram of the weather for each day over the south part of Australia, Tasmania, and New Zealand is published the same afternoon in Sydney, Melbourne, Adelaide, and Hobart, and by a system of numbered blocks, which have been supplied by this department, a diagram of the weather of each day is published in the morning newspapers in Auckland, Wellington, Christchurch, and Dunedin, and the information without diagrams is published by most of the other papers in the colony, being distributed by the Press Agency. The local weather warnings for the benefit of the shipping round the coast continue to be supplied as heretofore by Captain Edwin, R.N., and are very generally appreciated.

Observatory.

The time-ball is still dismounted, but hourly signals are given by galvanometer to the Telegraph Department and at the Museum. No change has been made in the Observatory during the year, except that Mr. T. King kindly undertook the meridian observations at a time when both Archdeacon Stock and myself were absent from Wellington. The principal work of the year was the observation of the transit of Venus on the 7th December, 1882, for which purpose I established a temporary observatory at Clyde, in Otago, at the request of Colonel Tupman, R.E., the officer in charge of the British Expedition. The account of my observations has been already published ("Eighteenth Museum and Laboratory Report, 1883," Appendix L, p. 13).

Laboratory.

The total number of analyses made in the Colonial Laboratory during the past year for general purposes is 293. Besides this, a number of analyses have been made under the Adulteration Act of 1880, and a few in aid of criminal procedures. The Laboratory number now arrived at is 3,511. The ordinary analyses are divisible as follows: Coals, 26; rock and minerals, 64; metals and ores, 52; examinations for gold or silver, 50; water, 37; and miscellaneous, 64: making up a total of 293.

The heaviest labour of the year has been expended upon analyzing the Taupo mineral waters—a work which has long been urgently required. Twenty-two of these, representing the principal mineral waters of this district, and well certified as to locality, etc., have been fully analyzed.

Those results which have a general interest are given in full in the annual Laboratory report.

James Hector,
Director.

20th July, 1883.

PROCEEDINGS

WELLINGTON PHILOSOPHICAL SOCIETY.

First Meeting. 13*th June*, 1883.

The Hon. G. Randall Johnson, President, in the chair.

New Members.—F. Stevens and Dr. Grabham.

1. Address by President.

ABSTRACT.

He said the Society had been constituted fifteen years, and its efforts had been successful in harmonizing views and in stimulating concerted action upon a wide range of scientific and philosophical subjects. He then reviewed the work of the Society during the past year. Speaking of University matters, he suggested the importance of having a College established in Wellington similar to those in the other chief cities of the colony. Referring, at the close of his address, to the recent ascent of Mount Cook by Mr. Green, and to conflicting theories as to glacier action on the high lands in these islands as we see them now, he inclined to the theory that the accumulations of snow on plateaux above the line of perpetual snow would send down glaciers to scour deep fiords and narrow valleys till the area of the plateaux became reduced by this very process of vertical denudation; this theory being more in accord with our existing geological knowledge than the more extreme supposition of a glacial epoch similar to that which was conjectured to have once covered Europe. From all that was known of New Zealand geology, he concluded that from long prior to the glacial epoch down to the present time, the same physical forces had been at work, in the same manner and with the same intensity. The frost had continued without intermission to break down the cliffs; the glaciers all along scoured the valleys, polished the rocks, and carried the *débris* to valleys and plains below; the water most efficiently distributing what was so brought down; the only difference of circumstance being attributable to the alteration effected by those very forces in the mass on which they had been so long at work, and the consequent diminution of the power of the glaciers.

2. Dr. Hutchinson exhibited recent photographic views of the large active volcano which forms a prominent landmark in the Sandwich Islands, and gave some interesting information explanatory of the photographs.

Dr. Hector said the evidence afforded by these photographs of the extremely fluid nature of the lava-flow from these volcanoes was most remarkable.

3. "On the Igneous Rocks of the East Coast of Wellington," by A. McKay. (*See* Geol. Reports, 1883).

ABSTRACT.

The author described the geological features of a series of low hills and gullies about fourteen miles from Masterton, on Mr. Beetham's run; and showed a model indicating a well-defined crater, which he had no doubt was the low neck of an extinct volcano, which was in activity during the cretaceous period. He inferred from the adjacent strata, that the volcano was not ancient in a geological sense, though he offered no comparative data as to the period of its probable activity.

Dr. Hector spoke of this volcanic rock as being chiefly important in fixing accurately some of the grades in geological sequence. The discovery had also an importance in searching for gold and other minerals in the district. Although the Terawhiti District showed indirect evidence of former volcanic influences, direct evidence was afforded by large masses of hornblende, like the rock now exhibited from districts near Wellington, and the nature and origin of which they had not been able to account for until the discovery of this volcanic neck. Now they saw the reason, and there might be found other necks of old volcanic craters not far from the surface and nearer Wellington.

Mr. Beetham said this survey near Masterton had been made at his suggestion, and—though Mr. McKay might not know it—they in the district had been used to speak of this broken hill as the "crater." Then it was covered with bush, but now that the bush was mostly burnt off, the crater shape had become more distinct. Gold had formerly been traced in rock specimens, and in the early days he had lost some money in trying to work a hole for gold quartz.

Second Meeting. *4th July*, 1883.

The Hon. G. Randall Johnson, President, in the chair.

New Members.—A. Hoby, H. Gully, W. Dawson.

1. "Notes on Monstrosities in Animals," by Dr. Newman.

ABSTRACT.

The author stated that during several years of observation he had met with a number of rare monstrosities in man, as well as among animals. By noting all the peculiarities of monstrosities that came before them they might, by degrees, learn the law which governed them, while they would also see more distinctly their connection with the early history of the species in which it occurred. In the olden days monsters were looked upon as objects for aversion, and perhaps as occurring as a punishment from God or the gods; now, however, science had shown that they were really nothing but animals, with extraordinary variations from the original species. He then proceeded to describe and classify the different malformations that give rise to monstrosities. In concluding his interesting lecture he said it was possible to obtain monstrosities in chickens by treating eggs in particular ways. Monstrosities of the present day were losing interest, as they were now known to be nothing but the reappearance of a portion of the form of an ancestor. They were only of interest when they were of a very unusual type, when something new might be gathered regarding the history of the species.

Dr. Hector thanked Dr. Newman for the manner in which he had handled a very difficult subject. He, however, doubted whether it was correct to say that monsters were merely a reappearance of a portion of the form of an ancestor.

2. "On the History of the Aorere River, Collingwood, since the Miocene times," by S. H. Cox, F.G.S.; (*see* Geol. Reports, 1883).

ABSTRACT.

The author showed that the various deposits in the lower portions of that river were due to the fact that what now formed two separate streams, which found their way to the West Coast, were formerly its head waters, as the débris could not have been derived from any portion of its present channel.

3. Among the exhibits on the table were about two pounds of quartz, taken from a point between Lowry Bay and Pencarrow Lighthouse, which Dr. Hector said had been tested, and found to contain gold at the rate of 607 oz. to the ton. Dr. Hector added

that the breaks were all fresh, he himself having made them, but beyond that he could say nothing about the find, except that the quartz had a very close resemblance to that of the Wealth of Nations at Reefton.

Dr. Hector also exhibited a calf of *Kogia breviceps*, a rare species of whale, which had been taken from a cow harpooned near Petone, and a fossil ammonite belonging to the Permian formation, found near Nugget Point, in the South Island, by Mr. McKay, and measuring nearly eighteen inches in diameter.

Third Meeting. 18*th July*, 1883.

The Hon. G. R. Johnson, President, in the Chair.

New Members.—E. F. Clarke, J. S. M. Thompson, E. D. Bell.

1. "On Earth Tremors and Earthquakes," by Hon. Robert Hart.

ABSTRACT.

The author sought to establish that matter near the earth's surface is in a constant state of vibration; that matter so in a state of vibration is constantly seeking a level; that the level so sought is on no two consecutive days alike; and, incidentally, that the denudation of a portion of surface of a considerable amount of superimposed weight must tend to the elevation of the denuded surface by the pressure of the surrounding accumulations.

Sections and drawings were exhibited.

Mr. Cox was not prepared to entirely support the author's conclusions, as elevation must occur before denudation commences. As regards the origin of earthquakes, he was of opinion that to a large extent they were due to the gradual shrinkage of the solid earth, from the loss of heat by radiation—for, although we must consider the earth as a highly elastic solid body as a whole, as shown by a comparison of the theoretical and actual specific gravity of the surface rocks and the entire mass—still the earth was a solid, and the shrinkage due to loss of heat could only be attended by sudden and at times violent fractures, which are shown geologically in the faults which traverse the strata, and of which in more recent times we have actual evidence in the earthquake shocks. He did not mean to dispute that some earthquakes were due to volcanic energy, but these were of secondary origin and were of comparatively small extent, while those which had a more wide-spread character owed their origin equally with volcanic phenomena to the shrinkage of the solid earth.

Dr. Hector considered that in discussing the causes of earthquakes and of changes of relative level, the important part played by the interstitial water that is absorbed by rocks under certain conditions, was too much lost sight of.

Fourth Meeting. 1*st August*, 1883.

The Hon. G. R. Johnson, President, in the chair.

New Member.—J. S. Rutherford.

1. "On a new Cuttle-fish, *Tremoctopus robsonianus*, obtained by C. H. Robson at Napier," by T. W. Kirk.

ABSTRACT.

Tremoctopus robsoni, n. sp.

