ART. XLV.—*Notes on a Brief Botanical Visit to the Poor Knights Islands.*

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1. GENERAL REMARKS.

DURING a recent excursion in the Government steamer "Hinemoa" I had the good fortune, thanks to special facilities afforded by Captain J. Bollons, of botanizing on the Poor Knights Islands, a group which no naturalist had previously visited. Nor is this at all remarkable, for these islands lie out of the track of vessels, while it is only under the most exceptional circumstances that a landing can be effected.

The Poor Knights, or "Tawhiti Rahi," as the Maoris call them, lie isolated in the open ocean at about latitude 35° 30′ S., and distant some eleven miles from the east coast of northern Auckland. They consist of two precipitous islands lying in close proximity, and extending in a north and south direction for two miles and a half. They are of volcanic origin, and about 182 meters in height As seen from the east the southern island is somewhat conical in form, but with a very broad base, while the northern island, although rugged enough, is much flatter in its upper part. Three miles to the south are the islets known as the High Peak Rocks, which rise to a height of 60 meters, and these must be included in the group.

Unfortunately the time at the captain's disposal was limited, so he was only able to allow me some two hours and a half for my work, a considerable portion of which was occupied by sailing round much of the two main islands in search of a landing-place. This, however, gave an opportunity of noting the distribution of certain conspicuous plant-formations.

We landed at two places on the southern island, one below the precipices on its west coast, not far from the very narrow strait which divides the two islands; and the other, where some rocks stretch out into the sea on the north-east side. This latter is the most favourable place from whence to explore the island, since a comparatively gentle slope up a wide, shallow gully, full of scrub or low forest, leads right to the summit of the island. Elsewhere, so far as I could judge, the coast is extremely precipitous.

I did not land on the northern island, but Captain Bollons and some of the sailors climbed up to the meadow above the cliffs on the west side, near the remarkable tunnel which there forms a narrow passage right through the island.

From the above it may be gathered that what follows regarding the vegetation is quite fragmentary—so much so, indeed, that but for the fact that nothing whatever was known about the natural history of the Poor Knights I should not have ventured to publish these notes.

2. The Plant Formations.

Everywhere on the Poor Knights, excepting in the most unfavourable positions, such as faces of precipices, is an abundant vegetation. This, so far as I could judge, consists of three principal formations—viz., cliff, tall scrub, and meadow. There is also a limited amount of flat ground, more or less wet, near the rocks where we landed on the north-east of the southern island, where grow certain halophytes. This is treated below under the heading "Salt Meadow."

(*a.*) *The Cliff Formation.*

The cliffs vary considerably in their slope, and on this the richness or otherwise of their plant-covering chiefly depends. Where quite perpendicular, as in many places on the east of the northern island, plants—lichens excepted—are absent; but where the slope is more gentle there is frequently so abundant a covering that the rocks are clothed with greenery. The chief members noted of this formation were: *Poa anceps*, *Arundo conspicua* (*Gramineæ*); *Arthropodium cirrhatum*, *Phormium tenax* (*Liliaceæ*); *Rhagodia nutans*, *Salicornia australis* (*Chenopodiaceæ*); *Mesembrianthemum australe* (*Aizoaceæ*); *Apium prostratum* (*Umbelliferæ*); *Coprosma baueri* (*Rubiaceæ*); *Lobelia anceps* (*Campanulaceæ*); *Metrosideros tomentosa* (*Myrtaceæ*); *Polypodium serpens*, *Asplenium flaccidum* var. (*Filices*). Of these some play a much more important part than others. For instance, in some places the succulent *Mesembrianthemum* forms a close covering of bright-green; in others, colonies of the thick-leaved *Arthropodium** cover some square meters of the rock-surface, while near by the tall yellow plumes of *Arundo* wave in the breeze. *Poa anceps*, so common as a coastal grass in the north of New Zealand, in many places hangs in long tufts down the rock-face; and *Phormium tenax*, its large clumps of sword-like leaves a meter or more in length, stands out conspicuous from the cliffs.

