

ART. XXIII.—*On the Flora of the Kermadec Islands; with Notes on the Fauna.*

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A FEW months ago the Colonial Government dispatched the steamer *Stella* to the Kermadec Islands, for the purpose of formally annexing the group to the Colony of New Zealand; and through the kind offices of the Assistant Surveyor-General, Mr. Percy Smith, I received permission to accompany the expedition. Mr. Smith has contributed to the Institute an account of the physical features and geology of the islands; I propose to describe the chief characteristics of the flora, and its relationship to that of New Zealand, also to Norfolk Island and Lord Howe's Island, both of which are very similar in character to the Kermadec Islands, and are situated in the same latitude. To this I shall ask leave to add some scattered notes on various branches of the fauna, and a few general considerations on the probable mode by which the islands have received their plants and animals.

The Kermadec Group consists of a chain of widely separated small islands, four in number, situated between $29^{\circ} 10'$ and $31^{\circ} 30'$ S. lat., and stretching in a south-west and north-east direction over more than 140 miles. The largest of the islands, Raoul, or Sunday, is about 20 miles in circumference. It is the furthest from New Zealand, being rather more than 640 miles from Auckland, and a little less than that distance from Tonga. The next in size, Macaulay Island, is 68 miles to the south-west of Sunday Island. The remaining two, Curtis and L'Esperance, are still further to the south-west, but they are little more than mere rocks. On the last mentioned we were unable to land; and bad weather rendered our visit to Curtis Island a very brief one. My remarks must, therefore, be in great measure confined to Sunday and Macaulay Islands.

The depth of the ocean between the islands, so far as is known, varies from 500 to 600 fathoms. In the map accompanying the narrative of the *Challenger* expedition, the 1,000 fathom line is shown to enclose the whole of the group within a narrow elliptical area about 200 miles in length. To the north-east and south-west, on a line drawn through the islands from Tonga to New Zealand, the depth varies from 1,000 to 2,000 fathoms. Immediately to the eastward, however, much deeper water is found, and stretches all the way across the Pacific to the American coast. A large triangular patch, over 2,000 fathoms in depth, occurs also to the west and north-west of the

group, in the direction of Norfolk Island and New Caledonia. The Kermadec Islands may, therefore, be said to rest on a broad submarine ridge connecting New Zealand with Tonga and Fiji. A similar but much broader ridge joins New Zealand, by way of Norfolk Island and Lord Howe's Island, with New Caledonia and North-eastern Australia.

The sole knowledge previously existing of the vegetation of the Kermadec Islands was based on a small collection of plants made on Sunday Island, in July, 1854, by Messrs. Milne and McGillivray, the naturalists attached to H.M.S. *Herald* during her surveying voyages in the South Seas. This collection was placed in the hands of Sir J. D. Hooker, and formed the subject of a very interesting paper entitled "On the Botany of Raoul Island," which is printed in the "Journal of the Linnean Society" (vol. i., Botany, pp. 125-129). The total number of species collected was 41 (42 are enumerated in the list, but two plants now usually considered to be varieties are treated as distinct species).

The conclusions arrived at by Sir J. D. Hooker from his study of the collection may be summarised as follows:—(1.) That the flora is most nearly allied to that of New Zealand, the greater portion of the species being absolutely identical with plants found in that country; (2.) That there is a remarkable absence of any of the plants peculiar to Norfolk Island, which is almost exactly the same distance from the Kermadec Islands as New Zealand; and (3.) That the proportion of Polynesian species is much less than might have been reasonably expected.

I may at once say that the larger and more complete collection that I have been able to make bears out, in the main, the above conclusions; for, although I have been able to prove that some of the peculiar Norfolk Island plants do occur on Sunday Island, and although some Polynesian species not known to Hooker are also found there; still, there can be no doubt, to use Sir J. D. Hooker's own words, that the affinities of the flora "are most strong with that of New Zealand, and feeble to a very unaccountable degree with the flora of those other groups with which it might be expected to possess a very strong relationship."

Seen from the distance of a mile or two, SUNDAY ISLAND has much of the appearance of some of the outlying islands off the New Zealand coast. Like most of these, it is high, steep, and almost mountainous, intersected with numerous ravines, and with a bold coast line, the cliffs often plunging abruptly into the sea. The beach, with the exception of two sandy bays, is everywhere composed of boulders and masses of rock; and as there is no harbour, or moderately sheltered bay, landing is always difficult, and sometimes dangerous. Although situated

on the verge of the tropics, it has none of the characteristics of a tropical island, and its vegetation, when seen from a moderate distance, has precisely the monotonous dull brownish-green tint so noticeable while sailing along the shores of New Zealand.

In shape, Sunday Island is roughly triangular. Its greatest length, from Hutchinson Bluff, the western termination of the island, to Wilson Point on the east side, is about $6\frac{1}{2}$ miles. The greatest breadth, measuring from Fleetwood Bluff on the north to Smith Bluff at the southern extremity of Denham Bay, is a little over 4 miles. The total area is estimated by Mr. Smith at 7,260 acres. It is purely volcanic in structure, and the centre of the island is occupied by a large crater more than a mile in diameter. The encircling rim of this is steep, and in many places precipitous. On the south side its average height is over 1,000 feet, rising in the south-east corner to 1,720 feet, the highest point on the island; but on the north it is much lower, falling in one place to 180 feet. The floor of the crater is undulating, and contains three little crater lakes, by the side of one of which steam is still escaping. The soil is rich and fertile, but exceedingly porous, so much so that there are no permanent streams, although the rainfall is evidently large, and distributed pretty equally over the whole year.

Except a limited area on the floor of the crater, the whole of the island is covered with forest, from the water's edge to the tops of the highest peaks. The prevailing tree, forming two-thirds or more of the vegetation, is the widely diffused *Metrosideros polymorpha*, which seems to range through the greater part of Polynesia, from the Sandwich Islands and Tahiti to Fiji and New Caledonia. It is very closely allied to our pohutukawa (*M. tomentosa*), differing chiefly in its rather smaller size, smaller rounder leaves, and smaller clusters of flowers. Young trees growing on level ground are often very symmetrical in shape, with numerous closely placed branches, but on the steep ridges, where it attains its greatest size, it is much more distorted and gnarled. Sometimes the trunk or main branches spread out horizontally a few feet above the ground, sending up numerous erect branches, which at a distance look like separate trees. It produces the only really good and durable timber found on the island, and might be applied to all the purposes for which pohutukawa is used.

Next to the *Metrosideros*, the most abundant and conspicuous plant is a palm, which I take to be *Kentia baueri*, hitherto supposed to be confined to Norfolk Island. It is a much larger and more handsome species than our nikau (*Kentia sapida*), with a stouter cleaner stem, and more numerous leaves with broader leaflets. It was in fruit at the time of our visit, and the bright red berries, collected in large clusters at the top of the trunk, had a very fresh and pretty appearance. It is not nearly so

fond of secluding itself in the recesses of the forest as the nikau, and often flourishes in the open, exposed to both sun and wind. On some terraces of rich volcanic soil on the northern side of the island it forms large groves, to the exclusion of almost all other trees. I was surprised at the deepness of the shade in these groves—one would have thought that such a gloom could only have been produced by the overlapping branches and foliage of tall forest trees.

A fine tree-fern (*Cyathea milnei*), which is peculiar to the island, is also very plentiful, especially towards the tops of the hills, and in all the ravines. It is often 50 or 60 feet in height, and is thus quite equal in stature to our *Cyathea medullaris*, which it much resembles.

Two common New Zealand trees, the well-known karaka (*Corynocarpus laevigatus*) and the ngaio (*Myoporum laetum*) are abundant, especially near the sea. The last mentioned is much more variable in the shape of its leaves than is usual in New Zealand. Abandoned cultivations are soon overrun with it. Other trees of frequent occurrence are the wharangi (*Melicope ternata*), mahoe (*Meliccytus ramiflorus*), tupaki (*Coriaria ruscifolia*), and the whau-whau-paku (*Panax arboreum*), all of them familiar plants to the New Zealand botanist. The kawakawa or pepper-tree (*Piper excelsum*) is also very generally distributed, but it is much more luxuriant, and has much larger leaves and flower-spikes than the New Zealand form, and appears to be certainly worthy of distinction as a sub-species at the least.

Three trees appear to be confined to the island, and to be found nowhere else: a *Coprosma* (*C. acutifolia*) allied to our *C. tenuifolia*, but a more slender plant, with very different inflorescence; a new species of *Myrsine*, not very far removed from the Norfolk Island *M. crassifolia*, but sufficiently distinct; and a handsome plant belonging to the Polynesian genus *Carumbium*. The last mentioned has a most graceful mode of growth, and very handsome foliage. Young trees form slender unbranched rods, 6–15 feet in height, with large leaves, sometimes 18 inches in diameter. When old, it branches after the manner of some poplars, and the leaves become very much smaller. If hardy in this climate, it will prove a very ornamental addition to our gardens.

