

B. SPECIAL ECOLOGY.

1. TREES AND SHRUBS.

Between these two categories no hard and fast line can be drawn. The adult form of a plant, which may appear at an abnormally early stage of development, as Diels has so ably shown (8), is marked by the appearing of the reproductive organs, and he cites various examples from the Australian and other floras. A considerable number of the Waipoua plants behave in a similar manner, and such in the following list are marked thus: *. One or two examples demand brief discussion. *Weinmannia sylvicola* is a lofty forest-tree, very common not only in the Waipoua Forest, but in northern New Zealand generally. It has distinct juvenile and adult forms, the former with large pinnate leaves, and the latter with smaller pinnate, or ternate, or even simple leaves. Within the forest are abundance both of juvenile and adult plants, but on the heath the former alone are to be found, and these in some instances, although so different not only in stature but in form from the adult, produce fully matured flowers and ripen seed. Here, then, is a species which, according to its environment, is either a moderate-sized shrub or a forest-tree of lofty stature with a stout trunk. Its close relative, *Weinmannia recemosa*, a still taller and more massive tree of more southern New Zealand, behaves in a similar manner. The small, erect tree, *Dodonaea viscosa* (akeake), is, on some parts of the New Zealand coast, a prostrate plant, as is also *Leptospermum ericoides* (a fairly large tree of the Waipoua Forest), both on mountain hillsides and near fumaroles. So, too, *L. scoparium*, though usually a shrub and sometimes blooming precociously when an inch or two tall (20, p. 235), is a tree of the transition forest, but on the wet mountain-meadows of Stewart Island, according to my observations, it is prostrate, and roots with adventitious roots from near the ends of the branches, resembling a turf-forming plant in general appearance. The hangehange (*Geniostoma ligustrifolium*) is another example of precocious blooming, seedlings on rotten logs near the Waipoua River blooming when only about one year old and two or three inches tall at most.

In certain instances edaphic conditions such as the above appear to have nothing to do with the life-form. Thus the horopito (*Drimys axillaris*) may remain as a shrub of the forest and bloom, &c., or it may be found under similar conditions as a slender-stemmed tree. The tupakihi (*Coriaria ruscifolia*) belongs to another category. This plant in certain places produces an annual woody stem, which dies to the ground yearly, while at other times it is found only as a tall shrub or even small tree with a stout main stem. In this case, however, there are probably several elementary species included under the botanical conception of *C. ruscifolia*.

The trees may be divided into tall, medium, and small, though here again true hard and fast lines cannot be drawn. The rewarewa (*Knightia excelsa*), for instance, exceptionally attains a height of 90 ft., but it is frequently much smaller, and blooming plants 20 ft. high are not rare in the transition forest. The following lists show the categories to which the trees belong:—

Tall trees, finally attaining a height of from 80 ft. to 100 ft., and in some species more: *Libocedrus Doniana*, *Podocarpus totara*, *P. ferrugineus*, *P. spicatus*, *P. dacrydioides*, *Dacrydium Kirkii*, *D. cupressinum*, *Agathis australis*, *Knightia excelsa*, *Laurelia novae-zelandiae*, *Beilschmiedia tawa*, *Metrosideros robusta*.

Medium trees, finally attaining a height of from 50 ft. to 60 ft.: *Phyllocladus trichomanoides*, *Beilschmiedia tarairi*, **Weinmannia sylvicola*, *Dysoxylum spectabile*, *Alectryon excelsum*, *Elaeocarpus dentatus*, *Olea lanceolata*, *O. montana*, *Vitex lucens*.

Small trees, 20 ft. to 40 ft. tall, and sometimes less: *Dacrydium Colensoi*, *Rhopalostylis sapida*, *Macropiper excelsum*, *Persoonia toru*, *Fusanus Cunninghamii*, **Drimys axillaris*, *Hedycarya arborea*, *Litsea calicaris*, *Quintinia serrata*, *Ixerba brevifolia*, **Carpodetus serrata*, *Ackama roseifolia*, *Sophora tetraptera*, **Melicope ternata*, **Coriaria ruscifolia*, **Dodonaea viscosa*, **Aristotelia racemosa*, *Hoheria populnea*, **Melicytus ramiflorus*, *M. macrophyllus*, **Leptospermum ericoides*, *Eugenia Maire*, **Fuchsia excorticata*, *Nothopanax Edgerleyi*, **N. arboreum*, *Pseudopanax crassifolium*, **Grisebinia littoralis*, *Dacrophyllum latifolium*, *Rapanea salicina*, **R. Urvillei*, *Coprosma arborea*, **Olearia Cunninghamii*, **Brachyglottis repanda*, **Myrtus bullata*.

The relative size of the trees has some bearing on their life-conditions. The tall trees have always their crowns exposed to the maximum force of the wind and heat of the sun—i.e., to the greatest transpiration conditions—while the smaller may be quite within the moist atmosphere of the forest, or, where forming a part of the roof, still sheltered in a measure by the crowns of the taller trees even when they are some distance away. Still, it must not be forgotten that these smaller trees in many New Zealand forests are dominant, and there, too, under much severer conditions than in the formation under discussion.

With the exception of *Fuchsia excorticata* and to some extent of *Sophora tetraptera*, all the trees and shrubs are evergreen. The tall and medium-sized trees have usually erect trunks quite without branches until the forest-roof is gained. These naked trunks are partly the result of rapid growth towards the overhead illumination, the main axis chiefly developing, and partly the effect of closeness of growth and destruction of lateral branches when young. The bark may be comparatively smooth, furrowed, or frequently scaling or hanging in strips. Plank buttresses occur in some instances, especially in certain of the taxads at times, in the tawa (*Beilschmiedia tawa*), but above all in the pukatea (*Laurelia novae-zelandiae*), where they are always to be found. For instance, one rather small tree had a trunk 26 in. in diameter above the buttresses, which themselves averaged about 50 in. in height and 5 in. in thickness, becoming thinner very gradually from the base to the rounded margin. These buttresses were continued as roots spreading along the surface of the ground, still in plank-form, one extending in serpentine fashion from the base of the tree for a distance of 30 ft., and finally entering the ground on the opposite side of a gully. At 24 ft. from the tree the flat root was still 16 in. tall, rounded on its upper margin, and of an almost uniform thickness of 2½ in. At 24 ft. from the tree it gave off similar lateral