* To show how this plant can resist drought, a plant which I collected on the Poor Knights on the 28th February, and had kept between drying-papers, was still alive and vigorous on the 14th April, at which date I planted it in my garden, where it grew vigorously, and by the 1st June has produced several roots more than 16 cm. in length.

(*b.*) *The Tall Scrub Formation.*

Even at a distance it can plainly be seen that much of the surface of both islands is occupied by a thick growth of low trees. A closer view shows that some of these stand out distinctly above the others. This at first led me to think that the former might be the rare *Meryta sinclairii*, which has for a long time been reputed as occurring on the Poor Knights.* But, as shown further on, these plants are merely *Cordyline australis*, so that the presence of *Meryta* on these islands still remains a moot point.

The formation under consideration occupies the gullies, together with that flatter ground forming the surface of the islands above the precipices. It seems to be of greatest extent on the southern island, where alone I had an opportunity of penetrating into it. Had the time not been so short it would have been quite easy to have gone right through the scrub to the summit of the island, but as it was I was only able to examine the part at no great distance from the sea.

Unlike the cliff formation, which is identical with that of the neighbouring mainland, the scrub is quite distinct from any allied formation with which I am acquainted in the New Zealand biological region, not because it contains any peculiar or rare species, but from the special combination of its members.

Seen from without, the scrub presents a dense mass of foliage, greyish or green in colour. Between the scrub proper and the open ground bordering on the sea is a broad, thick belt of *Phormium tenax*, while in places within this again is a good deal of low-growing *Metrosideros tomentosa*, the representative here of the characteristic belt of that tree along most of the rocky shores in northern New Zealand. Here, too, outside the scrub, is *Myoporum lætum*—not an erect tree as usual, but semi-prostrate. This unusual habit did not surprise me, for on the Moko Hinou Islands and on Cuvier I had already observed numerous absolutely prostrate plants, looking on this account altogether different from the normal tree. How far this prostrate habit is hereditary and the plant an elementary species, or whether it is merely a case of fluctuating variation, the result of constant winds on plants which would otherwise be upright, has yet to be ascertained—an easy enough matter to determine by means of culture experiments.

The two dominant plants of the scrub are *Suttonia divaricata* (*Myrsinaceæ*) and *Macropiper excelsum* (*Piperaceæ*). *Melicytus ramiflorus* (*Violaceæ*) appears to come next in abundance.

* See T. Kirk, "An Account of the Puka (*Meryta sinclairii*, Seem.)," Trans N.Z. Inst., vol. ii, p. 100, 1870.

Associated with these, but in much smaller proportion, are *Hymenanthera latifolia* (*Violaceæ*), *Myoporum lætum* (*Myaporaceæ*), *Entelea arborescens* (*Tiliaceæ*), *Geniostoma ligustrifolia* (*Loganiaceæ*), *Corynocarpus lævigata* (*Anarcardiaceæ*), and *Sideroxylon costatum* (*Sapotaceæ*).

The scrub is about 3 m. tall. The low trees or tall shrubs—call them as you please—have usually rather slender naked trunks and dense heads of foliage. The ground is bare for the most part, but here and there are seedlings of the different species, together with *Veronica macroura** and a few ferns. It was pleasant to note that the bell-bird (*Anthornis melanura*), now all but extinct in many places, was plentiful. Further from the sea the scrub probably changes its character considerably, for *Cordyline australis* (*Liliaceæ*) becomes one of the most abundant members, its much-branched heads raised above the other foliage and rendered conspicuous at a distance through this and their yellowish-green colour.

