

a whipcord-veronica—i.e., very thick cuticle on under (outer) surface, sunken stomata, much-thickened epidermal cell-walls, close palisade for half thickness of leaf or more, and roundish and close-celled pneumatic tissue.

(e.) *Lianes.*

Climbing plants are not an important feature of Stewart Island, though most of those found in the southern floristic province are present. Leaving the climbing ferns on one side, there are eleven species, which may be thus classified: Scramblers—*Tetragonia trigyna*, *Rubus australis*, *R. schmedelioides*, *R. schmedelioides* var. *coloratus*, *R. subpauperatus*; twiners—*Rhipogonum scandens*, *Parsonsia heterophylla*, *Muehlenbeckia australis*, *M. complexa*; tendril-climbers—*Clematis indivisa*; root-climbers—*Metrosideros hypericifolia*. All except *Tetragonia* are woody plants.

The species of *Rubus* climb by means of numerous hooked prickles situated on the midribs of the leaves, and in some cases on the stems. In *R. subpauperatus* the leaves are much reduced, and serve partly as special climbing organs.

The supplejack (*Rhipogonum scandens*) is to be found principally in forest-gullies. The young stem is soft, succulent, virtually leafless, and of rapid growth. At first erect, it soon gains a shrub, which, if small, it ultimately leaves for another, until finally a support may be gained by which it can reach the forest-roof, where it puts forth leaves and flowers in abundance. Adult leaves are also frequently present on lateral branches from the climbing stem at no great distance from the ground (for further details regarding this liane see Cockayne, 25, p. 24). The characteristic entanglements of stems without supports arises from these having perished.

The climbing white rata (*Metrosideros hypericifolia*) has a slender woody leafless main stem, which is fastened closely to the bark by roots 1 in. or more long, given off at a right angle so closely together as to touch, and holding tightly to the tree-trunk. Small, lateral, very slender, flexible twigs pass off from the climbing stem at a wide angle, and are provided with numerous small, shining, dark-green ovate leaves on their flanks. Such shoots look rather like a long pinnate leaf, and are rarely held close to the bark. Frequently the plant is prostrate upon the forest-floor, in which case there will be a flexible, stout creeping stem beneath the loose peaty soil, many yards in length,* and which branches frequently, putting forth terrestrial shoots which creep over logs or climb the tree-trunks, the plants of adjacent trees in this manner being at times merely branches of one plant. The species of *Muehlenbeckia* are rare, and rather grow over shrubs near the shore than in the forest; both are more or less deciduous.

(f.) *Epiphytes.*

This important ecological class, so striking in northern New Zealand forests, is of comparatively slight importance in those of Stewart Island. Epiphytic asteliads and pittosporads are wanting, nor do ferns, except on tree-fern trunks, play much part. But the origin of the epiphytic habit—i.e., the adopting the perching life by certain ground-plants—is in evidence, while also true spermatophytic epiphytes—e.g., *Dendrobium Cunninghamii*, the two species of *Earina* and *Sarcochilus adversus*—are not wanting.

As in the forests of the north we see the puka (*Griselinia lucida*) as a true epiphyte, so, too, in Stewart Island is the broadleaf (*G. littoralis*) very common, perched high on the branches of a rimu, the seeds brought originally by some bird. But, unable to occupy such a position permanently, as it increases in size, its demand for water likewise augments, and a root is sent to the ground looking just like a liane-stem (see Photo No. 12). The southern rata (*M. lucida*) behaves similarly, thanks to the lightness of its seeds, and the composite root-trunks of many trees have thus originated (see Photo No. 6). The kamahi (*Weinmannia racemosa*) as a seedling is common, growing on the trunk of *Dicksonia squarrosa*. The epiphytic orchids are fastened to the tree-trunks or boughs by their much-branching roots, whose spongy tissue near their extremities absorbs water, of which there is usually no lack even on the tree-trunks, but in case of drought the leaves are of xerophytic structure. The roots of *D. Cunninghamii* are of great length, and hold the plant very firmly, even to a vertical trunk.

(g.) *Ferns.*†

The richness of Stewart Island in ferns was pointed out by Kirk (56, p. 228), though this is rather in number of individuals than in species, since out of sixty-five at least sixteen are rare or local.

The two common species of tree-ferns are not generally very tall. They are most abundant in the gullies. All the ferns are evergreen, excepting the thousand-leaves (*Hypolepis millefolium*), the alpine shield-fern (*Polystichum cystotegia*), and the cut-leaved bracken (*Histiopteris incisa*); but in spring (October and November) new fronds are developed, the older ones gradually dying. Besides the true tree-ferns, the common hard fern (*Blechnum discolor*), the crape-fern (*Leptopteris superba*), and the prickly shield-fern (*Polystichum vestitum*) have distinct trunks, those of the *Leptopteris* being of a curious pyramidal shape. The mountain tree-fern (*Alsophila Colensoi*) has its trunk prostrate, and more or less buried beneath the ground.

Many of the ferns have coriaceous leaves, a matter probably more connected with their evergreen character than with the water-relation. Some have, however, true xerophytic leaves in harmony with the epiphytic mode of life (*Polystichum capense*, *Cyclophorus serpens*, *Asplenium flaccidum*), or their xerophytic stations (*Blechnum durum*, *B. Banksii*, *Asplenium obtusatum*—ferns of coastal rocks; *Polypodium pumilum*—subalpine rocks); fleshy stems, as in *Polypodium diversifolium* (the climbing polypody), serve the same end.

* I am indebted to Mr. Laing, who called my attention to this habit.

† Not really a true ecological class, but it is convenient to deal with them under one head.