The well-known "candle-nut" of Polynesia (*Aleurites moluccana*), a plant common in the tropics of both hemispheres, occurs in a few localities, but is decidedly scarce. A small grove on the north side of the island contains some examples over 60 feet in height, with trunks 3 feet in diameter, but its usual size is rather less than that. The ground underneath the trees is always thickly covered with the fallen nuts. These contain an abundance of fine hard oil, so that in some parts of Polynesia the kernels are strung on a string and lighted as candles.

Other trees deserving notice are *Bœhmeria australis*; hitherto supposed to be confined to Norfolk Island; *Cordyline terminalis*, the common "Ti" of Polynesia; *Pisonia brunoniana*, a Polynesian and Norfolk Island plant, found in a few scattered localities on the coast of New Zealand; and the littoral plants karo (*Pittosporum crassifolium*), *Coprosma petiolata*, and *C. baueriana*.

The herbaceous plants may be passed over with less detail. In both the sandy bays, the tropical *Ipomœa pes-capree* is plentiful. Its running stems are often quite 30 or 40 feet in length, and with its large fleshy two-lobed leaves give the plant a very odd appearance. A very different species of the same genus, *I. palmata*, occurs on the cliffs in one or two places. *Canavalia obtusifolia*, a common maritime plant in tropical regions, was observed on Meyer Island, a rocky islet distant about a mile and a half from the northern coast of Sunday Island. *Sicyos angulatus* is one of the commonest plants in the lower portions of the island, creeping over the ground, and festooning the trees to a considerable height. It is a very troublesome weed in the cultivations. *Scaevola gracilis* is one of the few plants peculiar to the islands, and is plentiful in rocky places, both on the sea-cliffs and inland. It has handsome white fragrant flowers, and would make a good garden plant. *Haloragis alata*, *Hydrocotyle moschata*, *Lagenophora forsteri*, and *Parietaria debilis*, all well-known New Zealand plants, are of frequent occurrence. Three Composites—*Bidens pilosa*, *Ageratum conyzoides*, and *Siegesbeckia orientalis*, with *Solanum nigrum*, are everywhere present in open or cultivated ground. The *Ageratum*, which has received the local name of "cherry pie" or "wild heliotrope," is a most troublesome weed, and has taken complete possession of the old cultivations in Denham Bay, forming a dense growth 3–4 feet high. It is possible that both it and the other three plants are naturalized, but there is no direct evidence of this, and as they are all widely distributed in many tropical and sub-tropical countries, and have all the appearance of being true natives, it seems best to consider them as such.

The common bulrush (*Typha angustifolia*) is found in a lagoon in Denham Bay, and in the crater lakes. It seems to be the only true marsh plant on the island. Sedges are rare: two species of *Carex*, which cannot be identified until better specimens are obtained, are plentiful in open places in the forest; and our "cutting-grass" or toe-toe (*Cyperus ustulatus*) is everywhere present at low elevations, readily taking possession of the abandoned cultivations. Grasses are more abundant, and include several tropical species not found in New Zealand. The handsome *Imperata arundinacea* is particularly plentiful on the cliffs.

Ferns are wonderfully numerous and luxuriant, and compose over one-fourth of the entire flora. They form the chief undergrowth in the forest, filling every ravine and hollow place, and descend the cliffs to the level of the sea. Even in the banana plantations they appear as weeds, *Pteris comans* being particularly abundant in such situations, forming a dense tangled mass 5 feet in height or more, which is soon renewed if cut down. The species most generally distributed are *Cyathea milnei*, *Pteris comans*, and *P. tremula*, *Aspidium aristatum*, *Hypolepis tenuifolia*, *Asplenium flaccidum*, *Lomaria acuminata*, and *Doodia media*. Our common fern, *Pteris aquilina*, is decidedly scarce, and is apparently confined to a locality in Denham Bay and another near Fleetwood Bluff. A few tropical species were added to those already known to inhabit the island, the most interesting being *Nephrolepis exaltata*, which is abundant in Denham Bay; *Nephrodium setigerum*, not uncommon in most of the ravines; and an *Asplenium* of the *Diplazium* section, which was only noticed in a ravine on the north side of the island, but was plentiful enough there.

My visit was too short to allow me to make collections of any size in the other families of cryptogams. Mosses and liverworts are abundant, but the species are few in number. The larger foliaceous lichens, of the genera *Sticta*, *Parmelia*, etc., are pretty frequent, both on trees and rocks. Very few fungi were noticed, but then the time of our visit was probably unfavourable for them.

Naturalised plants are not so numerous as might have been anticipated, considering that small portions of the island have been cultivated for forty years. One of the commonest and most conspicuous weeds is the Cape gooseberry (*Physalis peruviana*), which rapidly overruns deserted cultivations. I observed one patch of three or four acres that was almost entirely covered with it, to the exclusion of other vegetation. *Stellaria media*, *Cerastium vulgatum*, *Senebiera coronopus*, *S. didyma*, *Erigeron canadensis*, *Senecio vulgaris*, and *Veronica arvensis*, are all plentiful, and pretty generally distributed in suitable places.

The cultivated plants of Sunday Island have a thoroughly tropical aspect, and make a strong contrast with the indigenous vegetation. The cultivations are mostly little plots on terraces of fertile volcanic soil, or sunny nooks in the open gullies. Several varieties of bananas are grown; a tall coarse kind attains nearly 25 feet in height, with leaves 12 to 15 feet in length. Four or five varieties of the taro, three of yams, and two or three of kumaras are cultivated, and appear to do very well. The sugarcane, the pineapple, the guava, the custard-apple, the rose-apple, the pomegranate, the papaw, the mango, oranges, shaddocks, citrons, &c., are all grown to some extent,

and look healthy and thriving. Evidently the climate and soil are favourable for the cultivation of many tropical and sub-tropical fruits; and if frequent and regular communication existed, such might be profitably grown for the New Zealand market. I may add that the ordinary cultivated fruits and vegetables of Europe, so far as they have been tried, succeed very fairly indeed.

The second of the group, MACAULAY ISLAND, is about $1\frac{1}{4}$ miles in length, by about a mile in greatest breadth. It is everywhere surrounded by high vertical cliffs, ranging from over 700 feet at the west end to about 150 feet at the eastern point of the island. Access to the top can only be obtained at one place, where a lava stream has fallen over the cliffs, and formed a rough natural staircase. On reaching the top of the cliffs the surface of the island is seen to be gently undulating, with a gradual slope from the west. There are several shallow gullies, and in one of them small pools of water were seen; but, as on Sunday Island, there are no permanent streams. It is entirely covered with a beautiful sward of natural grass, apparently composed of a species of *Poa* and an *Agrostis*; but in the absence of flowers I cannot be sure of the determinations. There are no trees or woody plants of any kind, with the exception of a few stunted bushes of *Carumbium*, and two or three dwarf ngaios (*Myoporum*). A few small herbaceous plants, as *Gnaphalium involucreatum*, *Haloragis alata*, *Oxalis*, *Erigeron*, etc., were scattered here and there among the grass. Tussocks of toe-toe (*Cyperus ustulatus*) fringed the edges of most of the gullies; and a few ferns were found in sheltered nooks along the sides of the dry water-courses. The ice-plant (*Mesembryanthemum australe*), *Scavola gracilis*, *Tetragonia expansa*, *Lobelia anceps*, and *Coprosma petiolata*, were all plentiful on the cliffs. The flora must be considered as very scanty, only 33 species being observed.

CURTIS ISLAND is rather more than 20 miles to the south-west of Macaulay Island. It is nearly half-a-mile in length, and about 450 feet in height; but is little more than the rocky rim of a still partly active crater. The crater-wall is broken down on the north-west side, where there is a sheltered little cove, so that landing can be effected within the crater itself, in proximity to numbers of steam jets and boiling mud-pools. Our stay was so short that it was impossible to ascend the cliffs to examine the vegetation on the top of the island, where several green patches had been noticed from the deck of the *Stella*. The only plants actually identified were *Mesembryanthemum australe* and *Lobelia anceps*, which were growing on a mud-flat on the floor of the crater. A grass, and some bushes of what seemed to be *Coprosma petiolata*, were also observed on the face of the cliffs a short distance from the landing place. In all probability

a dozen species of flowering plants will exhaust the flora of the island.

Appended to this paper will be found a catalogue of the flowering plants and ferns collected in the group. The total number of species is 115; but only 5 of these, or $\frac{1}{23}$ rd, are endemic, a remarkably small proportion considering the isolated position of the islands. Seventy-four species are now recorded for the first time, and 20 of these are new to the New Zealand flora. Only one species is new to science.