With the exception of *Suttonia divaricata*, the presence of which was most unexpected, and which separates this scrub most distinctly from any other formation, its other members are what might be expected in a northern coastal forest. But *S. divaricata* is by no means a common plant in the north of New Zealand, so Mr. T. F. Cheeseman informs me. It, however, is much commoner as we go further south, until on the Auckland and Campbell Islands it becomes one of the characteristic forest or scrub plants.† From Mr. R. H. Matthews, of Kaitaia, to whom I wish to express my obligation for botanical assistance, I learn, however, of a still more anomalous station for this shrub—viz., on mangrove islands in the Rangaumu Estuary.

The most striking ecological fact about this scrub of the Poor Knights is that, notwithstanding the small size and consequent exposure to fierce winds of the islands, the foliage of many of the plants is abnormally luxuriant. *Macropiper excelsum* is probably that large-leaved variety originally discovered by Cheeseman on the Kermadec‡ and Three Kings Islands.§ The leaf-blades of my specimens measure ± 16 cm. by $\pm 16{\cdot}6$ cm.

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* If the identification be accurate this extends the range of this plant considerably to the northward, at the same time affording evidence that the Whangarei habitat of Colenso is correct.

† Cockayne, L., "A Botanical Excursion during Midwinter to the Southern Islands of New Zealand" (Trans. N.Z. Inst., vol. xxxvi, 1904, p. 251).

‡ "On the Flora of the Kermadec Islands" (Trans. N.Z. Inst., vol. xx, 1888, p. 154).

§ "Notes on the Three Kings Islands" (Trans. N.Z. Inst, vol. xxiii, 1891, p. 412; see also p. 415 as to the large-leaved *Geniostoma*).

Those of *Myoporum lætum* measure ± 14·5 cm. by ± 6·2 cm., whereas Kirk gives from 2·5 cm. to 10 cm. long by 1·3 cm. to 3·8 cm. broad.* The leaves of the *Melicytus* and *Geniostoma*, too, are considerably above the average. But most surprising of all are the leaves of *Suttonia divaricata*. These on specimens from the Southern Islands measure 11 mm. by 10 mm.,† but those of Poor Knights plants are 33 mm. by 22 mm.; moreover, they are thin, and not "somewhat coriaceous."

Such luxuriance of foliage on wind-swept small islands, far out in the open ocean, where the contrary might be expected, is not easy of explanation. There is far more shelter than might be thought at first glance, for usually the formation will only get the wind from one quarter, while the dense growth of the whole also protects the individual members. The air, too —although no statistics are available—may be assumed to be always highly charged with moisture, and so will check transpiration and encourage leaf-development. Finally, the volcanic soil of the islands is probably extremely fertile. Mr. T. Kirk long ago called attention to a similar condition of affairs on the lava-field of Rangitoto, the well-known landmark in the Hauraki Gulf, the richness of whose vegetation in conjunction with the apparent absence of soil and water must strike even the most careless observer. My above explanation, so far as it goes, adds little to that originally put forth by Kirk.‡ I must confess, however, that it seems to me at best but a partial solution of this puzzling question.

(*c.*) *Meadow.*

Regarding this formation I can say little, having only seen it from a distance. Captain Bollons, however, as mentioned above, climbed up to the open gound above the cliffs of the northern island, bringing back for me a few specimens of the meadow vegetation. The ground is in many places carpeted with *Mesembrianthemum australe*. Everywhere is *Phormium tenax*, sometimes in large masses, at other times dotted about. Large tussocks of *Arundo conspicua* here and there all over the meadow give a distinct character to its physiognomy. Roundish bushes, too, of stunted *Metrosideros tomentosa* are frequent. The meadow is broken into in many places by greater or smaller pieces of scrub, thanks to the shelter afforded by the *Phormium*. Whether this scrub is similar to that described above I am not in a position to say. Neither can I bring for-

* "Forest Flora," p. 253.

† *Loc. cit*, p. 251.