This species differs from the description of the genus *Tremoctopus* as given by Adams, in that the web reaches to and extends beyond the tips of the superior arms.

Colour.—Above: dark-purple, lighter on the head. Below: bright silvery colour, with patches of rose. The web, which shows strong transverse lines, is of a pale rose colour.

Three specimens were obtained at Napier by Mr. C. H. Robson; but the pouches of two of them contained each an *Hectocotylus*, or third right arm of the male, peculiarly modified in order that it may perform certain functions, not yet fully understood, in connection with the propagation of its kind.

The species being new, it has been named after the discoverer, who was good enough to present the best specimen and also the *Hectocotylus* to the Museum.

2. "On the Occurrence of English Butterflies for the first time, at least in Wellington District," by T. W. Kirk.

ABSTRACT.

During the summer of 1881, the author captured in the Wellington Botanic Gardens, a butterfly which, on examination, proved to be the English Red Admiral or Alderman Butterfly (*Vanessa atalanta*). On several subsequent occasions specimens were seen, but contrary to their habit in England, they proved exceedingly shy and capture was impossible. However, examples of another English species, the *Small Tortoiseshell* butterfly (*Vanessa urticæ*) were obtained.

The importation of plants and seeds from various countries is now so extensive, that it is almost certain numerous insects, some useful, some destructive, will be brought into the colony. In order, therefore, that the noxious forms may be more speedily detected, and that confusion may not hereafter arise in our lists and catalogues, it is important that the appearance in a district of any uncommon or foreign form should be carefully noted.

3. "On certain Phenomena of Burning Camphor in Water," by W. Skey.

ABSTRACT.

The peculiarity is that the camphor moves in the direction from which the wind blows, which is accounted for by the unequal output of oil around the camphor when displaced by the oil collecting on the off-side of the camphor and forcing it through the still water towards the wind. Experiments to illustrate this were exhibited.

4. "On the Origin of the Old Lake Basins of Otago," by A. McKay. (*See* Geol. Reports, 1883.)

ABSTRACT.

This paper dealt with two theories of the origin of the old lake basins of Central Otago—that of Dr. Hector, which accounts for these basins by the unequal movements of the land—and that of Professor Hutton, who advocates their having been excavated by ice.

The author agreed in the main with Dr. Hector's theory, but differed in the details as to how it was brought about, and with respect to the age of some of the beds found in these old lake basins. The author's theory is, that in Miocene times a large river flowing across North Otago was checked by the upheaval of the coast line, and converted into a series of swampy lakes, the eastern outlet of which was barred by volcanic rock, thus gradually deepening the lakes, and determining for a time the outflow of their waters by way of the Molyneux River. Subsequently, movements determined the area of the Taieri watershed, and compelled its waters to escape by their present channel along Strath Taieri.

Mr. Cox disagreed with Mr. McKay on his theory of formation of the lakes. He thought that to a large extent they had been excavated by the action of ice, and we had evidence of the great glaciers which had existed during Cretaceous times. He instanced the Blue Spur and Weatherstone's Gully as illustrations of this, and argued that these glaciers, which had deposited the drifts, had also in the first instance determined the configuration of the land, and that in all subsequent elevations and depressions, the form of the mountains then assumed, had been more or less maintained.

FIFTH MEETING. *15th August*, 1883.

Dr. Newman, Vice-president, in the chair.

1. "Remarks on the Distribution of the Organic Productions of New Zealand," by W. T. L. Travers, F.L.S. (*Transactions*, p. 461.)

Dr. Hector said the principle of the paper was to establish an isolated origin for the fauna and flora of New Zealand. It did not, however, disclose any source for that origin.

Dr. Newman said a very short time would suffice to make difference in species. For example, the colour of caterpillars depended on the food they ate.

Mr. Travers said he assumed that the flora and fauna of New Zealand were modified descendants of the fauna and flora of these islands during geological epochs. They were distinct from those seen elsewhere.

2. "Some new Discoveries in the Neighbourhood of Milford Sound," by Donald Sutherland; communicated by A. McKay. (*Transactions*, p. 454.)

3. "On the Occurrence of Chalcotrichite in New Zealand," by S. H. Cox, F.G.S. (*Transactions*, p. 448.)

This paper recorded the occurrence, in the Champion Copper Mine, Nelson, of a mineral not hitherto discovered in New Zealand. Specimens were shown; and the author also exhibited some very rich samples of copper ore from the same mine, that yielded as much as 67 per cent. of copper.

4. A letter was read from Mr. F. L. Dodds, describing a supposed Aerolite, which fell at Urenui on the 8th June last.

5. Dr. Hutchinson exhibited some transparencies of views taken in the Sandwich Islands; and Dr. Hector called attention to an exhibit of some very fine oranges, grown at the Bay of Islands by the Hon. Mr. Williams, M.L.C.

SIXTH MEETING. *29th August*, 1884.

The Hon. G. R. Johnson, President, in the chair.

New Member.—Lee Connell.

1. "Remarks concerning the Greenway Floating Breakwater," by J. C. Crawford.

ABSTRACT.

This information was communicated by the author, in the hope that the system might be applied to certain parts of Evans Bay, in Wellington Harbour, with a view to converting it into a wet dock. He suggested also that certain improvements might be made in the harbour itself, by placing these floating breakwaters in various places, which would lessen the difficulty of landing from vessels in rough weather.

2. "On the Storage of Energy by utilizing Water Power," by J. C. Crawford.

ABSTRACT.

He called attention to the splendid water supply in the neighbourhood of Wellington —the best, perhaps, in the Colony—for the generation of electricity for lighting the towns and manufacturing purposes.

3. Dr. Hector gave some interesting information relative to recent tidal disturbances. He expressed his opinion that the disturbance in Wellington harbour and along the coast of New Zealand yesterday morning had been caused by the volcanic eruption which took place at Krakatoa, in the Straits of Sunda, on Monday last, telegraphic intelligence of which appeared in last evening's paper. In the course of his remarks, Dr. Hector mentioned that the Straits of Sunda had always been remarkable for the eruptions which occurred there, and tradition assigned their formation and separation of the Islands of Java and Sumatra to a violent convulsion during the eleventh century. One eruption in the year 1772 swallowed up a tract of country fifteen miles long and six broad, and destroyed about 3,000 people. This was followed in 1815 by a violent disturbance which resulted in the loss of 7,000 lives, and the noise of which was heard 1,000 miles away; it would be interesting to trace the length of time occupied by the wave in reaching the shores of New Zealand.

4. "Lecture on the Lower Miocene Formation in New Zealand," by Dr. Hector.

ABSTRACT.

An interesting geological lecture, illustrated by large maps and sections and large collections of fossils, and dealing with the subject of the date of the last great emergence of the land in the south of New Zealand.

Mr McKay said that if the glaciers had their greatest extension in Pliocene times it appeared that, considering the amount of strata of intermediate age, it was difficult to regard the Awamoa beds as belonging to the Upper Miocene period. The percentage of recent fossils indicated these beds as belonging to the Lower Miocene period, and thus the palæontological evidence was in accordance with the stratigraphical.

Mr. Travers referred to the important bearing of this subject on the origin of the fauna and flora of the country.

5. Dr. Hector exhibited several additions to the Museum, viz., skull of frigate bird, gannet, jaw of parrot fish, from Jervois Island, presented by Mr. H. Winkelmann; also, marine fossils from interior lake basins of Otago.

SEVENTH MEETING. *26th September*, 1883.

The Hon. G. R. Johnson, President, in the chair.

New Members.—Dr. Sidney Skerman, C. C. Howard.

1. "On a new *Lycopodium*," by T. Kirk, F.L.S., named *Gracile*, and found in Nelson. (*Transactions*, p. 376.)

2. "On a Bird-catching Tree," by Mr. R. H. Govett. (*Transactions*, p. 364.)

Dr. Hector conjectured that the viscid matter exuded from the seeds when ripe was an incident of evolution, the seed attaching itself to a live bird, and so getting carried away and dropped elsewhere for germination.

Mr. Kirk thought the tree was identical with *Pisonia umbellifera*, and that the sticky exudation did act like birdlime in getting those large seeds carried on the feathers of birds.

3. Dr. Hector made some interesting remarks on earthquake disturbances in the ocean, referring to what he had said at the previous meeting, that the tidal disturbances felt on these shores about the time of the Sunda eruptions were due to their influence. The editor of the "New Zealand Journal of Science" had objected that, as the great Australian continent intervened directly between the Straits of Sunda and New Zealand, no tidal wave from that cause could have been felt here without being felt much more forcibly along the southern and western shores of Australia and Tasmania, and suggested that the disturbances felt here were probably due to other submarine movements in the Pacific. Late reports showed that the tidal disturbance was very marked on the west coast of Tasmania; and the disturbances felt here were found to coincide suggestively with the succession of earthquake shocks that followed the eruptions at Sunda. The retardation or acceleration of the tidal swell by those earthquake shocks would act and react in various directions, thereby causing disturbances of varying intensity on all the shores of these islands. An extraordinary phenomenon to which he particularly drew attention was, that atmospheric disturbances as self-registered by a delicately-adjusted barograph coincided remarkably in the sudden jerks on several days with the recorded eruptions at Sunda, beginning on the evening of the 27th August, and recurring on four or five days. These barometrical jerks and curves were exhibited by a diagram, with dates and hours given; and Dr. Hector moreover pointed out that these readings in Wellington corresponded with similar jerks in the curves recorded by a self-registering barometer at Dunedin, showing that they were produced by a fast-moving influence that traversed the atmosphere quite independently of the ordinary cyclonic movements that were in progress during the same period.