Having thus described the chief features of the flora, we may now proceed to inquire into its relationship and origin. We have already seen that the Kermadec Islands are far removed from any large land masses. The nearest part of New Zealand is distant about 600 miles. The Tongan or Friendly Isles are a little over 500, while New Caledonia is nearly 950. To the west, the continent of Australia is separated by more than 1,500 miles of ocean. In the intervening space, however, there are two islands which have several features in common with the Kermadecs, and to which it seems advisable to draw special attention. I allude to Norfolk Island and Lord Howe's Island.

NORFOLK ISLAND, situated about 420 miles north-west of the North Cape, and 840 miles east of Australia, is almost exactly the same distance from Sunday Island as New Zealand, and very nearly the same size, its area being estimated at 8,000 acres. Like Sunday Island, it is purely volcanic, but is not so lofty and rugged. It has always been noted for its fertility, and at the time of its discovery was covered with a most luxuriant vegetation. Its plants were first examined by the celebrated botanical artist, Ferdinand Bauer, who in the years 1804 and 1805 lived for several months on the island. His collections were worked out by the late Professor Endlicher, and fully described in a little pamphlet entitled, "Prodromus Floræ Norfolkicæ," published at Vienna in 1833. The island has since been botanized over by several travellers, and is probably pretty well explored. So far as I can make out, the total number of species recorded from the island is 146; and of these no less than 36, or one-fourth, are peculiar, and not found elsewhere. Several of them have been introduced into cultivation, the Norfolk Island pine (*Araucaria excelsa*) being a well-known example. The flora is certainly very closely allied to that of New Zealand, and some plants—for instance, *Phormium tenax*—are absolutely confined to the two localities. It is, however, much more tropical, and is probably more closely connected with that of North-eastern Australia and New Caledonia.

LORD HOWE'S ISLAND is 1,200 miles from Sunday Island, and 750 from New Zealand. Its distance from Australia is barely

350 miles. Its area is almost exactly the same as that of Norfolk Island and Sunday Island, but it is much more mountainous than either, Mount Gower, the highest peak, being 2,840 feet high. Its flora is pretty well known, chiefly through the exertions of Mr. Charles Moore, the Director of the Sydney Botanic Gardens, and other Australian naturalists. Most of the new species have been described by Baron Müller in his "Fragmenta Phytographiæ Australiæ," where also a carefully-compiled catalogue of the flora is given. Two hundred and two species have been collected on the island, 51 being peculiar to it—exactly the same proportion that obtains on Norfolk Island. Many New Zealand plants occur; but the chief relationship of the flora is with New Caledonia and North-eastern Australia.

To show clearly what are the affinities of the Kermadec flora it is necessary to give a few figures. Of the 115 species collected by me in the group, no less than 85 are found in New Zealand, or very nearly four-fifths of the entire flora. Fourteen of the 85 are absolutely confined to the two localities. Forty-four species are found in Norfolk Island, but of these no less than 40 are found in New Zealand, and there are only two plants confined to Norfolk Island and the Kermadec Group. Forty extend as far as Lord Howe's Island, but 34 of these occur in New Zealand, and none of the peculiar Lord Howe's plants reach the Kermadecs. Seventy-six plants are common to Australia and the Kermadecs, but none of these are peculiar Australian species, and 63 of them are natives of New Zealand, the remainder occurring in Polynesia. Lastly, 47 Kermadec species are Polynesian, 31 of them being found in New Zealand as well. Two plants are peculiar to the Kermadec Islands and Polynesia.

It is impossible to doubt the significance of these figures; they clearly point to New Zealand as the origin of the major portion of the flora of the group. Admitting that one-half or more of the Kermadec plants are species having a very wide distribution, occurring not only in New Zealand but also in Norfolk Island, Lord Howe's Island, Australia, and many of them also reaching Polynesia; yet the fact that they are accompanied by a large proportion of plants otherwise confined to New Zealand, affords very good reason for supposing that the greater portion, if not all, are immigrants from thence. Had they made their way from any other source, in all probability some of the endemic plants of that country would also have made good an entrance. For instance, we have seen that Norfolk Island and Lord Howe's Island possess nearly 50 of the Kermadec plants. Now these islands contain 86 peculiar species. They are in the same latitude as the Kermadec Islands, and one of them is as near as New Zealand. Their climate, geological structure, and physical features generally, are very similar to those of Sunday Island.

Yet only two of their peculiar plants have migrated to the Kermadec Group. Had the 40 widely distributed species that are common to Norfolk Island and the Kermadecs immigrated directly from Norfolk Island, a larger proportion of the endemic plants of that island would undoubtedly have followed them. Similarly, 76 plants of wide geographical range are found both in Australia and the Kermadec Group; yet I cannot believe that they have migrated direct from Australia. Surely, if that had been the case, a few, at least, of the many hundred endemic Australian species would have accompanied them.

We have seen that, out of the 115 species collected in the group, 85 are New Zealand plants. This leaves 30 to be accounted for. Five are peculiar to the group, and 5 more cannot be determined until flowering specimens are obtained. Two are strictly Polynesian species, and the remaining 18 are wide-ranging tropical or sub-tropical plants, many of them common in both hemispheres, and all of them found in Polynesia, coming as near to the Kermadecs as Tonga. Probably it is from thence that the Kermadecs have received them. Taking the above data into consideration, it appears to me most probable that the Kermadec Islands have received their plants from two sources: that there have been two opposite streams of colonization—one, much the largest and most important, from New Zealand; the other, much less conspicuous, from the Polynesian Islands.

In coming to this conclusion, it is assumed that the Kermadec Islands have always been isolated from other land masses, or, at any rate, have not formed part of any other land during the tertiary period. But views opposed to this are often held. In endeavouring to solve the difficult and much-debated question of the origin of the New Zealand fauna and flora, it is usually assumed that New Zealand was formerly connected, by way of Norfolk Island and Lord Howe's Island, with North-eastern Australia and New Caledonia; and, as mentioned at the commencement of this paper, a submarine ridge—nowhere much more than 1,000 fathoms in depth, and for a considerable part of the distance much less than that—actually extends in the right direction. This theory has the merit of accounting for two salient features in the natural history of New Zealand. It shows how the ancestors of our struthious birds may have arrived from a country at present inhabited by their nearest living representatives; and it explains, if taken in connection with certain very probable geological changes in Australia, how the very anomalous nature of the relationship of our flora with that of Australia may have arisen. But it is unnecessary to go into the details of the theory here—they can be found in Mr. Wallace's "Island Life," or in Professor Hutton's papers "On the Origin of the New Zealand Fauna and Flora."

It is not quite clear whether Norfolk Island and Lord Howe's Island are to be considered as remnants of this former extension of New Zealand, or as evidences of volcanic activity since its subsidence in whole or in part. Their flora certainly lends some support to the first view, for, in addition to possessing considerable affinity with that of New Zealand, it is undoubtedly much more closely allied to that of North Australia and New Caledonia than it is to that part of temperate Australia nearest to them and situated in the same latitude. The large proportion of endemic species also goes to prove that the islands are of considerable antiquity. With respect to the fauna, the presence of a species of *Ocydromus* in Lord Howe's Island, and of *Nestor* in Norfolk Island, cannot but be regarded as highly suggestive.

No doubt a considerable amount of probability attaches to the supposed former extension of New Zealand to the north-west. But an extension to the north-east has not nearly such cogent evidence in support of it. In the first place, the submarine ridge connecting New Zealand with the Kermadec Group, and through it with Tonga and Fiji, is much narrower, and, so far as can be judged from the few soundings taken, is covered with much deeper water. This would put back the subsidence of the land to a more remote period. But the flora of the Kermadec Islands is composed almost wholly of plants living in New Zealand or Polynesia, the proportion of endemic species being only $\frac{1}{3}$, against $\frac{1}{4}$ in Norfolk Island and Lord Howe's Island. This undoubtedly demands that the connection should be of recent date. Again, had there been land uniting New Zealand with Tonga and Fiji, there should, as Mr. Wallace states, be more community between the natural history productions of the two localities. Every botanist knows that the Polynesian element in the New Zealand flora is small and unimportant; and, although some branches of the fauna are perhaps more closely connected, even there the affinity is by no means close. The scanty and fragmentary nature of the Kermadec flora, and the still more scanty fauna, are not what we should expect to find had the islands been connected with better peopled countries; while they are quite in harmony with the view that they have received their inhabitants by trans-oceanic migration. I must admit feeling much scepticism as to the likelihood of any recent extension of New Zealand towards the north-east. In all probability, if a land connection with Polynesia in that direction ever existed, it had disappeared long before the origin of the Kermadec Islands. According to Mr. Percy Smith's observations, the two chief islands are mainly composed of distinctly stratified pumiceous tuffs, evidently deposited under water. In the absence of fossils, their age cannot be precisely fixed; but they must be assigned to a comparatively recent period.

