

REFERENCES.

The following are the chief references additional to those given in the first part of this paper. The references to the "Flora Novæ-Zelandiæ" are all to volume ii.

1. "Species Algarum," 1848-63. (J. Agardh.)
2. "Bidrage till Algernes Systematik," parts iv., v., vi. Lunds Univ. Årsskr., tom. xxi. and xxiii. (J. Agardh.)
3. "Epicrisis Floridearum," 1876. (J. Agardh.)
4. "Analecta Algologica,"* 1892-99. (J. Agardh.)
5. "De dispositione Delesseriearum," 1898. (J. Agardh.)
6. "Flora Antarctica," 1847. (Sir J. D. Hooker.)

The species of the order *Sphacelariaceæ* are being revised in the "Journal de Botanique" by Professor Sauvageau (August, 1900, *et seq.*). Already several New Zealand forms have been dealt with. De Toni's "Sylloge Algarum," unfortunately, is not procurable in the colonies, but would be of considerable assistance to the student.

I cannot close this paper without referring to the death, at a ripe old age, of the greatest of algologists, Professor J. G. Agardh. I found him always ready and willing to assist me, and I regret that he was unable himself to draw up this list, when it would have been of much greater value than it is.

ART. XXXI.—On the Occurrence of *Panax arboreum* as an Epiphyte on the Stems of Tree Ferns in the Mauku District.

By H. CARSE.

[Read before the Auckland Institute, 7th October, 1901.]

IN a paper read before the Hawke's Bay Philosophical Institute on the 9th August, 1886, by the late Mr. Colenso, mention is made† of the peculiar growth of a *Panax arboreum* upon and around the stem of a tree fern, *Cyathea dealbata*. Mr. Colenso said, "I have a curious anomaly to mention, which, as far as I know, is quite unique. Four years ago, while botanising in the high and dry woods near Matamau, I came upon a fine tree fern (*Cyathea dealbata*) whose caudex

* I have, unfortunately, not seen the sixth part of this work.—
R. M. L.

† Trans. N.Z. Inst., vol. xix., p. 257.

below was almost wholly surrounded by its former epiphytal foster-child, a stout spreading specimen of *Panax arborea*, from which or out of which the fern-tree luxuriously grew as if it were springing from a large vase. On the one side (or, rather, speaking correctly, on three sides) the tree fern was wholly enclosed."

I am not aware whether any other botanist since Mr. Colenso's time has drawn attention to this peculiar habit of growth of *Panax arboreum*, or whether it is of frequent occurrence, but I have noticed so many examples of this curious combination that I thought it might prove of some interest once more to draw the attention of the students of plant-life of our country to this subject.

For some reason which I am unable to explain *Panax arboreum* is almost invariably an epiphyte on the stems of tree ferns in the forest regions around Mauku. In open *Leptospermum* scrub, on banks of streams, and on declivities, when tree ferns are not present, *Panax* grows as a standard. As an epiphyte *Panax arboreum* may be seen as a seedling a few inches high, as a sapling a few feet high, or as a tree 20 ft. high. The roots of the seedling appear to strike inwards among the damp fibrous remains of old stipes until, reaching the hard inner coating of the caudex, their further inward progress is barred. One root, which I take to be the tap-root, now begins to make its way earthwards, usually in a more or less straight line, though occasionally they appear to progress spirally. As the young tree increases in stature other roots are given off from the original base of the *Panax*—*i.e.*, from the point on the trunk of the tree fern where the seed germinated. In some cases these roots follow the line of the first; in others they appear to grow for a time laterally before descending. With increased growth of the tree the roots become so crowded together that they grow one into another and coalesce, forming a continuous mass of what for want of a better name I have called "root-stems," for by this time they have ceased to be roots, and true roots are now developed in the soil round the base of the fern-tree. While the "root-stems" have been growing downwards the upper stem has ascended, in some cases in line with the fern-tree, in others at a greater or less angle with the caudex. In some cases the "root-stems" have entirely enveloped the caudex of the fern-tree for 5 ft. or 6 ft. above the ground, and have grown so closely together as to present the appearance of a solid *Panax* trunk, thus giving the appearance of a growing from an urn, referred to by Mr. Colenso. In other fern-tree cases they have formed a more or less open network, through the meshes of which the caudex of the fern-tree is visible.