4. The President exhibited a skin of a rat from Poverty Bay, which the Natives asserted was the true Maori rat, and raised a discussion as to there being a rat indigenous to these islands.

Dr. Buller believed the so-called Maori rat, which lived in trees, was really identical with the common *Mus rattus* of Europe.

Dr. Hector said that he concurred in this opinion; but Captain Hutton had inferred the former existence of another species from bones found in a subfossil state, and which was a flesh-eating rat, and therefore not *Mus rattus*, which species is very common in the bush country, and comes into Wellington during hard winters. In the northern forests they become very fat at certain seasons, when they feed on the bark of the *Patete*. They also feed largely on wild honey, and after Christmas are often found dead and stupefied in large numbers at the foot of the Puriri trees, being poisoned by the honey, which in some years is dangerous and even fatal to human life at that season.

Mr. McKay said rat bones were found mixed up with moa bones in situations which suggested that the rat and the moa were contemporaries, and exhibited specimens to illustrate this. Either the moa was not so ancient an inhabitant of these islands, or the rat must have been here anterior to the Maori immigration. If the *Mus rattus* of Europe existed here with the moa, by what agency was the rat introduced into these remote islands? It was suggested that the rat might have been introduced by the earliest navigators—perhaps by Tasman—and that the earliest rats and the latest moas existed together.

The President considered that what had been said, proved that this interesting point in the natural history of New Zealand was far from being satisfactorily settled, and hoped that no time would be lost in collecting authentic information on the subject from the natives, before it was too late.

EIGHTH MEETING. 31*st October*, 1883.

Dr. Newman, Vice-president, in the chair.

It was announced that Dr. Buller had been chosen to vote in the election of Governors of the New Zealand Institute for the ensuing year.

1. "On the Anatomy of the Cuttle-fish, (*Sepioteuthis bilineata*)," by H. B. Kirk, M.A.; with drawings and preparations in spirit. (*Transactions*, p. 145.)

2. "On some rare Species of New Zealand Birds," by Dr. Buller, F.R.S. (*Transactions*, p. 308.)

3. Dr. Buller also communicated some notes made by Mr. C. H. Robson on the Eastern Golden Plover, *Charadrius fulvus*. (*Transactions*, p. 308.)

Dr. Hector said that the fact that the Golden Plover was found breeding at sea-level was curious, as he had only met with it formerly at great altitudes on Black Peak, Otago, in 1862.

4. "On *Hieracidea novæ-zealandiæ* and *H. brunnea*," by W. W. Smith, communicated by Dr. Buller. (*Transactions*, p. 318.)

5. Dr. Hector exhibited a specimen containing silver, and associated with Tellerium, found at the Thames, which latter mineral is thus discovered for the first time in New Zealand. He had recognized it among some specimens shown to him by Mr. Pond of Auckland, and his identification had been confirmed by Mr. Skey's analysis of the mineral. The locality is reported to be near Karangahape Mine.

NINTH MEETING. 14*th November*, 1883.

Dr. Buller, Vice-president, in the chair.

New Member.—James Lambert.

A nomination was made for the election of an honorary member of the New Zealand Institute.

1. "On the Occurrence of a Species of *Rhagodia* at Port Nicholson," by T. Kirk, F.L.S. (*Transactions*, p. 369.)

2. "Description of a new Pine, *Podocarpus acutifolius*," by T. Kirk, F.L.S. (*Transactions*, p. 370.)

3. "Notes on the *Parapara* and *Puka*," by T. Kirk, F.L.S. (*Transactions*, p. 367.)

4. "Notes on a Fragment of Samaritan Pentateuch," by T. W. Pennefather, LL.M. (communicated by the President.)

ABSTRACT.

The author exhibited a part of a roll of a Samaritan Pentateuch, brought by him from Nablous, the ancient Shechem. He then read a paper briefly narrating the history of the Kingdom of Israel or Samaria; discussing the question of the probable origin of the "Samaritans" who were in occupation of the country at the time of the return of the Jews from Babylon; tracing the history of the Samaritan nation under the Roman Empire and through the middle ages; and mentioning the accounts contained in the Samaritan chronicles. He then referred to the bringing of the Samaritan Pentateuch to Europe, and the controversy which raged as to its supposed superiority to the Jewish form; but stated that it is now all but universally believed that the latter represents the original text. After describing the great MS. at Nablous, which he had himself examined, he discussed the question of the way in which the Samaritans had become possessed of the Pentateuch, maintaining that the more probable view was that it had been brought to them by Manasseh, a Jewish Priest expelled from Jerusalem by Nehemiah. He then mentioned more in detail some of the points in which the Samaritan differs from the Jewish version, especially the shape of the letters, and the words added by the Samaritan to Exodus xx., 18. After speaking of the rolls now at St. Petersburg and Cambridge, he gave a full account of the Samaritan Passover, Nablous being the only place in the world where the Passover, as described in the Book of Exodus, is still celebrated.

The Rev. Mr. Van Staveren examined the fragment and expressed himself highly pleased with it and the author's remarks.

5. "The Law of Gavelkind," by Coleman Phillips. (*Transactions*, p. 518.)

6. Dr. Hector exhibited the original curve drawn by the large barograph at the Melbourne Observatory on the 27th and 28th of August last, which have very courteously been sent to him by Professor Ellery. This curve shows abnormal oscillations similar to those which he (Dr. Hector) had pointed out at previous meetings of the Society on 29th August and 26th September last as having been produced simultaneously by the barographs at Wellington and Dunedin. By expressing these curves in the same local time it was found that the oscillations occurred about 90 minutes earlier at Melbourne than in New Zealand. If, as was very probable, these remarkable oscillations were connected with the great eruption in Sunda Straits, by measuring the distance along great circles the actual difference in the time would be reduced to about 75 minutes, which would give for the velocity of the transmission of these curious atmospheric waves 600 miles an hour or 1,000 feet per second, or nearly the velocity of sound.

This seems to point to the dispersal of waves through a medium very different from anything we are acquainted with, and suggests the probability of the existence of a somewhat definite limit in altitude to the terrestrial atmosphere with which we are familiar, and in which all our winds and slow moving cyclonic impulses are transmitted. On the occasion of a great outburst of force from the earth's surface, such as the late Java eruption, it is probable that a volume of gaseous matter may be projected through this denser part of the atmospheric envelope, and being there condensed under very different conditions of temperature and pressure, gives rise to pulsations that traverse the upper and more attenuated medium.

Dr. Hector mentioned that the extraordinary coloured glow in the sky which has been visible every clear night and morning since the first week in September, seemed to support this view by proving the existence at an enormous altitude of some vapourous matter capable of refracting the sun's light into its prismatic components. He had observed, to his surprise, on several evenings, that through rifts in the vapour masses, crimsoned in the ordinary manner by the sun after it had set, a back-ground of intense greenish blue was visible. After all the ordinary sun-set tints had faded, this blue changed to orange pink, and graduated off through the various prismatic tints to a magnificent crimson spanning over what appeared to be cloudless sky, considerably to the eastward of the meridian. This spectacle gradually faded with the advance of nightfall, but lasted about one hour and twenty minutes after the ordinary twilight tints had faded. This shows that the vapour causing the tints must have an enormous and very unusual altitude. A similar phenomenon in the evening sky was observed in New Zealand about sixteen years since, but the exact date has not been ascertained. The glow of September last still continues, but it is drawing now towards the pole, as if the unusual height of the refracting medium was extending the antarctic twilight tint even to our latitudes.

With the hint we get from the self-recording barometers it is very difficult to avoid connecting this curious phenomenon which has been seen all over Australia and New Zealand, with the Sunda eruption.*

Dr. Hector also read a letter from Major Scannell, Inspector A. C., stationed at Taupo, giving an account of marked oscillation in the level of Taupo Lake, amounting to a vertical rise and fall of 18 inches, which was repeated several times at intervals of 20 minutes at about noon on the same date that the tidal disturbance was felt on the coast, viz., on 28th August; affording clear evidence of the passing of waves through the lake, due to a motion of the land, probably produced by the unusual periods of the tidal inequalities of pressure on either coast.

Mr. Higginson, C.E., reminded the meeting that in a paper read before this Society on 2nd February, 1878,† he had described similar disturbances of Lake Wakatipu, which were observed by him on 17th November, 1877.

7. "Notes on the Colour of Tellerium," by W. Skey.

Annual Meeting. 13*th February*, 1884.

Dr. Buller, President, in the chair.

New Members.—W. F. Wheeler, F. W. Pennefather, — Richmond, and Rev. H. van Staveren.

Abstract of Report for 1883.

During the past year ten general meetings and a conversazione were held. The attendance at the meetings was larger than usual. Six papers had been read on Geological subjects, 6 on Zoology, 13 on Botany, 2 on Chemistry, and 13 on Miscellaneous subjects. There were now 247 members on the roll, 15 having been added during the year. 75 volumes had been added to the library. Extensive alterations were being made in the library of the New Zealand Institute, and the Museum authorities had converted

* In "Nature," October 25th, No. 730, p. 627, received to-day, I find that a similar disturbance was traced by the barograph, at Mauritius, at the same Greenwich date as at Melbourne, and as these two stations are at the same distance from Sunda, in nearly opposite directions, there can be no doubt but that the disturbance was due to the propagation of a circular wave in the upper atmosphere having the velocity already stated. J. Hector, 20th December, 1883.