There are three principal ways by which the seeds of plants can be carried across wide spaces of ocean: by wind, by ocean currents, and by birds. The first mode is chiefly applicable in the case of the spores of ferns and cryptogamic plants generally; and it is no doubt through it that ferns constitute such a large proportion of the flora of almost all oceanic islands. But with respect to flowering plants, its importance is, I think, very much over-rated. Had it operated to any extent, plants possessing light seeds, or seeds furnished with winged appendages or down (*pappus*), would be common on most oceanic islands. But this does not always happen, and is certainly not the case with the Kermadec Group. Distribution by means of ocean currents is a more promising mode, and it can be shown to be a likely one in the case of the Kermadec Group. It is well-known that in the whole of the southern portion of the South Pacific the drift of the ocean is to the north, forming what is called the antarctic drift current. This current hugs both shores of New Zealand, and extends to the North Cape; but is usually said to disappear about latitude 34°, and to be succeeded by a broad expanse of ocean in which the currents are variable or hardly perceptible. But in examining the shores of Sunday Island Mr. Smith and myself were surprised to find numerous kauri logs, evidently drifted from New Zealand. Mr. Bell informed us that over forty were lying stranded on the beaches, and from what I saw myself I do not think his estimate is much above the mark. The logs bore brands of different dates, and, apart from that, it was evident from their appearance that they had arrived at different periods, so that it cannot be assumed that a specially favourable gale, or temporary current, had drifted over a batch that had made its escape from some of our timber-mills. Probably the antarctic current extends further to the north in this portion of the Pacific than has hitherto been supposed. But if logs are regularly drifted across, so may seeds, branches of trees bearing seed-vessels, and vegetable *débris* of all kinds. Many seeds are capable of germination after a prolonged submersion in salt water. Mr. Darwin proved by actual experiment that some retained their vitality after an immersion of over 100 days; and M. Gustave Thuret has succeeded in getting the seeds of nine species to germinate after being floated for thirteen months in a vessel of salt water. Even in 100 days the branch of a tree bearing ripe seed-vessels might be floated across a distance even greater than that separating New Zealand from Sunday Island. Dispersal through the agency of birds might also be the means of stocking the Kermadec Islands with some plants. Most of the birds found in the group are New Zealand species; and in the case of sea-birds, such as the various species of albatrosses and petrels, which possess immense powers of flight and range over large distances of ocean, yearly

breeding on outlying islands, it would be an easy matter for seeds adhering to the feathers, or included in earth attached to the feet, to be conveyed across wide spaces of ocean.

In concluding my remarks on the flora, I may be allowed to repeat my conviction that its nature and composition, its relationship to that of New Zealand and Polynesia, and its peculiarities generally, are best explained on the supposition that the islands have been slowly stocked with their plants by chance migrations across the ocean.

My visit to the islands was so brief, and so much time was lost by exceptionally stormy weather, that little systematic work could be accomplished with the fauna. The following notes are based on observations made at odd moments, while engaged in examining the vegetation.

Mammals.—The only mammal that possesses any claim to be indigenous is a rat, and of this I was unfortunately unable to obtain a specimen. Mr. Bell informed me that it is abundant in the summer months, but uniformly disappears in the winter, in his opinion to hibernate. At the time of my visit I supposed that it had been introduced by some of the early settlers, but since my return I find that Lieut. Watts, in his account of the first discovery of the group in 1788, says that "a great number of rats and mice were seen on Macaulay Island." This would seem to prove that the species, whatever it may be, is truly indigenous. It is somewhat singular that there is no bat. Norfolk Island has a peculiar species; but Mr. Bell was positive that none exists on Sunday Island.

Birds.—The following species were collected or observed in the group, with the exception of one or two, specified in the list, which are inserted on the authority of Mr. Bell:—

1. Common Hawk (*Circus gouldi*). Not uncommon on Sunday Island and Macaulay Island.

2. Kingfisher (*Halcyon vagans*). Sunday Island; plentiful.

3. Tui (*Prothemadera novæ-zealandiæ*). The commonest bird on Sunday Island. Its note differs slightly from that of its New Zealand relatives, but the plumage is precisely the same.

4. White-eye (*Zosterops lateralis*). Seen on both Sunday and Macaulay Islands, but not plentiful.

5. Lark (*Anthus novæ-zealandiæ*). Two or three specimens noticed on Macaulay Island.

6. Red-fronted Parrakeet (*Platycercus novæ-zealandiæ*). Mr. Bell stated that this formerly existed on Sunday Island, but had been exterminated by the wild cats. On Meyer Island, an outlying rock off the coast of Sunday Island, it is still plentiful. On Macaulay Island it is in great numbers, going about in flocks

of from 12 to 50, hopping among the short grass, and apparently feeding on the seeds of *Erigeron* and *Gnaphalium*. So tame was it, and so unused to man's presence, that I caught two by simply walking quietly up and suddenly putting my hat over them while they were walking on the grass. Several more were caught by the sailors of the *Stella* in a similar way.

7. Long-tailed Cuckoo (*Eudynamis taitensis*). Mr. Bell showed me the tail of a specimen of this species. According to him, it is a yearly visitant, but is never very plentiful.

8. Shining Cuckoo (*Chrysococcyx lucidus*). Also stated by Mr. Bell to be an occasional visitor. I did not see it.

9. Pigeon (*Carpophaga* sp. ?). Mr. Bell informed us that a large fruit-pigeon, which he thought was the same as the New Zealand species, was formerly not uncommon, but had been killed off by the cats.

10. Pukeko (*Porphyrio melanotus*). A single specimen was noticed in the lagoon in Denham Bay.

11. Grey Duck (*Anas superciliosa*). Said by Mr. Bell to exist in the crater lakes, but to have been very scarce since the eruption of 1872. I did not see it; but Mr. Bell is confident as to its identity with the New Zealand species.

12. Grey Noddy (*Anous cinereus*). I believe that I am correct in referring a pretty little tern, very plentiful all through the group, to this species. I obtained several specimens, which agree very well with the description in Gould's "Handbook."

13. Albatross (*Diomedea exulans*). A few individuals were noticed during the voyage to and from the islands. According to Mr. Bell, it breeds on the Chanter Islands, some small rocks off the north-east coast of Sunday Island.

14. Mollymawk (*Diomedea melanophrys*). Plentiful. Breeds on Curtis Island.

15. Sooty Albatross (*Diomedea fuliginosa*). Noticed at sea between Sunday and Macaulay Islands.

16. Small Shearwater (*Puffinus assimilis*). Abundant on Meyer Island, where it was breeding in great numbers at the time of our visit.

17. Mutton Bird (*Puffinus* sp.). A species of this genus, clearly different from any of the New Zealand forms, breeds on Sunday Island in September and October, laying its eggs on the bare ground among the trees on the hill-sides. The young birds, when cured, form no inconsiderable portion of the food of the residents, and are by no means bad eating. The old birds had only just commenced to arrive at the time of our visit, but during the middle of the season they are present in enormous numbers. Large portions of the island are then entirely covered

with them, and the noise and confusion is said to be almost indescribable.

18. Cape Pigeon (*Procellaria capensis*). Plentiful at sea all round the group.

19. Stormy Petrel (*Thalassidroma melanogaster*). Plentiful everywhere at sea.

20. Gannet (*Dysporus* sp.). A fine gannet, differing from the New Zealand species in wanting the buff-coloured feathers on the head, was not uncommon, but I was unable to obtain a specimen.

21. Tropic-bird (*Phaeton rubricauda*). Breeds on the islands in the month of October, according to Mr. Bell. I did not see it.

22. Frigate-bird (*Tachypetes aquilus*). Mr. Bell informed us that the frigate-bird visits the island regularly every spring and summer; but none were observed during the visit of the *Stella*.

In addition to the above, several petrels were seen at sea, which could not be identified from the deck of the vessel. It is worthy of remark that the whole of the land-birds are common New Zealand species.

Reptiles.—No land reptilia of any kind were observed, and Mr. Bell informed us that none exist. He alluded, however, to the occasional presence of a water-snake, which, from his description, I take to be *Pelamys bicolor*, a common species throughout Polynesia. Several specimens of the common turtle (*Chelonia viridis*) were seen, and it is said to be not uncommon during the summer months.

Fishes.—The following were caught by the sailors of the *Stella* during our stay (I had not time to collect any myself):—Hapuka (*Oligorus gigas*), plentiful, and attaining a large size; specimens weighing over 80lbs. were caught. Kahawai (*Arripts salar*), abundant. Trevally (*Caranx georgianus*). Kingfish (*Seriola lalandii*), very large and fine-flavoured. *Scorpana* sp. Tarakihi (*Chilodactylus macropterus*), and a few others not yet identified.

