Of these, the northern rata (*Metrosideros robusta*), the toro (*Rapanea salicina*), the pepper-tree (*Drimys axillaris*), the tawa (*Beilschmiedia tawa*), the broadleaf (*Griselinia littoralis*), the pukatea (*Atherosperma novæ-zelandiæ*), the towai (*Weinmannia racemosa*), and the makomako (*Aristotelia racemosa*) are the chief. The ferns also differ considerably. The tree-ferns are *Hemitelia smithii*, *Dicksonia squarrosa* and *D. fibrosa*. *Todœa hymenophylloides* and *Polypodium pennigerum* appear, and there are a number of species of filmy ferns. The epiphytic asteliads are chiefly in these upper parts of the forest, and so are the tussocks of *Gahnia*. Here, too, are the few trees of the *Taxaceæ*.

(*g.*) *The Ecology of the Plants.*

This is altogether too wide a subject for detailed treatment here—only a few more or less general particulars can be given.

The trees and shrubs are, with the exception of the native *Fuchsia*, evergreens. They are for the most part of low stature, with slender trunks, and in some cases stand on the border-line between shrubs and trees. Their leaves are frequently rather large and thin, though in some instances they are distinctly coriaceous. A number of the species have dicœcious flowers, and the flowers, generally speaking, are small and inconspicuous. The fruits of many are fleshy, an important fact indeed in an island set apart for its bird-life.

Some of the plants exhibit distinct ecological peculiarities. Thus *Atherosperma novæ-zelandiæ*, the tree *par excellence* of shady gullies watered by a stream, has a most striking development of thin "plank-buttresses" at the base of its trunk. *Dysoxylum spectabile*, *Knightia excelsa*, *Rapanea salicina*, *Rap. urvillei*, and *Melicytus ramiflorus* all exhibit cauliflory*—*i.e.*, have flowers on their naked branches or stems—in a more or less marked degree. The roots of trees frequently spread out horizontally at no great distance beneath the surface of the ground, even at times being quite exposed; but this character does not occur to nearly the same degree as in a typical New Zealand rain-forest. *Pennantia corymbosa*, *Knightia excelsa*, *Rapanea salicina*, *Weinmannia racemosa*, *Nothopanax edgerleyi*, and *Pseudopanax crassifolia* pass in the course of their development through a distinct juvenile form, which persists for a considerable period before they assume the adult condition. In these cases there is not merely a change of leaf, but usually a more or less distinct change of habit.

Although the formation is decidedly hygrophytic, the leaves of the majority of the trees are more xerophytic than are those of a northern deciduous forest. This is not to be wondered at when we consider that such leaves are to endure the changes of the seasons. Also, it must be pointed out that a hygrophyte is more susceptible to changes with regard to its water-supply than a xerophyte, and that even a very short period of drought may be detrimental without some compensating xerophytic adaptation. It is on this account that the liverworts, filmy ferns, and certain mosses have drought-resisting contrivances, or can change their form during a dry period. Thus several of the *Hymenophyllums* curl up their leaves and reduce their leaf-surfaces to an extraordinary degree during dry weather. *Olearia cunninghamii* has tomentose leaves; but it is quite probable that such are rather a family characteristic than adaptations to the above-mentioned conditions. The same explanation may be given for *Brachyglottis repanda*, which compensates the effect of its tomentose leaves by the extent of their surface and their texture.

Lianes are an important biological group of the forest. *Rubus australis* is a scrambler, which is assisted in its work by numerous hooked prickles on the leaves and stems. These are finally lost by the latter, which assume great thickness and become covered with a rough bark. The *Muehlenbeckias* and *Rhipogonum scandens* are winding lianes. All of these show more or less heterophylly. *Rhipogonum* (supplejack) has an erect leafy early seedling form, then when its woody rootstock is developed it puts forth long succulent asparagus-like erect shoots which are provided with distant reduced entire leaves pressed to the stem. Finally, on reaching the tree-tops it assumes a more bushy though straggling habit, and produces large leaves of an ovate type. The species of *Clematis* and the passion-flower (*Tetrapathœa australis*) are tendril climbers, the former using the leaf-stalks, and the latter probably metamorphosed flower-stalks,† for the purpose. The various species of *Metrosideros* and *Freycinetia banksii* are root climbers, the former when growing in the open frequently assuming a shrub-like habit (see Plate VI, 2). Some of the most characteristic lianes belong to the ferns. *Polypodium billardieri* has a stout greenish juicy stem, and large bright-green coriaceous simple leaves. *Polypodium serpens* is a distinct xerophyte, with small and very fleshy leaves. The forest form, however, has leaves rounder, greener, and thinner than those of rocks in the open, and might be taken for a different species. But the most interesting fern biologically is *Lomaria filiformis*. This is characterized by a most striking heterophylly, the extreme leaf-forms being so different that one unaccustomed to this plant would not believe them to belong to the same species (see Plate IV, 2). The form with comparatively short linear leaves flattened close to the substratum, and more or less orbicular leaflets, is the early stage of the plant, and the principal form when growing on the ground. This is succeeded by the large-leaved stage with lanceolate leaves and long acuminate leaflets, more or less cordate at the base. There is evidently some connection here between the habit of growth and the dimorphism, but the phenomenon is now distinctly hereditary, and in nature, at any rate, the plant under ordinary forest conditions assumes both habits in due course, even should there be no support on which the fern can climb. Other climbing ferns of the Kapiti forest are *Polypodium tenellum* and *P. punctatum*.

Leaving out of the question the epiphytic cryptogams, epiphytes do not play much part in the Kapiti forest. But high in the forks of the branches, or on the horizontal trunk of *Metrosideros robusta*, the birds-nest-like masses of *Astelia solandri* are common. This plant possesses large fleshy leaves

* Schimper was unaware that any New Zealand trees exhibited this phenomenon (see his Pflanzengeographie, p. 507).

† See H. Schenck, "Beiträge zur Biologie und Anatomie der Lianen," p. 242; 1892.