† Trans. N.Z. Inst., vol. x., p. 180.

ERRATUM.

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For "being a reply to F. W. Frankland, by W. Skey:" *read* "being a reply to W. Skey, by F. W. Frankland."

the lecture-room into a library for the use of the society. The balance-sheet showed the total receipts for the past year to have been £316 15s. 7d., including balance from last year's accounts of £105 14s. 7d., and the expenditure to have been £171 13s. 8d., leaving a balance of £145 1s. 11d. in hand.

The report and balance-sheet were adopted.

ELECTION OF OFFICERS FOR 1884: — *President* — Dr. Buller, C.M.G., F.R.S.; *Vice-presidents*—A. K. Newman, M.B., M.R.C.P., R. H. Govett; *Council*—James Hector, M.D., S. H. Cox, F.G.S., F.C.S., T. King, W. T. L. Travers, F.L.S., F. B. Hutchinson, M.R.C.S., G. W. Grabham, M. D. Lond. etc., Martin Chapman; *Secretary and Treasurer*—R. B. Gore; *Auditor*—H. Logan.

The new President, Dr. Buller, then delivered an address.

1. "On new Species of Plants," by J. Buchanan, F.L.S. (*Transactions*, p. 394.)

2. "Botanical Notes," by J. Buchanan. (*Transactions*, p. 397.)

3. "Non-Euclidean Geometry vindicated," being a reply to F. W. Frankland, by W. Skey.

4. "On the Lichenographia of New Zealand," by Dr. Knight. (*Transactions*, p. 400.)

5. "On Campbell Island Plants," by J. Buchanan. (*Transactions*, p. 398.)

6. "On Sunset Glows," by Dr. Hector.

ABSTRACT.

This paper gave an account of what has been observed of this curious phenomenon in other parts of the world, as recorded in "Nature" and other periodicals recently received. These mainly showed that all the phenomena to which he had directed the attention of the Society had been seen in every part of the world.

7. "Notice of Discovery of *Amphibromus* in New Zealand;" with Description of a new Species, by T. Kirk, F.L.S. (*Transactions*, p. 374.)

8. "Description of new Plants from Stewart Island," by T. Kirk. (*Transactions*, p. 371.)

9. "Notes on *Carmichælia*," with Descriptions of new Species; by. T. Kirk. (*Transactions*, p. 378.)

10. "On New Zealand Ichthyology," by Dr. Hector. (*Transactions*, p. 322.)

AUCKLAND INSTITUTE.

First Meeting. *4th June*, 1883.

The Rt. Rev. W. G. Cowie, D.D., President, in the chair.

New Members.—Professor F. D. Brown, A. J. Hunter, Dr. Mackellar, J. K. Nicholls, Professor A. P. Thomas, Professor T. G. Tucker.

1. The President delivered the anniversary address.

ABSTRACT.

In thanking the members for his election he referred to the improved position of the Institute, due to the munificent bequest of the late Mr. Edward Costley, and to the endowment in land granted to the Museum by Parliament. The work of the Society was next reviewed, and the increased facility provided for the study of science by the recent establishment of the Auckland University College was pointed out. The important function which is exercised by courses of popular lectures and Sunday lectures was impressed on the Institute as one of its duties in the promotion of science. The facilities which the Institute affords for the pursuit of literature and art as a recreation and means of mental development, and the importance of enlarging and improving the Museum as one of the most powerful educational institutions in the midst of a city population, was urged on the members.

2. "Notice of the Discovery of the Australian genus *Rhagodia* in New Zealand," by T. F. Cheeseman, F.L.S. (*Transactions*, p. 408.)

3. "On a new Genus of *Silphidæ*," by Captain T. Broun, M.E.S.

4. "Our Water-supply," by Mr. Justice Gillies.

Second Meeting. *2nd July*, 1883.

The Rt. Rev. W. G. Cowie, D.D., President, in the chair.

New Members.—E. Champtaloup, G. H. Moore, Rev. G. H. S. Walpole.

1. "On the Effect of extreme Cold on Fishes," by Neil Heath. (*Transactions*, p. 275.)

2. "Descriptions of some new Species of Beetles of the genus *Sagola*," by Captain T. Broun, M.E.S.

3. "On the Botany of the Thames Goldfields," by J. Adams. (*Transactions*, p. 385.)

4. "The Law of Tolerance," by E. A. Mackechnie.

Third Meeting. *20th August*, 1883.

The Rt. Rev. W. G. Cowie, D.D., President, in the chair.

New Members.—T. Maben, J. Mayo.

1. "Further Experiments with *Sorghum*," by Mr. Justice Gillies. (*Tranactions*, p. 512.)

2. "The Pottery Clays of the Auckland Provincial District," by J. A. Pond. (*Transactions*, p. 448.)

3. "Comparative Philology and its relation to Polynesia," by Professor T. G. Tucker.

FOURTH MEETING. 17*th September*, 1883.

The Rt. Rev. W. G. Cowie, D.D., President, in the chair.

1. Mr. Moore and Mr. Justice Gillies, made some remarks on Professor Tucker's paper on Comparative Philology, read at the previous meeting.

2. "Supplementary Remarks on *Sorghum* Cultivation," by Mr. Justice Gillies. (*Transactions*, p. 515.)

3. "New Species of *Carabidæ*," by Captain T. Broun.

4. "Some recent Additions to the Flora of New Zealand," by T. F. Cheeseman, F.L.S. (*Transactions*, p. 409.)

5. "On the natural Spread of *Eucalyptus* in the Karaka District," by A. G. Urquhart. (*Transactions*, p. 383.)

6. "A Visit to Lord Howe's Group, Central Polynesia," by G. H. Moore.

7. "Psychological Investigations," by W. D. Campbell, F.G.S.

FIFTH MEETING. 15*th October*, 1883.

E. A. Mackechnie, Vice-president, in the chair.

New Member.—J. Pickering.

1. "New Species of *Coleoptera*," by Captain T. Broun.

2. "The Spell of the Supernatural," by E. A. Mackechnie.

A lengthy discussion arose on Mr. Campbell's paper on Psychological Investigations, read at the last meeting.

SIXTH MEETING. 12*th November*, 1883.

The Rt. Rev. W. G. Cowie, D.D., President, in the chair.

New Member.—N. G. Lennox.

1. "Direct Evidence of a Change in the Elevation of the Waikato District," by A. J. Hunter, C.E. (*Transactions*, p. 459.)

2. "New Species of *Coleoptera*," by Captain T. Broun.

3. "On the Habits of Earthworms in New Zealand," by A. T. Urquhart. (*Transactions*, p. 266.)

4. "A Revision of the New Zealand species of *Carex*," by T. F. Cheeseman, F.L.S. (*Transactions*, p. 414.)

5. "The Citizenship of Women," by Dr. Wallis.
6. "The New Zealand Railways," by S. Vaile.

Annual General Meeting. *25th February*, 1884.

The Rt. Rev. W. G. Cowie, D.D., President, in the chair.

ABSTRACT OF ANNUAL REPORT.

Twelve new members have been elected during the year. The losses amount to 29, there being a decrease of 17 during the year. The total number on the roll at the present time is 304.

The revenue for the year has been £422 9s. 3d., of which £294 consisted of members' subscriptions. The expenditure amounts to £472 10s. 6d., thus leaving a debit balance of £50 1s. 3d.

Attention was drawn to the bequest made to the Institute by the late Mr. Edward Costley, estimated to be over £10,000, and which is expected to be paid over to trustees for the benefit of the Institute in a short time. Steps were also being taken to utilize the landed endowment granted to the Auckland Museum under the provisions of the "Auckland Museum Endowment Act, 1882."

Six meetings were held during the session, at which 23 papers on various scientific and literary subjects were read.

Brief mention was made of the principal additions to the Museum, Art Gallery, and Library during the year, and the valuable donations of paintings and books received from Mr. J. T. Mackelvie were specially referred to.

Election of Officers for 1884:—*President*—H. G. Seth Smith, R.M.; *Vice-presidents*—Rt. Rev. W. G. Cowie, D.D.; E. A Mackechnie; *Council*—G. Aickin, Professor F. D. Brown, B.Sc., J. L. Campbell, M.D., Hon. Colonel Haultain, Neil Heath, J. Martin, F.G.S., J. Murray Moore, M.D., T. Peacock, M.H.R., J. A. Pond, Rev. A. G. Purchas, M.R.C.S.E., S. Percy Smith, F.R.G.S.; *Secretary and Treasurer*—T. F. Cheeseman, F.L.S., F.Z.S.; *Auditor*—T. Macffarlane.

PHILOSOPHICAL INSTITUTE OF CANTERBURY.

First Meeting. *1st March*, 1883.

Professor F. W. Hutton, President, in the chair.

New Member.—L. Cohen.

A discussion took place on the "Small Birds Question," which was introduced by Mr. M. Murphy, and was joined in by most of the members present.

Second Meeting. *5th April*, 1883.

Professor F. W. Hutton, President, in the chair.

New Members.—J. A. Newell, W. Ives.

"On the Artesian Water Supply of Christchurch," by G. Gray.

Third Meeting. *3rd May*, 1883.

Professor F. W. Hutton, President, in the chair.

New Members.—Dr. R. H. Bakewell, R. M. Laing, W. P. Evans.

