

The filmy ferns have, with the exception of the kidney-fern (*Trichomanes reniforme*), leaves only one cell thick, and are without stomata, the plants being as much "aquatic" as if they were submerged. Many live on the forest-floor, others on decaying logs, and some are true epiphytes (*H. rarum*, *H. pulcherrimum*, *H. scabrum*, *H. rufescens*, *H. flabellatum*, *T. Lyallii*, *T. venosum*), some being especially abundant on the trunks of tree-ferns. All these stations are plentifully supplied with water by the frequent showers, and plants on logs and trees, or even on the ground, are generally associated with bryophytes of various kinds, which hold water like a sponge, and amongst which the wiry, far-spreading rhizomes, furnished with numerous roots, can ramify. In some cases the hairs on the leaves help to hold water, and so keep them wetted, as in the rusty filmy fern (*H. ferrugineum*), where every frond may have a drop of water hanging from its apex. Those species with finely cut leaves retain water between their leaf-segments.

In very wet gullies is the almost black-leaved black hard fern (*Blechnum nigrum*), and it is a curious fact that in a similar situation the crape-fern (*Leptopteris superba*) has excessively dark-coloured fronds. The liverworts of the genus *Hymenophyllum* and some others "mimic" the filmy ferns, and their assimilation-shoots are analogous to leaves, and function just as those of *Hymenophyllum*, growing also under the same conditions.

The genus *Gleichenia* is well represented in Stewart Island, both in species and individuals. They cover large areas of ground, increasing rapidly vegetatively by means of their far-spreading rhizomes. The flat-margined species, *G. Cunninghamii* (the umbrella-fern) (see Photo No. 20) and *G. circinata* (scrambling umbrella-fern), are generally in the forest—i.e., are "shade-loving"—whereas the species having segments with recurved margins (*G. dicarpa*, *G. alpina*) are plants of the open, bog-xerophytes, and "shade avoiding."

In the *Gleichenias* the apical growth of the leaf is arrested periodically, the circinate leaf-tip, which is incorrectly called an "adventitious bud," and the new growth "proliferous," commencing to unfold in the spring.* Through the plagiotropous position of the pinnae which are thus formed there are frequently two, and often very many more, distant tiers one above the other. This reaches its maximum in *G. circinata*, which is a true liane, scrambling for a height of 10 ft. or more through the branches of shrubs, the plagiotropous pinnae acting as climbing-organs, while the leaf itself is practically of unlimited growth. The same thing occurs, but to a much greater degree, in *Lygodium articulatum*, of northern Auckland, whose fronds may thus reach a length of 50 ft., or considerably more.

Heterophylly is frequent amongst the ferns, and is usually connected with spore-production, the sporophylls differing more or less from the foliage leaves. This is especially the case in the genus *Blechnum*, the sporophylls being more erect and narrower than the foliage leaves, but transitional forms are common.

In some cases the foliage leaves vary much in form on the same individual, being entire or irregularly pinnatifid, as in the case of *Blechnum Patersoni* or *Polypodium diversifolium*. Such variation seems quite independent of outer circumstances. Variation may also occur amongst individuals, and in some instances may be hereditary. This is probably the case in some of the forms of the "variable" common spleenwort (*Asplenium bulbiferum*), a "species" which would repay patient experimental investigation. The proliferous form is usually confined to specially moist situations; but, strange to say, it is not as luxuriant in Stewart Island as in many other parts of New Zealand.

Schizaea fistulosa var. *australis* (the slender comb-fern) has the habit of a small rush, and is a well-marked bog-xerophyte. The sporangia are confined to the apical portion of the leaf, which consists of a few short, slender, linear pinnae arranged closely together. The basal portion is rigid, wiry, and filiform.

3. VARIATION ACCORDING TO ENVIRONMENT.

Here only certain striking cases are dealt with which directly concern Stewart Island.

(a.) Large Size of Leaves.†

Various plants possess considerably larger leaves than do the average of the same species on the main islands of New Zealand. The wineberry (*Aristotelia racemosa*) is of a specially luxuriant habit. The leaves are of a dark colour, and not infrequently measure, even when growing in the open, 8 x 5½ in., with petiole 4 in., whereas 3 in. is a common length of leaf on the mainland.

The lawyer (*Rubus australis*) has remarkably fine leaves, often measuring 1 ft. in length, with the petiole, and the leaflets 4½ x 2¼ in., thus being very different from the narrow-leaved form so common in the Auckland Province.

Olearia nitida, *Nothopanax simplex*, and *N. Edgerleyi* furnish other examples.

Olearia Colensoi (Colenso's daisy-tree) is a somewhat different case. On the mountains of the mainland it is a shrub, with leaves about 2–2½ in. long; but as a member of the coastal scrub of Stewart Island it is a small tree, and its leaves are 8½ x 4¼ in., or larger; while in the subalpine scrub they are much smaller, approximating to those of the mainland. It seems probable that the coastal plant may be the subantarctic *O. Lyallii*, or that this latter and *O. Colensoi* are one and the same, but varying according to their surroundings.

* Goebel (Organography, p. 319, part ii) also points out that no species of *Gleichenia* has a dichotomous leaf, the so-called "forking" being in consequence of the two pinnules below the circinate persistent leaf-tip developing equally.

† Very large leaves may be found on plants within the forest of the Otago fiords, but in Stewart Island the large leaves referred to are on plants in the open.