‡ "Notes on the Botany of Waiheke, Rangitoto, and other Islands in the Hauraki Gulf" (Trans. N.Z. Inst., vol. xi, 1879, pp. 451, 452).

ward any facts as to the causes determining the presence of meadow or scrub, though doubtless it is largely a matter of degree of exposure to the prevailing winds. Captain Bollons made one most interesting discovery. At the base of the *Phormium* plants he observed large numbers of the great snail *Placostylus hongii*, var. *novoseelandica*, now quite extinct on the mainland, but still occasionally to be found on the small island, Cape Maria van Diemen.

(*d.*) *The Salt Meadow.*

Here the presence of that collection of halophytes to which I am giving the name "salt meadow" for comparative purposes is dependent rather on the sea-spray blown inland, and on the lack of shelter, than on any other factors. The ground is more or less wet, in some places water lying on the surface. Here the vegetation is richest, the dominant plant being the rush-like and strongly xerophytic *Leptocarpus simplex* (*Restiaceæ*). Other plants of this formation are: *Lobelia anceps* (*Campanulaceæ*), *Juncus maritimus*, var. *australiensis*, and *J. planifolius* (*Juncaceæ*), *Paspalum distichum* and *Deyeuxia billardieri* (*Gramineæ*), *Mariscus ustulatus* (*Cyperaceæ*), *Apium prostratum* (*Umbelliferæ*), *Samolus repens*, var. *stricta* (*Primulaceæ*), and *Carmichælia williamsii* (*Leguminosæ*). If my identification of this latter plant be correct—and both Messrs. Petrie and Cheeseman, to whom I have shown specimens, are of opinion that it is so—its presence on the Poor Knights is very remarkable.* Between the "salt meadow" and the scrub is the zone of *Phormium* before mentioned, which may perhaps be included in this formation.

Regarding the occurrence of *Carmichælia williamsii* a few words may not be out of place. Up to the present this most striking plant† of a remarkable genus has only been recorded from the East Cape district, where it is rare and local. The only explanation that I can suggest as to its occurrence in two places so far apart is that it was once much more widely distributed along the east coast of northern New Zealand, but shrinkage of the land-surface has led to a fiercer struggle for existence, which has caused its extinction except in a few specially situated localities. It is just on islands which once upon a time formed part of the mainland, or in peculiar stations such as the cliffs of the East Cape, that relics of a former vegetation might be expected. The North Cape, at no very distant date

* Mr. Cheeseman has also, since writing the above, very kindly given me an opportunity of examining a type specimen of *C australis*, var. *lata*, from the herbarium of the late Mr. T. Kirk, which certainly is quite distinct from the Poor Knights plant.

† See fig. 3, pl. xxvi, Fenton, E. H., "The Art Album of the New Zealand Flora."

an island, is a case in point. Here Cheeseman* discovered four plants not found elsewhere, which may well be considered either remnants of a more extensive ancient coastal flora, or new species which originated during a separation of the place in question from the mainland. But in the case of *Carmichœlia williamsii* the former supposition seems the more feasible. This view is also supported by the occurrence of *Veronica macroura* on the Poor Knights, another species known authentically only from the East Cape region and the coast for some distance to the south, including Portland Island.

3. SUMMARY OF RESULTS.

1. There are three principal plant formations on the Poor Knights—viz., cliff, tall scrub, and meadow—and a minor formation composed principally of halophytes.

2. The cliff formation is identical with that of the adjacent coast.

3. The scrub, owing to the combination of its members and the presence of *Suttonia divaricata* as a dominant species, differs from any allied formation in the New Zealand biological region.

4. *Carmichœlia williamsii*, a plant hitherto only known from the East Cape district, much further to the south, occurs on the Poor Knights, and its limited distribution in New Zealand may be explained on the supposition of a shrinkage of the land-surface, with a consequent increase in the struggle for existence and the extinction of plants over wide areas, leaving the survivors isolated in such places as small islands.

5. The arborescent plants exhibit a most remarkable luxuriance of foliage, greater considerably than that of the same species on the mainland.

Before concluding I must express my sincere thanks to the Hon. W. Hall-Jones, Minister of Marine, for his kind assistance in furthering my botanical work on this and previous occasions.