1. "On the Economic Limit to the Use of Reservoirs," by E. Dobson.
2. "Description of a new Rosaceous Plant," by R. Brown (communicated by the President). (*Transactions*, p. 382.)
3. "On the Occurrence of the Fern *Botrychium lunaria*," by J. D. Enys. (*Transactions*, p. 366.)
4. "Description of N.Z. *Micro-lepidoptera*," by E. Meyrick. (*Transactions*, p. 3.)

Fourth Meeting. *7th June*, 1883.

Professor F. W. Hutton, President, in the chair.

New Member.—A. Loughrey.

1. "Notes on the Fertilization of Red Clover," by J. B. Armstrong.
2. "Notes on a Native Species of *Mantis*," by T. H. Potts. (*Transactions*, p. 114.)
3. "On some New Zealand Land-shells," by the President. (*Transactions*, p. 161.)
4. "Notes on some Marine Mollusca," by the President. (*Transactions*, p. 212.)

Fifth Meeting. *5th July*, 1883.

Professor F. W. Hutton, President, in the chair.

1. The Chairman announced that Mr. George Gray had resigned his position as Secretary, and that the Council had appointed Mr. C. Chilton in his stead, and that Mr. Gray had been elected to fill the vacancy thus caused in the Council.

On the motion of Mr. W. M. Maskell, it was agreed "That a hearty vote of thanks be accorded to Mr. Gray for the very able way in which he had discharged his duties as Secretary."

2. The Chairman then introduced Dr. R. von Lendenfeld, who delivered a lecture on "A Visit to the Central Alps of New Zealand."

The lecture was illustrated by numerous photographs, maps, etc., and at its close a hearty vote of thanks was accorded to Dr. Lendenfeld.

Sixth Meeting. *2nd August*, 1883.

Professor F. W. Hutton, President, in the chair.

New Members.—T. P. Arnold, R. F. Irvine, A. W. Beaven, Dr. Stewart.

1. "The Germ Theory of Disease, with especial reference to the Infectiveness of Consumption," by Dr. R. H. Bakewell.

2. "A Monograph of the New Zealand *Geometrina*," by E. Meyrick. (*Transactions*, p. 49.)

3. "Description of a new Species of *Cidaria*" (*Lepidoptera*), by R. W. Fereday. (*Transactions*, p. 119.)

4. "Revision of the Zew Zealand Land-shells," by the President." (*Transactions*, p. 186.)

Seventh Meeting. *6th September*, 1883.

Professor F. W. Hutton, President, in the chair.

1. "Revision of the recent *Rhachiglossate Mollusca* of New Zealand," by the President. (*Transactions*, p. 216.)

2. "Notes on *Botrychium lunaria*," by T. Kirk, F.L.S. (*Transactions*, p. 366.)

Eighth Meeting. *4th October*, 1883.

Professor F. W. Hutton, President, in the chair.

New Members.—Dr. R. von Lendenfeld, F. Wilding.

1. "On the Hot Winds of Canterbury," by F. Barkas.

2. "A few Notes on Thermal Springs at Lyttelton," by R. M. Laing. (*Transactions*, p. 447.)

3. "Further Notes on *Coccidæ* in New Zealand, with Descriptions of new Species," by W. M. Maskell." (*Transactions*, p. 120.)

ANNUAL MEETING. 1*st November*, 1883.

Professor F. W. Hutton, President, in the chair.

ABSTRACT OF ANNUAL REPORT.

During the year nine ordinary meetings have been held, the attendance at which has been fair. At these meetings, thirty papers have been read, viz.:—15 on Zoology, 5 on Botany, 1 on Chemistry, 1 on Geology, and 8 on Miscellaneous subjects. These papers have been contributed by 19 authors; and the Council is glad to be able to draw attention to this fact, since it shows that a larger number of members are now taking an active part in the work of the Society.

During the year the Council has made a somewhat new departure in endeavouring to secure for each meeting a paper, which, while making no pretension to be an original contribution to science, introduces some subject admitting of discussion by the members generally.

Thirteen new members have joined during the year, while several have left; and the total number of members is now 161.

Twenty-one volumes and numerous pamphlets have been added to the Library as donations, several volumes have been purchased, a large number of volumes of various periodicals have been suitably bound, and an order for about sixty pounds' worth of books, including a complete set of the Publications of the Ray Society, has been sent to London.

The Hon. Wm. Rolleston has been chosen by the Council to vote at the election of the Board of Governors of the New Zealand Institute.

The balance-sheet shows total receipts for the year £190 17s. 4d.. Expenditure, £153 12s. Balance in bank, £37 5s. 4d. Balance in Savings Bank (Life Subscriptions), £33 1s. 0d. Total balance, £70 6s. 4d.

ELECTION OF OFFICERS FOR 1884:—*President*—R. W. Fereday; *Vice-presidents*—Professor F. W. Hutton, J. Inglis; *Treasurer*—W. M. Maskell; *Secretary*—C. Chilton; *Auditor*—C. R. Blakiston; *Council*—H. R. Webb, G. Gray, G. Hogben, E. Dobson, T. Crook, Dr. Lendenfeld.

The retiring President, Professor F. W. Hutton, then delivered a lecture on "The Origin of the Fauna and Flora of New Zealand."

ORDINARY MEETING. 15*th November*, 1883.

R. W. Fereday, President, in the chair.

New Member.—J. R. Wilkin, junr.

1. "On the Lower Gorge of the Waimakariri," by Professor F. W. Hutton. (*Transactions. p.* 449.)

2. "Additions to the Sessile-eyed Crustacea of New Zealand," by C. Chilton. (*Transactions, p.* 249.)

3. "On the Occurrence of *Phalaropus fulicarius*, Pennant (Red Phalarope), in New Zealand," by Professor J. von Haast. (*Transactions*, p. 279.)

OTAGO INSTITUTE.

First Meeting. *8th May*, 1883.

A. Montgomery, President, in the chair.

New Members.—E. A. Petherick, J. R. Wilkinson, M.A., T. Cheyne Farnie, M.A., G. A. Chalmers.

1. "On the *Pycnogonida*, with Descriptions of Species," by G. M. Thomson. (*Transactions*, p. 242.)

2. "On a new *Daphnia*," by G. M. Thomson. (*Transactions*, p. 240.)

3. "On a *Torpedo* recently caught near Dunedin," by Professor Parker. (*Transactions*, p. 281.)

4. The Secretary exhibited, and described, some embryos of the Elephant Fish (*Callorhynchus antarcticus*), which he had obtained from Wickliffe Bay, Otago Peninsula.

Second Meeting. *12th June*, 1883.

A. Montgomery, President, in the chair.

New Members.—A. Crooke, P. Goyen, J. B. Mason, Miss Wimperis.

The meeting resolved itself into a conversazione.

Third Meeting. *10th July*, 1883.

A. Montgomery, President, in the chair.

1. "On a Specimen of the Great Ribbon Fish (*Regalecus argenteus*, n. sp.), recently obtained at Moeraki, Otago," by Professor Parker. (*Transactions*, p. 284.)

2. "On the Occurrence of the Spinous Shark (*Echinorhinus spinosus*) in New Zealand Waters," by Professor Parker. (*Transactions*, p. 280.)

3. The following resolution was proposed by Mr. G. M. Thomson; seconded by Mr. Petrie, and carried unanimously:—"That, as a new Flora of New Zealand is now very much wanted, the members of this Institute would ask the Governors of the New Zealand Institute to request the Government to place a sum of money on the Estimates for bringing out a new edition of the *Phanerogamia* of the 'Handbook of the New Zealand Flora.'"

4. The Secretary exhibited, and described, some recent additions to the museum, including the disarticulated skull of a calf with the cartilaginous parts preserved.

Fourth Meeting. *14th August*, 1883.

A. Montgomery, President, in the chair.

Mr. F. R. Chapman opened a discussion on "The Nationalization of Land," considering the present aspects of the question, and bringing forward a scheme by which freeholds might be acquired by the State.

The discussion was continued by Mr. J. A. Connell, Mr. W. D. Stewart, Professor Mainwaring Brown, Mr. C. Y. O'Connor, and Mr. W. N. Blair.

FIFTH MEETING. *28th August*, 1883.

A. Montgomery, President, in the chair.

1. The adjourned discussion on "The Nationalization of Land," was begun by Mr. J. E. Denniston, and continued by Mr. W. Arthur and Mr. C. Y. O'Connor.

Mr. Chapman replied, answering the objections which had been made to nationalization, and to his scheme for effecting it, and the discussion was brought to a close by a few remarks from the President.

SIXTH MEETING. *11th September*, 1883.

A. Montgomery, President, in the chair.

1. "The Lower Harbour and Bar of Otago," by G. M. Barr, C.E.

2. "On the Structure of the Head in *Palinurus*, with especial reference to the Classification of the Genus," by Professor Parker. (*Transactions*, p. 297.)

3. The Secretary exhibited some recent additions to the Museum, including the skeleton of a Porbeagle Shark (glycerine jelly preparation), and the baleen of a large specimen of *Balænoptera*, the skeleton of which had lately been purchased.

SEVENTH MEETING. *9th October*, 1883.

A. Montgomery, President, in the chair.

New Members.—S. P. Seymour, J. C. Thomson.

A discussion on "Technical Education" was opened by Professor Mainwaring Brown, who considered the various methods which had been adopted or proposed for the training of artizans in their various handicrafts, and promulgating a scheme which he considered to be applicable to New Zealand.

The discussion was continued by Mr. R. Gillies, the Secretary, Mr. G. M. Thomson and Mr. G. M. Barr.