Mollusca.—A large limpet, more than 5 inches in diameter, is common on the rocks, and there are two or three species of smaller size. *Nerita atrata*, *Triton spengleri*, *Ranella leucostoma*, *Cassia pyrum*, all well-known New Zealand species, were collected. Worn specimens of *Conus marmoreus* and another species of the same genus, together with *Cypræa caput-serpentis*, were picked up on the beach. Two or three *Trochidae* of Polynesian facies were also picked up; but, as a rule, shells are very few in number, as might be predicted from the heavy surf continually rolling on the shore. The only land mollusca observed were broken fragments of two species of *Helicidae* of small size.

CATALOGUE OF PHÆNOGAMIC PLANTS AND FERNS INHABITING THE
KERMADEC ISLANDS.

(Species new to the New Zealand Flora marked with an asterisk.)

1. CRUCIFERÆ.

1. *Cardamine stylosa*, D.C.

Open gullies on Macaulay Island; not uncommon. Not seen on Sunday Island. New Zealand, Australia, Tasmania.

2. VIOLARIÆ.

2. *Melicytus ramiflorus*, Forst.

Plentiful on Sunday Island, especially on the rich volcanic terraces on the northern side of the island. New Zealand, Norfolk Island.

3. PITTOSPOREÆ.

3. *Pittosporum crassifolium*, Banks and Sol.

A few trees scattered along the northern shore of Sunday Island. New Zealand.

4. GERANIACÆ.

4. *Geranium dissectum*, L., var. *pilosum*.

Cliffs on the northern shore of Sunday Island; not common. Temperate regions of both hemispheres.

5. *Geranium molle*, L.

In various places on Sunday Island, but perhaps naturalised only. New Zealand, Tasmania, Europe, N. Africa, W. Asia.

6. *Oxalis corniculata*, L.

Common on both Sunday Island and Macaulay Island. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and most parts of the world.

5. RUTACEÆ.

7. *Melicope ternata*, Forst.

Sunday Island; plentiful. Foliage and capsules much larger than in New Zealand examples, and the plant might be appropriately distinguished under the name of var. *grandis*. New Zealand.

6. ANACARDIACÆ.

8. *Corynocarpus laevigata*, Forst.

Plentiful in all the lower portions of Sunday Island. New Zealand.

7. CORIARIÆ.

9. *Coriaria ruscifolia*, L.

Sunday Island; abundant, especially in the large crater-basin. New Zealand.

10. *Coriaria thymifolia*, Humb.

Recorded from the Kermadec Islands by *Sir J. D. Hooker* in the "Handbook of the New Zealand Flora," p. 47; but not mentioned in his paper printed in the "Journal of the Linnean Society" (vol. i., Botany, p. 125). I did not observe it, and judging from its distribution in New Zealand it does not seem a likely plant to occur in the islands. New Zealand; America, from Mexico to Peru.

8. LEGUMINOSÆ.

11. **Canavalia obtusifolia*, D.C.

Stems long, prostrate or climbing, glabrous, or the young shoots silky-pubescent. Leaves trifoliolate; leaflets obovate or orbicular, obtuse, 2-4 inches long, texture firm. Flowers in axillary racemes, rather large, pinkish. Upper lip of calyx very large, with two broad rounded lobes; lower lip small, three-lobed. Standard orbicular, $\frac{3}{4}$ inch diameter; keel curved, obtuse. Pod about 4 inches long by nearly 1 inch broad; seeds 3 to 6. Scrambling over rocks and shrubs on Meyer Island, an outlying rock on the north side of Sunday Island. Mr. Bell informed me that it occurs in some bays on the east side of Sunday Island. Norfolk Island, Lord Howe's Island, tropical Australia, and a common sea-coast plant in many parts of Polynesia, South America, Africa, and tropical Asia.

9. ROSACÆ.

12. *Acana sanguisorbæ*, Vahl.

Kermadec Islands, *Sir J. D. Hooker* ("Handbook," p. 56). I did not see this, and the plant was unknown to Mr. Bell. New Zealand, Australia, Tasmania, Tristan d'Acunha.

10. HALORAGÆ.

13. *Haloragis alata*, Jacq.

On both Sunday and Macaulay Islands, but by no means abundant. New Zealand, Australia, Juan Fernandez.

14. *Callitriche verna*, L.

Abundant in shady places on Sunday Island. World-wide, or nearly so.

11. MYRTACEÆ.

15. *Metrosideros polymorpha*, Forst.

Sunday Island; the most abundant tree, occurring from sea-level to the summit of the highest hills. Lord Howe's Island, and in many parts of Polynesia, extending as far north as the Sandwich Islands. Apparently not found in Norfolk Island.

12. CUCURBITACEÆ.

16. *Sicyos angulatus*, L.

Plentiful in the lower portions of Sunday Island, and of very luxuriant growth, climbing to the tops of the trees. It also creeps over the ground, and is a great nuisance in the cultivations, on account of the rapidity of its growth. New Zealand, Norfolk Island, Lord Howe's Island, Australia, America.

FICOIDEÆ.

17. *Mesembryanthemum australe*, Sol.

Shores of Sunday, Macaulay, and Curtis Islands; abundant. New Zealand, Norfolk Island, Lord Howe's Island, Australia.

18. *Tetragonia expansa*, Murr.

Shores of Sunday and Macaulay Islands; plentiful. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Japan, extra-tropical South America.

19. *Tetragonia trigyna*, Banks and Sol.

Cliffs on the north side of Sunday Island; not common. New Zealand, and also Australia and Tasmania, if it is identical with *T. implexicoma*, Hk. f., as seems probable.

14. UMBELLIFERÆ.

20. *Hydrocotyle moschata*, Forst.

Moist places on Sunday Island; plentiful. New Zealand.

21. *Apium australe*, Thou.

Shores of Sunday Island; not rare. New Zealand, Lord Howe's Island, Australia, Tasmania, Antarctic America.

15. ARALIACEÆ.

22. *Panax arboreum*, Forst.

Sunday Island; common towards the tops of the hills. New Zealand.

16. RUBIACEÆ.

23. *Coprosma baueriana*, Endl.

Eastern shore of Sunday Island; not common. New Zealand, Norfolk Island.

24. *Coprosma petiolata*, Hook. f.
Shores of Sunday, Macaulay, and Curtis Islands; plentiful.
New Zealand, Lord Howe's Island, Norfolk Island.
25. *Coprosma acutifolia*, Hook. f.
Plentiful all over Sunday Island. The female flowers, which were not known to Hooker, are on slender peduncles $\frac{1}{2}$ – $\frac{3}{4}$ inch long, which are either simple or trichotomously divided, and bear from 4 to 12 flowers. Calyx with 4–5 linear teeth. Corolla tubular, 3–5-lobed. Drupe oblong, $\frac{1}{4}$ inch long, reddish orange. Distinguished from my *C. tenuifolia* by its more slender habit, paler bark, smaller, thinner, and more acuminate leaves, with different venation, and by the much less compact inflorescence. Endemic.
17. COMPOSITÆ.
26. **Ageratum conyzoides*, L.
Sunday Island; abundant, especially in abandoned cultivations, where it forms a dense mass 2–3 feet high. Known by the local name of "Cherry Pie," or "Wild Heliotrope." Perhaps introduced, but it is truly native in many parts of Polynesia. Abundant in the tropics of both hemispheres.
27. *Lagenophora forsteri*, D.C.
Cliffs in Denham Bay, Sunday Island. New Zealand.
28. *Lagenophora petiolata*, Hook. f.
Kermadec Islands, Sir J. D. Hooker ("Handbook," p. 137). Not observed by me. New Zealand.
29. **Siegesbeckia orientalis*, L.
Sunday Island; common in open sunny places in the bush. Tropical Australia, Polynesia, India, China.
30. *Bidens pilosa*, L.
Sunday Island; plentiful everywhere in open and rocky places. New Zealand, Australia, Polynesia, and tropical countries generally.
31. *Cotula australis*, Hook. f.
Sunday Island; not uncommon in waste places. New Zealand, Australia, Tasmania, and Tristan d'Acunha.
32. *Gnaphalium luteo-album*, L.
Sunday and Macaulay Islands; common. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and most parts of the world.
3. *Gnaphalium involucratum*, Forst.
Sunday and Macaulay Islands; not rare. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Japan.

34. *Gnaphalium collinum*, Lab.
 Macaulay Island, plentiful; Sunday Island, not so abundant. New Zealand, Australia, Tasmania.
35. *Senecio lautus*, Forst. ?
 Macaulay Island; only a few specimens seen, and these so young that the identification is doubtful. New Zealand, Australia, Tasmania.
36. *Senecio* (?) sp.
 A plant possibly belonging to this genus occurs on the cliffs on the eastern shore of Sunday Island, but the specimens are much too immature to determine. The foliage somewhat resembles that of *S. banksii*, Hook. f.
37. *Sonchus oleraceus*, L., var. *asper*.
 Common on the cliffs of both Sunday and Macaulay Islands. New Zealand, Australia, and most temperate regions.