In some of the specimens I noticed the tree fern was perfectly healthy and in a robust state; in others it was apparently suffering from the close embraces of its too vigorous foster-child, as was shown by the poorly developed fronds. In two cases I saw the enclosed tree ferns had succumbed. In one of these instances the lower part of the caudex was entirely surrounded by the coalescing "root-stems" of the *Panax*, except at one point, where about 6 in. of the caudex was visible. Rising above the point where I judged the germination of the *Panax* to have taken place was seen about 2 ft. of caudex half imbedded in the trunk of the *Panax*. What remained of the caudex was dry and brittle, having apparently been dead for many years. Judging from the remains, I concluded that it had been a *Dicksonia squarrosa*, which fern is plentiful in the immediate vicinity. In the second case the circumstances are very similar, save that the enveloping and fatal "root-stems" have formed a ring about 3 ft. above the ground and have then coalesced, forming a concave trunk containing the compressed remains of the fern, apparently also a *Dicksonia*. In these two cases no "Crown's quest" appears necessary as to the cause of death. The self-evident verdict must be "Death from constriction." But in another case further inquiry is called for. The facts are as follow: A *Panax arboreum* has germinated on a *Cyathea dealbata*, has grown and flourished until it became a tree 20 ft. high, its coalescing "root-stems" enveloping a considerable portion of the stem of its foster-parent. The strange thing in this case is that, while the tree fern is in a state of luxuriant growth, producing a fine crown of fronds, the *Panax* is dead and dry.

From my observations I have arrived at the conclusion that *Cyathea dealbata* probably in many cases suffers in health from the embraces of *Panax arboreum*, but rarely, if ever, succumbs; but that *Dicksonia squarrosa*, being usually less robust, is more apt to find these embraces fatal.

Whether this peculiar habit of *Panax arboreum* shows its natural affinity with the ivy-plant (*Hedera*), as suggested by Mr. Colenso, or no, I leave to more advanced students of nature to decide; but it seems to me we might say the same of the rata (*Metrosideros robusta*), which usually begins life as an epiphyte in the clefts of the upper branches of forest trees, and frequently serves its foster-parent in a manner similar to that described above in the case of *Dicksonia squarrosa*.

Subjoined are a few notes of measurements in some of the cases referred to:—

No. 1. *Cyathea dealbata*, 15 ft. high; *Panax arboreum*, 20 ft. high. Point of germination, 6 ft. above ground.

Caudex entirely enveloped 4 ft. upwards from ground. *Cyathea* unhealthy.

No. 2. *Cyathea dealbata*, 10 ft. high; *Panax arboreum*, 15 ft. high. Point of germination, 8 ft. above ground. Single "root-stem" descending spirally.

No. 3. *Dicksonia squarrosa* (?); *Panax*, 20 ft. high. Germinating-point, 6 ft. above ground. Crushed remains of dead fern show near ground, and again 7 ft. up.

No. 4. *Dicksonia squarrosa* (?); *Panax*, 15 ft. high. Point of germination, 4 ft. up. Crushed remains of dead fern show on opposite sides of coalescing "root-stems," 2 ft. and 5 ft. up.

ART. XXXII.—*On the Flora of the Manuku District.*

By H. CARSE.

[Read before the Auckland Institute, 2nd September, 1901.]

"ALL rivers flow to the sea," and every stream helps to swell the volume of some river. I am sending forth the little creeklet of my observations to help to swell the great river of botanical knowledge, which is constantly bearing useful information and pleasure to thousands of true lovers of nature.

These notes are the outcome of a suggestion that the observations on botanical subjects by a resident in a particular district may be of some use to botany generally, in that they afford opportunities of comparing the flora of one district with that of others in the same country. This suggestion was made to me at one time by Mr. Cheeseman, and again by Mr. Petrie. I am glad to avail myself of this opportunity to tender to these gentlemen my hearty thanks for the great encouragement, ready assistance, and valuable information I have received from them from time to time during the period—a few years only—in which I have devoted my spare time to the fascinating study of plant-life.

The region to which my notes refer is that part of the Manukau County which is bounded on the north by the Manukau Harbour, on the east by the railway-line, on the south by the Waikato River, and on the west by the Tasman Sea. The Settlement of Mauku is fairly central, and was my headquarters. When first I arrived in the district, two years ago, I was afraid that as a field for botanical research it would prove very poor. But longer acquaintance with it