Professor Brown replied, and a few concluding remarks were made by the President.

ANNUAL MEETING. *19th November*, 1883.

A. Montgomery, President, in the chair.

New Members.—Lawrence V. Woods, M.A., Grant P. Farquhar, F. A. Bülau, Ph.D., Mungo Watson, M.A., and J. de Zouche, M.D.

1. "On the Brown Trout introduced into Otago," by W. Arthur. (*Transactions*, p. 467.)

2. "Notice of *Olearia hectori*," by D. Petrie. (*Transactions*, p. 393.)

3. "New Species of *Coprosma*," by D. Petrie.

4. "New *Pycnogonida*," by G. M. Thomson. (*Transactions*, p. 242.)

ABSTRACT OF ANNUAL REPORT.

Eight general meetings were held during the session, eleven original papers have been read: of these—7 are on Zoological Subjects, 3 on Botanical, while the eleventh treats of the proposed works for the Otago Harbour.

There were also discussions on the "Nationalization of Land," and on "Technical Education."

Fifteen new members have joined the Institute, making the total number on the roll 190.

The receipts of the session, including a balance from last year of £27 6s., amount to £179 11s.; the total expenditure has been £178 3s. 5d., leaving a balance in hand of £1 7s. 7d. The reserve fund in the Post Office Savings Bank is now about £170.

ELECTION OF OFFICERS FOR 1884:—*President*—Donald Petrie, M.A.; *Vice-presidents*—Alex. Montgomery, Professor Scott; *Hon. Secretary*—Professor Parker; *Hon. Treasurer*—J. C. Thomson; *Council*—F. R. Chapman, W. Arthur, C.E., Professor Mainwaring Brown, Professor Ulrich, R. Gillies, F.L.S., G. M. Thomson, F.L.S., T. M. Hocken, M.R.C.S.; *Auditor*—D Brent, M.A.

7. The President delivered an address on "Science and Ordinary Knowledge."

WESTLAND INSTITUTE.

ANNUAL MEETING. 12*th December*, 1883.

ABSTRACT OF ANNUAL REPORT.

The balance at credit of the Institute at the last annual meeting was £20 14s. 5d. The accounts now show a credit balance of £145 12s. 5d.

The number of members on the roll of the Institute for the year 1882, was 90, for this year there are 113, showing an increase of 23, as also an increase in the amount of subscriptions of £21 3s. 6d.

During the year there have been eight committee meetings, and two special meetings, making ten meetings altogether.

A meeting of the Westland Institute was held on the evening of the 21st of May, when a paper was read by Dr. Monckton, "On the Priority that should be given in Instruction in Natural History at the State School over many other Subjects."

Thirteen new books have been added to the library during the year, making now a total of 2,289.

It was resolved to send Home £50 for the purchase of new books.

The number of visitors to the public reading room have been as numerous as in 1882.

Applications have been made to the Borough and County Councils, and to the Harbour Board for subsidies to supplement the funds of the Institute, and they have received £25 from the Borough Council, and a like sum from the Harbour Board.

Of the £6,000 voted for public libraries, the Institute will receive between £30 and £40.

The committee acknowledge donations to the Library and Museum.

HAWKE'S BAY PHILOSOPHICAL INSTITUTE.

Annual General Meeting. *6th February*, 1883.

Election of Officers for 1883:—*President* — The Right Rev. the Bishop of Waiapu; *Vice-president*—Dr. Spencer; *Honorary Secretary and Treasurer*—Mr. Colenso; *Council*—Messrs. T. W. Balfour, J. N. Bowerman, H. R. Holder, T. K. Newton, F. W. C. Sturm, and C. H. Weber; *Auditor*—Mr. T. K. Newton.

Abstract of Annual Report.

During the past winter session six ordinary meetings were held, at which ten papers prepared by members were read.

The present number of members is 108, being an increase of 1 on the previous year; but, during the year, some had died and others resigned, and 11 new members have been elected.

Throughout the year several zoological, botanical, palæontological, and geological specimens were collected by a few of the members of the Institute for the Museum.

Upwards of 70 volumes of valuable scientific works, obtained from England, America, and Australia have been added to the Library.

The audited statement of accounts shows a balance of £215 to the credit of the Society.

First Meeting. *14th May*, 1883.

The Rt. Rev. the Bishop of Waiapu, President, in the chair.

New Members.—A. P. Sheath, C. I. Norton, and Rev. Brother Joseph.

1. "Contributions towards a better Knowledge of the Maori Race:" Part v.—"On the Hawaiki of the Maoris and the Greenstone Legends," division 1, by W. Colenso, F.L.S.

2. Specimens, mostly Conchological and Geological, a donation to the Museum, in part collected at the Barrier Island (Thames) by Mr. C. P. Winkelmann, and part at Jervis' Island (near the Equator, in long. 160° W.), by Mr. Henry Winkelmann, were shown. Living larvæ, chrysalides, and (artificially reared) imago of *Pyrameis gonerilla*, originally captured by the honorary secretary in the Seventy-mile Bush, were also shown; and also a fine specimen of *Torpedo fairchildii*.

Second Meeting. *9th July*, 1883.

The Rt. Rev. the Bishop of Waiapu, President, in the chair.

New Members.—J. H. Coleman, C. W. Reardon, J. N. Livesey, and J. Leonard.

1. Mr. Colenso gave an oral address respecting some of the smaller indigenous vegetable products of the country, their uses and economic value, illustrated with specimens.

2. The following indigenous zoological specimens were exhibited:—*Podiceps cristatus*, now very rare in the North Island; jaws of a large shark (*Carcharias*, sp.); specimen of *Ommastrephes*, etc., etc.

THIRD MEETING. 13*th August*, 1883.

Dr. Spencer, Vice-president, in the chair.

New Members.—Miss L. Large, Mr. R. Dobson.

"Notes on Zoological Specimens," exhibited by Mr. Hamilton.

FOURTH MEETING. 10*th September*, 1883.

The Rt. Rev. the Bishop of Waiapu, President, in the chair.

New Members.—J. F. Matthews, M.R.C.S., Dr. von Mirbach.

1. "On the Men of Science who preceded us in these Seas and Lands, with particular reference to their labours, adventures, and tragical ends" (illustrated with portraits of Sydney Parkinson, La Perouse, David Douglas, the two brothers Richard and Allan Cunningham, Dr. Darwin, Sir J. D. Hooker, and Wm. Swainson; and, also, with some striking views and scenes from La Perouse's Voyage, and Sir J. Ross's Antarctic Expedition); by W. Colenso, F.L.S.

2. Several exhibits (mostly artificial) of the Ancient Maoris, and also small living Cryptogams, chiefly *Hepaticæ* in fruit, were shown.

FIFTH MEETING. 8*th October*, 1883.

Dr. Spencer, Vice-president, in the chair.

1. The Hon. Secretary read, from a late June number of "Nature," a lecture, lately delivered before the University at Cambridge, England, by Professor Huxley, on "Evolution."

2. Newly received specimens, zoological, botanical, and geological, were exhibited.

SIXTH MEETING. 12*th November*, 1883.

Dr. Spencer, Vice-president, in the chair.

1. "Descriptions of several newly discovered indigenous Plants, consisting mostly of Cryptogams," by W. Colenso, F.L.S. (*Transactions*, p. 327.)

Specimens of the plants referred to were exhibited.

2. Specimens of rare indigenous ferns, chiefly contributed and lent for the occasion, by Messrs. Winkelmann, Hamilton, Norton, and Colenso, were exhibited.

Council Meeting. *8th October*, 1883.

Dr. Spencer, the Vice-president, was chosen to vote in the election of the Board of Governors for the ensuing year, in accordance with clause 7 of the New Zealand Institute Act.

Council Meeting. *12th November*, 1883.

Nomination was made for the election of an honorary member of the New Zealand Institute.

Annual Meeting. *4th February*, 1884.

Abstract of Annual Report.

During the past Session six ordinary meetings have been held.

Only one original paper, viz., on Botany, was read at those meetings.

During the year 13 meetings of the Council were held.

There is a total of 113 members now on the roll; 2 members having died during the year; others resigned; and 13 new members were elected.

Several books have been added to the Library; and £50 additional voted and sent to England for the purchase of more.

The statement of accounts shows a credit balance of £170 17s. 11d. The total expenditure for the year having been £163 8s. 8d.

SOUTHLAND INSTITUTE.

First Meeting. *29th May*, 1883.

J. T. Thomson, F.R.G.S., President, in the chair.

"On the Distribution of Seeds," by J. C. Thomson.

Second Meeting. *22nd June*, 1883.

J. T. Thomson, F.R.G.S., President, in the chair.

"On the Physical Geography of the North Island," illustrated by views of the Hot Spring districts, by J. T. Thomson.

Third Meeting. *17th July*, 1883.

J. T. Thomson, F.R.G.S., President, in the chair.

"On the Physiology of Plants and Tree Life," by W. S. Hamilton.

Fourth Meeting. *14th August*, 1883.

J. T. Thomson, F.R.G.S., President, in the chair.

1. "On Wind in Southland," by J. T. Thomson.
2. "On Lunar Influences and Popular Fallacies connected therewith," by the Rev. Mr. Fairclough.

Fifth Meeting. *18th September*, 1883.

J. T. Thomson, F.R.G.S., President, in the chair.

"On the Resources of Southland," by Mr. Scandrett.

This paper has been since printed in pamphlet form by the author.