18. GOODENOVIÆÆ.

38. *Scævola gracilis*, Hook. f.
 Sunday and Macaulay Islands; abundant on the cliffs. A very ornamental half shrubby procumbent plant, 2 to 4 feet high. Flowers white with a yellow eye, sweet-scented. Endemic.

19. CAMPANULACEÆ.

39. *Wahlenbergia gracilis*, A. Rich.
 Sides of dry gullies on Macaulay Island. New Zealand, Lord Howe's Island, Australia, Malayan Islands.
40. *Lobelia anceps*, Thunb.
 Sunday and Macaulay Islands; common. A large and stout broad-leaved form. New Zealand, Norfolk Island, Lord Howe's Island, Australia, S. Africa, and temperate South America.

20. PRIMULACEÆ.

41. *Samolus repens*, Pers.
 Maritime rocks on the east side of Sunday Island. New Zealand, Australia, New Caledonia.

21. MYRSINÆÆ.

42. **Myrsine kermadecensis*, n. sp.
 Common all over Sunday Island. Evidently closely allied to the Norfolk Island *M. crassifolia*, but I think sufficiently distinct. I defer describing it until I am able to compare specimens of the two plants. Endemic.

22. CONVOLVULACEÆ.

43. *Convolvulus sepium*, L.
Waste places on Sunday Island; rare. New Zealand, Australia, and most temperate and sub-tropical regions.
44. *Convolvulus soldanella*, L.
East coast of Sunday Island; apparently not common. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and most extra-tropical sea coasts.
45. *Ipomœa palmata*, Forst.
Cliffs on the north side of Sunday Island; not uncommon. New Zealand, Norfolk Island, Lord Howe's Island, Australia; tropical Asia, Africa, and America.
46. **Ipomœa pes-capræ*, Roth.
Perfectly glabrous. Stems prostrate, trailing, sometimes 40 feet in length. Leaves 2-4 inches long, broadly-oblong or orbicular, bluntly 2-lobed, thick and fleshy. Peduncles shorter than the leaves, 1-3-flowered. Calyx with 5 obtuse sepals. Corolla campanulate, 1 inch long, pinkish. Capsule large, nearly globose, $\frac{3}{4}$ inch in diameter, 2-celled. Seeds large, hairy. Abundant in the sandy bays and on some of the cliffs of Sunday Island. Lord Howe's Island, Australia, Polynesia, and the sea-coasts of most tropical countries.

23. SOLANACEÆ.

47. *Solanum nigrum*, L.
Sunday Island; most abundant, especially in cultivated ground. Macaulay Island, not so plentiful. New Zealand, Australia, Polynesia, and almost all tropical and temperate countries.
48. *Solanum aviculare*, Forst.
Sunday Island; by no means common. Macaulay Island, a single specimen only. New Zealand, Norfolk Island, Lord Howe's Island, Australia.

24. SCROPHULARINÆ.

49. *Veronica salicifolia*, Vahl.
Cliffs on the east side of Sunday Island; rare. New Zealand.
50. *Veronica ligustrifolia*, Vahl.
Stated by Sir J. D. Hooker to have been collected by McGillivray on Sunday Island. I did not observe it; but Mr. Bell informed me that a narrow-leaved "Koromiko" occurred in a few localities, which will doubtless be this species. New Zealand.

25. MYOPORACEÆ.

51. *Myoporum latum*, Forst.

One of the commonest trees on Sunday Island, and the first to appear on abandoned cultivations. It is much more variable in its foliage than in New Zealand, and unusually broad- and narrow-leaved varieties are common. A few stunted plants were noticed on Macaulay Island. New Zealand.

26. CHENOPODIACEÆ.

52. *Rhagodia nutans*, Br.

Cliffs on the north side of Sunday Island. New Zealand and Australia.

27. POLYGONACEÆ.

53. *Rumex flexuosus*, Forst.

Sandy beach in Denham Bay, Sunday Island. New Zealand.

28. NYCTAGINEÆ.

54. *Pisonia brunoniana*, Endl.

Scattered over the lower portions of Sunday Island, but by no means common. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and Polynesia.

29. EUPHORBIACEÆ.

55. **Aleurites moluccana*, Willd.

A stout, widely-branched tree; Sunday Island specimens ranging from 20 feet to 60 feet in height, with a trunk 1-3 feet in diameter. Leaves crowded towards the ends of the branches, alternate, 4-9 inches long, ovate-lanceolate to rhomboid, 3-5-lobed, acute or acuminate, tomentose when young, almost glabrous when fully grown; petioles 3-9 inches long. Panicles large, terminal, much branched. Flowers monœcious, not seen in a perfect condition, the calyx and corolla having just fallen before the time of our visit. Fruit almost 2 inches in diameter, usually with 2-3 cocci. Seeds globose, rugose, hard, and bony. North and east side of Sunday Island; not very common. North Australia, Polynesia, and the tropics of both hemispheres.

56. *Carumbium polyandrum*, Hook. f.

Sunday Island; not uncommon in sheltered places. Macaulay Island; half-a-dozen plants in the old crater basin. A graceful tree, with very handsome glaucous foliage, variable in shape and size. The leaves of young plants are often more than a foot in diameter; but they are seldom half that size in fully grown individuals. Endemic.

30. URTICÆÆ.

57. *Parietaria debilis*, Forst.

Sunday and Macaulay Islands; plentiful. New Zealand, Norfolk Island, Lord Howe's Island, Australia, and the tropics of both hemispheres.

58. **Bahmeria australis*, Endl.

A small tree, 8-20 feet high. Branches terete, hoary with minute appressed hairs. Leaves alternate, ovate-lanceolate to ovate, acuminate, obtusely serrate, rounded or slightly cordate at the base, 3-6 inches long; 3-nerved, green and glabrous above, below white and hoary with appressed hairs. Petioles stout, grooved on the upper surface, $\frac{1}{2}$ -1 $\frac{1}{4}$ inches long. Stipules small, deciduous, ovate-lanceolate. Flowers minute, in small axillary sessile glomerules, nearly all females in my specimens, but in one or two the lower glomerules have male flowers at the base of the glomerule. Male flowers: Perianth deeply 4-partite, segments oblong-ovate, acuminate, covered with erect hairs. Stamens 4, alternating with the perianth segments; filaments elastic, exserted and recurved between the perianth segments when the flower is mature. A minute oblong-clavate rudiment of an ovary present. Females: Perianth tubular, compressed, dilated below, contracted at the two-toothed mouth. Ovary included, 1-celled, 1-ovulate; stigma exserted, long, filiform, spirally recurved, hirsute. Ripe fruit not seen. This seems to differ from Endlicher's plant in the leaves not being so decidedly cordate at the base. Sunday Island; not uncommon in the lower portions of the island. Norfolk Island.

31. CHLORANTHACEÆ.

59. *Ascarina lucida*, Hook, f.

Sunday Island; plentiful on the hills. I have followed Sir J. D. Hooker in referring the Kermadec plant, which he originally distinguished under the name of *A. lanceolata*, to the New Zealand *A. lucida*. But the leaves are much longer and narrower, and more coarsely toothed, than in any New Zealand specimens I have seen. New Zealand, Fiji, Samoa, New Caledonia.

32. PIPERACEÆ.

60. *Piper excelsum*, Forst.

Extremely plentiful all over the lower portions of Sunday Island. Differs from the New Zealand plant in the very much longer leaves and longer catkins. New Zealand, Norfolk Island, Lord Howe's Island, Australia.

61. *Peperomia urvilleana*, A. Rich.
Sunday Island; plentiful. New Zealand, Norfolk Island,
Lord Howe's Island.

33. ORCHIDÆ.

62. *Acianthus sinclairii*, Hook. f.
Sunday Island; abundant. New Zealand.
63. *Microtis porrifolia*, Spr.
Shaded places in the crater of Sunday Island. Flowers
not seen, and the identification is therefore not certain.
New Zealand, Australia.

34. LILIACEÆ.

64. **Cordyline terminalis*, Kunth.
Stems 3-8 feet high. Leaves numerous, crowded at the
end of the stems, 12-18 inches long, 2-3 inches broad,
oblanceolate, acuminate, gradually narrowed into a sheath-
ing petiole 2-6 inches long. Panicle large, 1-2 feet long.
Flowers in clusters of 2 or 3 on the branches of the panicle,
shortly pedicelled, lilac. Perianth about $\frac{1}{2}$ inch long,
divided about half-way down into 6 segments. Ripe fruit
not seen. Lower portions of Sunday Island; not very
common. Australia, Polynesia, Malayan Islands, India.

35. PALMÆ.

65. **Kentia baueri*.
Abundant on Sunday Island, from sea-level to the tops
of the highest hills. I refer it to the Norfolk Island *K.*
baueri with some hesitation, for I have had no opportunity
of comparing specimens; but it seems to match Endlicher's
description very fairly, so far as foliage and fruit are con-
cerned. Unfortunately it was not in flower at the time of
my visit. It differs from *K. sapida* in the larger size (some
specimens reaching 60 feet), stouter habit, more numerous
leaves, much larger panicles, and larger nearly globose
fruit. Norfolk Island.