4. LIST OF PLANTS COLLECTED OR OBSERVED ON THE POOR KNIGHTS.

Filices.

Asplenium flaccidum, *Forst., var.*
Polypodium serpens, *Forst.*
Pteris esculenta, *Forst.*
,, tremula, Br.

* "On the Flora of the North Cape District" (Trans. N.Z. Inst., vol. xxix, 1897, p. 363).

Gramineæ.

Arundo conspicua, *Forst. f.*
Deyeuxia billardieri, *Kunth.*
Dichelachne crinita, *Hook. f.*
Oplismenus undulatifolius, *Beauv.*
Paspalum distichum, *L.*
Poa anceps, *Forst. f.*

Cyperaceæ.

Carex dissita, *Sol.*
Mariscus ustulatus, *C. B. Clarke.*
Scirpus nodosus, *Rottb.*
„ prolifer, *Rottb.*
„ cernuus, *Vahl.*

Restionaceæ.

Leptocarpus simplex, *A. Rich.*

Juncaceæ.

Luzula, *sp.*
Juncus maritimus, *var.* australiensis, *Buchen. Law.*
„ planifolius, *R. Br.*

Liliaceæ.

Arthropodium cirrhatum, *R. Br.*,
Cordyline australis, *Hook. f.*
Phormium tenax, *Forst.*

Piperaceæ.

Macropiper excelsum, *Miq.*
Parietaria debilis, *Forst. f.*

Polygonaceæ.

Muehlenbeckia complexa, *Meissn.*

Chenopodiaceæ.

Rhagodia nutans, *R. Br.*
Salicornia australis, *Sol.*

Aizoaceæ.

Mesembrianthemum australe, *Sol.*

Caryophyllaceæ.

Tissa media, *L. f.*

Ranunculaceæ.
Clematis parviflora, *A. Cunn.*

Cruciferæ.
Lepidium oleraceum, *Forst. f.*

Pittosporaceæ.
Pittosporum crassifolium, *Sol.*

Leguminosæ.
Carmichælia australis, *R. Br.*
„ williamsii, *T. Kirk.*

Oxalidaceæ.
Oxalis corniculata, *L.*

Linaceæ.
Linum monogynum, *Forst. f.*

Anarcardiaceæ.
Corynocarpus lævigata, *Forst.*

Tiliaceæ.
Entelea arborescens, *R. Br.*

Violaceæ.
Hymenanthera latifolia, *Endl.*
Melicytus ramiflorus, *Forst.*

Thymeliaceæ.
Pimelea lævigata, *Gaert., var.*

Myrtaceæ.
Metrosideros tomentosa, *A. Rich.*

Haloragidaceæ.
Haloragis erecta (*Murr.*), *Schindler.*

Umbelliferæ.
Apium prostratum, Labill.

Epacridaceæ.
Leucopogon fasciculatis, *A. Rich.*

Myrsinaceæ.

Suttonia divaricata, *Hook. f.*

Primulaceæ.

Samolus repens, *Pers., var.* stricta, *Cockayne.*

Sapotaceæ.

Sideroxylon costatum, *F. v. Muell.*

Loganiaceæ.

Geniostoma ligustrifolia, *A. Cunn.*

Solanaceæ.

Solanum aviculare, *Forst. f.*
„ nigrum, *L.*

Scrophulariaceæ.

Veronica macroura, *Hook. f.*

Myoporaceæ.

Myoporum lætum, *Forst. f.*

Rubiaceæ.

Coprosma baueri, *Endl.*
„ robusta, *Raoul.*

Cucurbitaceæ.

Sicyos australis, *Endl.*

Campanulaceæ.

Lobelia anceps, *L. f.*
Dichondra repens, *Forst.*

Compositæ.

Gnaphalium luteo-album, *L.*
Sonchus oleraceus, *L.*
Erigeron canadense (*introduced*).