Sixth Meeting. *16th October*, 1883.

J. T. Thomson, F.R.G.S., President, in the chair.

1. "On the Coal and Lignite Deposits of Southland," by W. S. Hamilton.
2. "On certain Finds of Moa bones," by Mr. Webber.

ANNUAL MEETING. 12*th February*, 1884.

J. T. Thomson, President, in the chair.

New Members.—Dr. Closs, — McArdell, — Froggatt, — Moir, R. B. Rigg, James Borrowman.

ABSTRACT OF ANNUAL REPORT.

The Report showed the total income for the year to have been £98 18s. 6d., and total expenditure £60 7s. 10d., of which £39 19s. 4d. was for books and binding.

It was resolved to expend one-third of the year's income in new books.

ELECTION OF OFFICERS FOR 1884:—*President*—J. T. Thomson; *Vice-president*—Mr. Denniston; *Secretary*—W. S. Hamilton; *Treasurer*—W. R. Robertson; *Council*—Dr. Galbraith, — Scandrett, — Webber, J. T. Martin, — Carswell, J. B. Greig.

Mr. Martin inquired if any effort had been made to secure a site from the Government on which the Institute might build.

The President replied in the negative, but suggested that the matter be committed to Messrs. Feldwick, M.H.R., and Joyce, M.H.R., to be attended to when they got to Wellington. This was agreed to.

NELSON PHILOSOPHICAL SOCIETY.

Preliminary Meeting. *25th August*, 1883.

The Bishop of Nelson in the chair.

Twenty-two gentlemen attended.

Resolutions were passed, affirming the desirability of forming an association to be called the "Nelson Philosophical Society," to be affiliated to the New Zealand Institute, and fixing the subscription, time of meeting, and office-bearers.

A Provisional Committee was appointed to draw up rules.

General Meeting. *22nd September*, 1883.

The Bishop of Nelson in the chair.

The Rules, as drawn up by the Provisional Committee, were read and passed with alterations.

Election of Officers for 1883–84:—*President*—The Bishop of Nelson; *Vice-presidents*—Dr. L. Boor, A. S. Atkinson; *Secretary*—Dr. J. Hudson; *Treasurer*—J. Holloway; *Council*—The Hon. J. C. Richmond, J. Meeson, M. Fearnley, J. Park, Col. Walcott.

Ordinary Meeting. *1st October*, 1883.

The Bishop of Nelson, President, in the chair.

The following Inaugural Address was then read by the President:—

ABSTRACT.

The President, after some introductory remarks, proceeded to discuss the position of the Society and the reasons for its establishment: "First of all there is the fulfilment of a duty towards promoting the accumulation of *knowledge* in the community. There are Commissions and Boards to look after primary education; others to look after the preservation of the peace and the maintenance of law and order; the interests of religion, too, have each of them their guardians, while the progress of culture in the departments of science, art, and literature ought to have those whose duty it is to watch, and to watch with intention to help, the spread of such culture in the midst of us, and not merely to accumulate facts (which is not culture), but the reduction of such facts into influence on character, which is culture.

"Further, the observation and registration of phenomena, which would otherwise pass unnoticed, is a duty which is now left undone in this place. Formerly, the Government had meteorological observations taken here, and rightly so too, for Nelson is exceptional in many points of view, and its merits and attractions lie in that exceptional position, and should be honestly and graphically, but not ostentatiously, set forth.

"It is said we are too ambitious in setting up a Society of this kind here, where there are few experts in any one branch of science: we can only answer, we see no unworthy ambition in giving out publicly that we are seeking knowledge; and it would seem unreasonable for us not to have in this our community an institution, a parallel to which may be seen to exist, in far less promising fields, in the provincial towns and cities of England. Should it be said, also, that there can be but one or two experts in so small a population; yet the encouragement which association will give to such persons will perhaps induce others to become specialists, and many facts will be saved from oblivion which would otherwise perish.

"A further reason let me add of increasing cogency: Nelson is likely to become a rendezvous for men of leisure and people of some substance, and the days and hours of a life of retirement, especially after active business habits, are likely to become tedious and full of ennui—it is something to occupy their minds. Labour, too, must not be allowed in this our new country to exercise the tyranny it is doing in the old, consuming all the hours of the day. Knowledge is also a kind of possession: a man who knows of what the landscape consists, what goes to make up its varied tints, and what are the wonders of its woods and the treasures of its rocks, though he may not possess any or many acres of land itself, gets more from the world as he looks on it, and enjoys it perhaps more than those who only look at it as a means of livelihood.

"We associate together to communicate and to receive; to look at phenomena from the point of view of others; to learn from others in a few words what many hours of study and time-consuming research and inquiry would perhaps scarce have told us.

"Above all, our position, with its many advantages, bids us exist; and our existence is its own best reason. No premium, political or social, invites us to unite, but only the legitimate attraction of combined operation and the well-known, though not easily accounted for, pleasure derived from the study of nature, the pursuit of knowledge, and the cultivation of art—a pleasure so great and so unique as to be one of the most distinguishing features of man above all other beings."

He then proceeded to explain more closely and specifically the objects the Society should have in view.

Speaking of the importance of studying the changes effected by the introduction of exotic animals and plants, the President said: "Is it altogether a vain idea that this Society might purchase a few rough tracts or gullies here and there, in distinctive situations, to be exempted from the fowler's snare and the sportsman's gun, where no cattle shall tear away the protective undergrowth, no lambent fire lick up the grassy carpet of herbage, nor scorching flame make the landscape sorrowful with mournful edges of blackened trunks, but where nature shall have her own sweet will? Are there no Government lands which could be leased by, say 1,000 acres, to this Society, for, say 100 years (not sold, of course, for that would be out of keeping with the spirit of the age), which might be our Yellowstone dominion? Must we have nature's vagaries and eccentricities to justify such a locality? I, myself, have secured on a lease, as much for the enjoyment of others as my own, the beautiful promontory near Cable Bay, in order to prevent its destruction by fires and cattle, and an association like this might easily kindle sufficient enthusiasm in the conservation of similar localities.

"The plot of ground which would suit us as an Herbarium or Aviarium would probably be of little use to the sheepfarmer or agriculturist, and the rising generation might learn that there was pleasure in seeing as well as in receiving, and it might become a recognized wrong to hurt or spoil in such a true sanctuary of nature.

"Would that I could say that these were the only animals and forces that we have to dread, lest they should extinguish some herb or flower. I am informed that within the very area of which I have spoken, a person discovered recently a fern, or peculiar species of fern, never before seen, and deliberately rooted up every fibre and rootlet of it to transport it to Melbourne to be raised there in their hot-houses in a strange land, for the sake of the money to be obtained thereby. Vandalism is too good a word to be used for such an act; that was chiefly directed against works of art of man's construction, of which it might be said, what man had done once he might do again; but, although his plea might be the promotion of the species in the flower shows of Victoria, yet the risk run of its extinction in the process does not justify the destruction, but legitimately calls forth my protest. Similar ruthless proceedings have removed many ferns from out-of-door habitats in England and elsewhere. The scientific botanist, indeed, knows how to take his specimen so as not to injure, but to further aid, the extension of it, while the ignorant and thoughtless collector will pull up and tear away from its appropriate bed a whole pile of roots and bulbs just to enlarge a nosegay, and too often to be cast away as a thing of no beauty, which has been neglected till it is too late to be preserved within the leaves of the drying book.

"What I say of Botany applies to the other departments as well, and I therefore am proud to congratulate this Society on having before it a large field, an accessible field, a varied field, and an untried field, a field in which it is well we should work, if only to show to ourselves and others how much there is to be known."

After impressing on the Society the importance of the Local Museum and Public Library, and expressing a hope that popular lectures and popular scientific excursions to collect observations in the field would be instituted as part of the work of the Society, the President concluded by expressing the satisfaction felt at the prospect of so many earnest workers being ready to take up many, if not all, of these branches in the pursuit of knowledge, and hoped that "the promise of this Society will be amply fulfilled, that its members will yearly increase, and that it will receive the recognition and support of the public, so that we may add to the natural attractions of the place an association hospitable to the devotees of science, art, and literature, and so the pure light and genial heat which the cultivation of these three departments gives to the human mind, will not be absent from the midst of us."

Ordinary Meeting. *5th November*, 1883.

Dr. L. Boor, Vice-president, in the chair.

New Members.—W. Wells, A. Elliott, A. A. Scaife, J. Tatton, jun., T. Mackay, David Burns, M. Andrews, C. Webb-Bowen, W. B. Gilmore, Peter Donald, W. E. Farver, W. E. Rowe, R. G. Begley, J. Barfield Akers, the Hon. Joseph Shepherd.

1. "Notes on the Mineral Resources of New Zealand," by J. Park.

2. Mr. S. Gully exhibited a specimen of a crab (*Cancer novæ-zealandiæ*) prepared by a process described by Professor Parker in vol. xiv. of the Trans. N.Z. Inst., p. 263.

Ordinary Meeting. *14th December*, 1883.

The Bishop of Nelson, President, in the chair.

New Members.—W. Oldham, Albert Pitt, Mostyn Jones, Charles Jones, Ralph Jackson, H. D. Jackson, — Banneher, J. Sigley, Colonel B. A. Branfill, Rev. R. Moore.

1. "On Forest Culture," by Mr. Hackett.

In the course of the discussion which followed, attention was drawn to the number of young birches which are growing up along the old Dun Mountain line, and the road through the Big Bush, showing conclusively that New Zealand birch bush tends to reproduce itself.