36. TYPHACEÆ.

66. *Typha angustifolia*, L.
Sunday Island; fringing the lakes in the crater basin,
and also in a lagoon in Denham Bay. Nearly all temperate
and tropical countries.

37. CYPERACEÆ.

67. *Cyperus ustulatus*, A. Rich.
Sunday and Macaulay Islands; plentiful. New Zealand.
68. *Scirpus nodosus*, Rottb.
Sunday and Macaulay Islands; plentiful. New Zealand,
Norfolk Island, Lord Howe's Island, Australia, South
Africa, extra-tropical South America.

69. *Carex* sp.

Sunday and Macaulay Islands. The specimens are not sufficient to determine the species, but the leaves much resemble those of the Norfolk Island *C. neesiana*.

70. *Carex* sp.

Sunday Island. Smaller, and with narrower foliage than the preceding.

38. GRAMINEÆ.

71. *Paspalum scrobiculatum*, L.

Denham Bay, Sunday Island. New Zealand, Australia, Polynesia, tropical Asia and Africa.

72. **Panicum (Digitaria) sanguinale*, L.

Sunday Island; plentiful, and apparently truly native. Lord Howe's Island, Australia, Polynesia, and most warm countries.

73. **Panicum (Digitaria)* sp.

Shaded places on Sunday Island.

74. **Oplismenus compositus*, Beauv.

Shaded places on Sunday Island; abundant. Lord Howe's Island, Australia, Polynesia, and most tropical countries.

75. *Oplismenus setarius*, Rœm. and Sch.

Sunday and Macaulay Islands; common in shaded places. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, and most tropical countries.

76. **Cenchrus calyculatus*, Cav.

Sandy flat on the north side of Sunday Island. Polynesia, from the Sandwich Islands to New Caledonia and Tonga.

77. **Imperata arundinacea*, Cyr.

Cliffs on the north side of Sunday Island; plentiful. Australia, Polynesia, and many other temperate and tropical countries.

78. **Polypogon monspeliensis*, Desv.

Macaulay Island; not uncommon. Not seen on Sunday Island. This is usually considered to be a very doubtful native of the Southern Hemisphere, although Bentham gives it a place in the "Flora Australiensis." Had it been observed on Sunday Island, I should have considered it naturalized; but it is hard to see how it could be carried to Macaulay Island, which has always been uninhabited, and which is perhaps not landed on once in ten years. Temperate and sub-tropical regions of the old world; Australia?

79. *Dichelachne sciurea*, Hook. f.

Macaulay Island; not uncommon. New Zealand, Norfolk Island, Australia.

80. *Deyeuxia forsteri*, Kunth.

Sunday and Macaulay Islands. A few specimens only were seen, but it would probably be more abundant later in the season. New Zealand, Lord Howe's Island, Australia.

81. *Agrostis* ? sp.

A small fine-leaved grass, very plentiful on Macaulay Island, but not seen in flower, is doubtfully referred to this genus for the present.

82. **Eleusine indica*, Gærtn.

Lower portions of Sunday Island, and on Meyer Island; abundant. Australia, Polynesia, and most warm countries.

83. *Poa* sp.

Cliffs of Sunday Island, and everywhere on Macaulay Island. Specimens too immature to determine the species.

84. *Agropyrum scabrum*, Beauv. ?

A doubtful identification, resting on a comparison of the foliage, the plant not being in flower at the time of our visit. New Zealand, Norfolk Island, Australia.

39. FILICES.

85. *Cyathea milnei*, Hook.

Sunday Island; most abundant, from sea-level to the tops of the highest hills. A noble species, attaining 50 feet in height. Endemic.

86. *Hymenophyllum demissum*, Swz.

Sunday Island; chiefly on fern-trunks towards the tops of the hills. New Zealand, Polynesia, Java, Philippines.

87. *Trichomanes venosum*, Br.

Sunday Island; trunks of fern-trees towards the tops of the hills. New Zealand, Australia.

88. *Adiantum diaphanum*, Blume.

Sunday Island; plentiful. Macaulay Island; fringing the sides of a dry watercourse. New Zealand, Norfolk Island, Australia, Polynesia, Malayan Islands, China.

89. *Adiantum affine*, Willd.

Ravines on Sunday Island. New Zealand, Australia.

90. *Adiantum hispidulum*, Swz.

Sunday and Macaulay Islands; plentiful. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, tropical Asia and Africa.

91. *Hypolepis tenuifolia*, Bernh.

Sunday Island, very plentiful; Macaulay Island, rare. The form is that sometimes kept separate under the name

- of *H. dicksonoides*, Hook. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, Java.
92. *Pellaea falcata*, Fec.
Sunday and Macaulay Islands; common. New Zealand, Lord Howe's Island, Australia, Malayan Islands, India.
93. *Pteris tremula*, Br.
Sunday Island, common; Macaulay Island, rare. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia.
94. *Pteris aquilina*, L., var. *esculenta*.
Sunday Island; scarce, and only seen in two localities. World-wide.
95. *Pteris comans*, Forst.
Sunday Island; the most common of all ferns. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, Juan Fernandez.
96. *Lomaria acuminata*, Baker.
Sunday and Macaulay Islands; common. New Zealand — Little Barrier Island, *A. Reischek*; Three Kings Islands, *T.F.C.*; Norfolk Island.
97. *Lomaria procera*, Spr.
Sunday Island; not uncommon. New Zealand, Lord Howe's Island, Australia, Polynesia, South America, South Africa.
98. *Doodia media*, Br., var. *milnei*.
Sunday and Macaulay Islands; plentiful. New Zealand, Norfolk Island, Australia, Polynesia.
99. *Asplenium obtusatum*, Forst.
Sunday and Macaulay Islands; common on maritime rocks. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia.
100. *Asplenium lucidum*, Forst.
Sunday Island; not uncommon. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia.
101. *Asplenium caudatum*, Forst.
Sunday Island; plentiful. Hardly separable from *A. falcatum* as a species. Australia, Polynesia, Malayan Islands, India, South Africa, South America.
102. *Asplenium flaccidum*, Forst.
Sunday Island; plentiful. In addition to the varieties α , β , and γ of the "Handbook of the N.Z. Flora," the form sometimes kept distinct, as *A. shuttleworthianum*, Kunze, is also present. New Zealand, Australia, Polynesia.

108. **Asplenium (Diplazium)* sp.

Ravines on Sunday Island; not common. A rather small species, seldom more than 18 inches high, with pinnate fronds. It is evidently closely allied to and may be identical with the Fijian *A. congruum*, Brack. Polynesia?

104. *Aspidium aristatum*, Swz.

Sunday Island; very plentiful. New Zealand—Taranga Isles, T.F.C.; Norfolk Island, Australia, Polynesia, tropical Asia, South Africa.

105. *Nephrodium decompositum*, Br.

Sunday Island; common towards the tops of the hills. New Zealand, Norfolk Island, Australia, Polynesia.

106. **Nephrodium tenericaule*, Hook. ; *N. setigerum*, Baker.

Ravines on Sunday Island; not rare. Norfolk Island, Australia, Polynesia, tropical Asia.

107. *Nephrodium molle*, Desv.

Sunday Island, in several places in the lower portions of the island. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, and tropical countries generally.

108. **Nephrolepis exaltata*, Schott.

Sunday Island; abundant in Denham Bay, but not seen elsewhere. Australia, Polynesia, and most tropical countries.

109. *Polypodium billardieri*, Br.

Sunday Island; very abundant. New Zealand, Norfolk Island, Lord Howe's Island, Australia.

110. *Polypodium serpens*, Forst.

Sunday Island; plentiful. New Zealand, Norfolk Island, Australia, Polynesia.

111. *Ophioglossum lusitanicum*, L.

A few specimens collected on the large crater of Sunday Island. New Zealand, Australia, and many temperate and tropical countries.

39. LYCOPODIACEÆ.

112. *Lycopodium billardieri*, Spring.

Sunday Island, on the trunks of tree-ferns; rare. New Zealand.

113. *Lycopodium cernuum*, L.

Sunday Island, in the large crater-basin; not common. Universal in tropical countries.

114. *Tmesipteris forsteri*, Endl.

Sunday Island, on the trunks of fern-trees towards the tops of the hills. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia.

115. *Psilotum triquetrum*, Swz.

Sunday Island; not uncommon, and attaining a large size. New Zealand, Norfolk Island, Lord Howe's Island, Australia, Polynesia, and most warm countries.