The Rev. J. C. Andrew remarked that totara bush can be cultivated, but that the trees grow very slowly.

2. Mr. J. Park then read a description of the fossils exhibited on the table. They were all found in the neighbourhood of Nelson, and included examples from the summit of the Cambrian to the Trias inclusive. They were mostly obtained from the Baton River, Eighty-eight Valley, and the Wairoa Gorge.

The President suggested that a pamphlet should be prepared by the Society, containing a short description of the fossils found; and of the localities in which to look for them.

3. "Description of a new *Octopus*, recently captured in the Harbour," by J. Park.

The author exhibited a drawing of the animal described.

4th February, 1884.

Dr. L. Boor, Vice-president, in the chair.

New Members.—C. E. Bunny, V. Harcourt (associate), Dr. Satchell.

1. Mr. J. C. Lockley, of the Cable Bay Station, then read a Paper on Electricity, entitled "Ohm's Law."

2. "On the Formation of a Sanitary Section in connection with the Society," by Colonel Walcott.

In consequence of the lateness of the hour, discussion on the subject was postponed until the next ordinary meeting.

ORDINARY MEETING. *3rd March,* 1884.

The Bishop of Nelson, President, in the chair.

New Member.—Moss Davis.

1. "The Drift Beds of Wakapuaka and the Port Hills, with some remarks on the Boulder Bank and its Formation," by W. Wells.

In the course of the discussion which followed, Dr. Hector spoke at some length on the geology of the district immediately around Nelson. In speaking of the Port Hills, he said they were partly of river drift and of Miocene age. The Moutere and Wakapuaka hills were of the same series. The Boulder Bank was undoubtedly derived from Mackay's Bluff; but the true Boulder Bank only extended about as far as the lighthouse, the portion between that and Haul Ashore Island being analagous to the bar of the Maitai River.

The President spoke on the desirability of some Manual being compiled, embodying the facts of the local geology of Nelson and other districts.

2. "On the Leg Bones of a new Species of Kiwi," by Professor von Haast.

ABSTRACT.

Professor von Haast said that he had found the leg bones of a new species of kiwi amongst some moa bones in the Nelson Museum. His reasons for classing these bones as belonging to a kiwi, and not to a moa, were their length as compared to their width and size; moa bones being always thick and massive, while the bones in question were thin as compared with moa bones of equal length. From their appearance he argued that they had probably been found in some peaty deposit, and not in a cave; cave bones being always highly charged with carbonate of lime. He proposed to call the new species *Megalapteryx hectori*, in recognition of Dr. Hector's important services to science.

3. Dr. Hudson exhibited a cluster of cones from a *Pinus insignis*, sent to him by Mr. Arthur Collins, Hillwood, Wakapuaka. Also a true New Zealand mackerel caught in Blind Bay.

APPENDIX

Meteorology.

Comparative Abstract for 1883 and previous Years.

STATIONS.	Barometer. At 9.30 a.m.		Temperature from Self-registering Instruments read in Morning for Twenty-four Hours previously.					Computed from Observations.		Rain.		Wind.		Cloud.
	Mean Reading.	Extreme Range.	Mean Temp. in Shade.	Mean Daily Range of Temp.	Extreme Range of Temp.	Max. Temp. in Sun's Rays.	Min. Temp. on Grass.	Mean Elastic Force of Vapour.	Mean Degree of Moisture (Saturation=100).	Total Fall in inches.	No. of Days on which Rain fell.	Average Daily Force in Miles for Year.	Maximum Velocity in Miles in any 24 Hours, and Date.	Mean Amount (0 to 10)
Auckland	30·036	·874	59·2	11·9	49·1	147·0	—	·380	74	52·215	216	—	—	6·5
Previous 19 years	29·954	—	59·4	—	—	—	—	·406	76	43·308	188	—	—	—
Wellington	29·933	1·442	55·0	12·4	53·0	148·0	30·0	·363	83	51·994	169	188	605—14 Aug.	4·5
Previous 19 years	29·919	—	54·8	—	—	—	—	·386	72	51·995	158	—	—	—
Dunedin	30·097	1·484	50·6	13·5	55·0	155·0	25·0	·286	76	38·312	175	119	720—14 Oct.	6·0
Previous 19 years	29·843	—	50·4	—	—	—	—	·279	74	35·046	163	—	—	—

Average Temperature of Seasons, compared with those of the previous Year.

STATIONS.	Spring. September, October, November.		Summer. December, January, February.		Autumn. March, April, May.		Winter. June, July, August.	
	1882.	1883.	1882.	1883.	1882.	1883.	1882.	1883.
Auckland	56·9	56·2	65·4	67·0	61·9	61·3	52·8	52·2
Wellington	53·8	52·1	61·5	62·5	57·8	56·5	48·8	48·6
Dunedin	50·6	48·6	56·8	57·7	52·3	51·3	43·8	44.9

NOTES ON THE WEATHER DURING 1883.

January.—Very fine throughout, with generally moderate winds prevailing from N.E. and N.W.; little rain; temperature about the average.

February.—Rainfall at most places greatly in excess of average; on the whole a wet unpleasant month; temperature in excess. Earthquakes at Wellington on 5th at 10 p.m., slight, and 14th, between 2 and 3 a.m., slight.

March.—Rain generally in excess, but some very fine pleasant weather, with prevailing southerly winds; the temperature about the average. Earthquakes at Wellington on 21st at 7·30 a.m., slight, and 28th at 10·30 p.m., slight. Aurora on 28th.

April.—Generally wet unpleasant weather, with S. and S.W. winds and low temperature. Tongariro in eruption.

May.—In the north rain in excess, but moderate in south; moderate winds, and temperature above the average.

June.—On the whole fine for time of year, with little rain, and temperature above average; strong winds at Central Station from westward, with hail, showers, and squally.

July.—A showery month generally, although some fine weather at intervals; temperature about the average. Earthquakes reported at Wellington on 4th after midnight, smart; on 5th at 3·3 a.m., slight; and on 9th at 2·40 p.m., slight.

August.—Fine month, with rain below the average, but at times squally cold weather. Tidal disturbances felt, and sharp earthquake in north.

September.—Generally showery early and latter part of month, but fine during middle, with moderate variable winds. Earthquake at Wellington on 27th at 7·15 p.m. A vivid colouration of the southern sky after sunset and before sunrise was observed during this month, due probably to vapour being suspended at an unusually great altitude.

October.—Rainfall in north in excess of average, but in south less; the temperature generally under the average; unseasonable weather.

November.—Generally a showery unpleasant month; rainfall in excess, and temperature below the average, and squally.

December.—Most unseasonable weather, cold, showery and squally at most places north and south. Earthquakes recorded at Wellington on 8th at 9·30 p.m., slight; and at Dunedin on 18th. slight.

EARTHQUAKES reported in NEW ZEALAND during 1883.

Place.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Taupo ..	..	24,* 25*	14†	..	..	..	..	..	..	..	..	..	3
Gisborne ..	..	..	..	..	..	..	..	15†	..	..	..	..	1
Patea ..	..	..	..	..	..	..	..	29*	..	..	..	..	1
Wanganui ..	..	..	..	..	..	..	..	..	..	..	..	24*	1
Wellington	..	5, 14	21, 28	..	..	..	4,* 5, 9	..	27	..	..	8	9
Blenheim ..	..	..	..	..	..	..	..	..	26*	..	..	..	1
Kaikoura ..	..	5*	..	..	..	24*	..	..	..	..	..	..	2
Christchurch	..	..	..	..	..	24	..	..	..	..	..	..	1
Hokitika ..	..	..	..	..	..	..	..	..	..	..	..	18	1
Westport ..	..	..	..	..	..	..	..	..	..	..	..	18*	1
Timaru ..	..	..	..	..	..	..	..	..	..	..	..	18,19	2
Balclutha ..	..	..	..	..	..	..	..	..	..	..	..	18*	1
Dunedin ..	..	..	..	..	..	..	..	..	..	..	..	18*	1
Greymouth	..	22	..	..	..	..	..	..	..	..	..	18*	2
Queenstown	..	..	..	..	..	..	..	..	..	..	..	18*	1
Invercargill	..	..	..	..	..	..	..	..	..	..	..	18†	1
Bluff ..	..	..	..	..	..	..	..	..	..	..	..	18*	1

The figures denote the days of the month on which one or more shocks were felt. Those with an asterisk affixed were described as *smart*, those with a dagger as *severe shocks*. The remainder were only slight tremors, and no doubt escaped record at most stations, there being no instrumental means employed for their detection. These tables are therefore not reliable so far as indicating the geographical distribution of the shocks.

NEW ZEALAND INSTITUTE.

HONORARY MEMBERS.

1870.

Drury, Rr.-Admiral Byron, R.N.
Finsch, Otto, Ph.D., of Bremen
Flower, W. H., F.R.S., F.R.C.S.
Hochstetter, Dr. Ferdinand von
Hooker, Sir J. D., K.C.S.I., C.B., M.D., F.R.S.
Müeller, Baron Sir Ferdinand von, K.C.M.G., M.D., F.R.S.
Owen, Sir Richard, K.C.B.,D.C.L., F.R.S.
Richards, Vice-Admiral Sir G. H., C.B., F.R.S.

1872.

Grey, Sir George, K.C.B., D.C.L.
Huxley, Thomas H.,LL.D.,F.R.S.
Stokes, Vice-Admiral J. L.

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