TABLE SHOWING THE DISTRIBUTION OF THE KERMADEC ISLANDS PLANTS:—

	Endemic.	New Zealand.	Norfolk Island.	Lord Howe's Island.	Australia.	Polynesia.
<i>Cardamine stylosa</i>	x	..	..	x	..
<i>Meliccytus ramiflorus</i>	x	x	..	..	..
<i>Pittosporum crassifolium</i>	x	..	..	..	..
<i>Geranium dissectum</i>	x	..	..	x	..
<i>Geranium molle</i>	x	..	..	x	..
<i>Oxalis corniculata</i>	x	x	x	x	x
<i>Melicope ternata</i>	x	..	..	..	..
<i>Gorynocarpus lævigata</i>	x	..	..	..	..
<i>Coriaria ruscifolia</i>	x	..	..	..	..
<i>Coriaria thymifolia</i>	x	..	..	..	..
<i>Ganavaha obtusifolia</i>	x	x	x	x
<i>Acæna sanguisorbæ</i>	x	..	..	x	..
<i>Haloragis alata</i>	x	..	..	x	..
<i>Callitriche verna</i>	x	..	..	x	..
<i>Metrosideros polymorpha</i>	x	..	x
<i>Sicyos angulatus</i>	x	x	x	x	..
<i>Mesembryanthemum australe</i>	x	x	x	x	..
<i>Tetragonia expansa</i>	x	x	x	x	..
<i>Tetragonia trigyna</i>	x	..	..	x	..
<i>Hydrocotyle moschata</i>	x	..	..	x	..
<i>Apium australe</i>	x	..	x	..	..
<i>Panax arboreum</i>	x	..	..	..	..
<i>Coprosma baueriana</i>	x	x	..	..	..
<i>Coprosma petiolata</i>	x	x	x	..	..
<i>Coprosma acutifolia</i>	x	..	..	..	..	..
<i>Ageratum conyzoides</i>	x	x
<i>Lagenophora forsteri</i>	x	..	..	..
<i>Lagenophora petiolata</i>	x	..	..	..
<i>Siegesbeckia orientalis</i>	x	x
<i>Bidens pilosa</i>	x	..	x	x	x
<i>Cotula australis</i>	x	..	..	x	..
<i>Gnaphalium luteo-album</i>	x	x	x	x	..
<i>Gnaphalium involucreatum</i>	x	x	x	x	..
<i>Gnaphalium collinum</i>	x	..	..	x	..
<i>Senecio lautus</i> ?	x	..	..	x	..
<i>Senecio</i> ? sp.

	Endemic.	New Zealand.	Norfolk Island.	Lord Howe's Island.	Australia.	Polynesia.
<i>Sonchus oleraceus</i>	x	..	..	x	..
<i>Scævola gracilis</i>	x	..	..	..	x	..
<i>Wahlenbergia gracilis</i>	x	..	x	x	..
<i>Lobelia anceps</i>	x	x	x	x	..
<i>Samolus repens</i>	x	x	..	x	x
<i>Myrsine kermadecensis</i>	x	..	..	..	..	..
<i>Convolvulus septium</i>	x	..	..	x	..
<i>Convolvulus soldanella</i>	x	x	x	x	..
<i>Ipomœa palmata</i>	x	x	x	x	x
<i>Ipomœa pes-capræ</i>	x	x	x
<i>Solanum nigrum</i>	x	x	..	x	x
<i>Solanum aviculare</i>	x	x	x	x	..
<i>Veronica salicifolia</i>	x	..	..	..	..
<i>Veronica ligustrifolia</i>	x	..	..	..	..
<i>Myoporum lætum</i>	x	..	..	..	..
<i>Rhagodia nutans</i>	x	..	..	x	..
<i>Rumex flexuosus</i>	x	..	..	..	..
<i>Pisonia brunoniana</i>	x	x	x	x	x
<i>Aleurites moluccana</i>	x	x
<i>Carumbium polyandrum</i>	x	..	..	..	..	..
<i>Parietaria debilis</i>	x	x	x	x	..
<i>Bœhmeria australis</i>	x	..	..	..
<i>Ascarina lucida</i>	x	..	..	..	x
<i>Piper excelsum</i>	x	x	x	x	x
<i>Peperomia urvilleana</i>	x	x	x	..	..
<i>Acianthus sinclairii</i>	x	..	..	..	..
<i>Microtis porrifolia</i>	x	..	..	x	..
<i>Cordylone terminalis</i>	x	x
<i>Kentia baueri</i>	x	..	..	..
<i>Typha angustifolia</i>	x	x	..	x	x
<i>Cyperus ustulatus</i>	x	..	..	..	..
<i>Scirpus nodosus</i>	x	x	x	x	..
<i>Cai ex sp.</i>
<i>Cai ex sp.</i>
<i>Paspalum scrobiculatum</i>	x	..	..	x	x
<i>Panicum sanguinale</i>	x	x	x
<i>Panicum sp.</i>
<i>Oplismenus compositus</i>	x	x	x
<i>Oplismenus setarius</i>	x	x	x	x	x
<i>Cenchrus calyculatus</i>	x
<i>Impepata arundinacea</i>	x	x
<i>Polygomon mospeliensis</i>	x (?)	..
<i>Dichelachne sciuea</i>	x	x	..	x	..
<i>Deyeuzia forsteri</i>	x	..	x	x	..
<i>Agrostus (?) sp.</i>
<i>Eleusine indica</i>	x	x
<i>Poa sp.</i>
<i>Agropyrum scabrum</i>	x	x	..	x	..
<i>Cyathea vulnei</i>	x	..	..	..	..	..
<i>Hymenophyllum demissum</i>	x	..	..	..	x

	Endemic.	New Zealand.	Norfolk Island.	Lord Howe's Island.	Australia.	Polynesia.
<i>Trichomanes venosum</i>	x	..	..	..	..	..
<i>Adiantum diaphanum</i>	x	x	x	x	x	x
<i>Adiantum affine</i>	x	x	x	x	x	x
<i>Adiantum hispidulum</i>	x	x	x	x	x	x
<i>Hypolepis tenuifolia</i>	x	x	x	x	x	x
<i>Pellaea falcata</i>	x	x	x	x	x	x
<i>Pteris tremula</i>	x	x	x	x	x	x
<i>Pteris aquilina</i>	x	x	x	x	x	x
<i>Pteris comans</i>	x	x	x	x	x	x
<i>Lomaria acuminata</i>	x	x	x	x	x	x
<i>Lomaria procera</i>	x	x	x	x	x	x
<i>Doodia media</i>	x	x	x	x	x	x
<i>Asplenium obtusatum</i>	x	x	x	x	x	x
<i>Asplenium lucidum</i>	x	x	x	x	x	x
<i>Asplenium caudatum</i>	x	x	x	x	x	x
<i>Asplenium flaccidum</i>	x	x	x	x	x	x
<i>Asplenium</i> sp.	x	x	x	x	x	x (?)
<i>Aspidium aristatum</i>	x	x	x	x	x	x
<i>Nephrodium decompositum</i>	x	x	x	x	x	x
<i>Nephrodium tenercaule</i>	x	x	x	x	x	x
<i>Nephrodium molle</i>	x	x	x	x	x	x
<i>Nephrolepis exaltata</i>	x	x	x	x	x	x
<i>Polypodium billardieri</i>	x	x	x	x	x	x (?)
<i>Polypodium serpens</i>	x	x	x	x	x	x
<i>Ophioglossum lusitanicum</i>	x	x	x	x	x	x
<i>Lycopodium billardieri</i>	x	x	x	x	x	x
<i>Lycopodium cernuum</i>	x	x	x	x	x	x
<i>Imesopteris forsteri</i>	x	x	x	x	x	x
<i>Psilotum triquetrum</i>	x	x	x	x	x	x

NATURALIZED PLANTS.

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|---------------------------------------|----------------------------------|
| <i>Fumaria officinalis</i> , L. | <i>Hypochaeris radicata</i> , L. |
| <i>Alyssum maritimum</i> , L. | <i>Physalis peruviana</i> , L. |
| <i>Capsella bursa-pastoris</i> , D.C. | <i>Nicotiana tabaccum</i> , L. |
| <i>Senebiera coronopus</i> , Poir. | <i>Plantago major</i> , L. |
| <i>Senebiera didyma</i> , Pers. | <i>Plantago lanceolata</i> , L. |
| <i>Cerastium vulgatum</i> , L. | <i>Veronica arvensis</i> , L. |
| <i>Stellaria media</i> , L. | <i>Rumex obtusifolius</i> , L. |
| <i>Trifolium pratense</i> , L. | <i>Euphorbia pepus</i> , L. |
| <i>Trifolium repens</i> , L. | <i>Cynodon dactylon</i> , Pers. |
| <i>Apium graveolens</i> , L. | <i>Dactylis glomerata</i> , L. |
| <i>Daucus carota</i> , L. | <i>Poa annua</i> , L. |
| <i>Erigeron canadense</i> , L. | <i>Poa pratensis</i> , L. |
| <i>Senecio vulgaris</i> , L. | <i>Lolium perenne</i> , L. |