

trunk covered with flaking bark. The juvenile, on the contrary, is a graceful tree of a slender pyramidal habit, branching and leafy to the base, and of a bright and shining green. Between the two forms come transitions, described by Kirk, as "like a silver fir below and a cyprus above" (21, p. 191). Evidently there is here no relation in these forms to the environment, both stages are hereditary, the juvenile persisting for a definite period just as in the case of other dimorphic plants, but with different leaf-characters—e.g., *Pseudopanax crassifolium*, *Pennantia corymbosa*, &c. Possibly in the case of *D. Kirkii* a fixed juvenile race could be produced from cuttings, and an admirable garden-plant be so raised.

PART IV.—HISTORY OF THE VEGETATION.

A. FLORISTIC DETAILS.

The Waipoua Forest Reserve contains, so far as my observations went, 241 species of flowering-plants, ferns, and fern-allies, 178 belonging to the first-named, and 63 to the two latter categories taken together. Of these plants, 27 are found only in the Northern Floristic Province or just beyond its bounds, 213 belong to the Central Province also, while 159 extend to the Southern Province, and 62 are also to be found in the New Zealand subantarctic islands or the Chatham Islands.

As for the distribution of the plants beyond New Zealand, 60 are Australian, including in that term Tasmanian also, but of these 37 are filices or lycopodiaceæ, and only one a true forest-plant; 14 are South American, 10 Malayan, and 20 are Polynesian, while no fewer than 154—i.e., 63 per cent.—are endemic. Of the non-endemic plants about 80 may be considered tropical or subtropical, and at the same time the genera of many of the endemic species also belong to the same category. The above figures deal with both the forest and heath plants, but if the former alone be considered, and the pteridophytes omitted, then out of a total of 127 forest plants, mostly trees and shrubs, no fewer than 120 are endemic. In other words, the kauri forest is strictly a production of New Zealand.

B. CAUSES FOR PRESENT DISTRIBUTION OF THE KAURI.

Before we can consider the origin of a kauri forest such as the Waipoua, it is necessary to examine into the reasons for the presence north of latitude 38° of such a large number of species, or, in other words, the question arises, Why do not the kauri, the pohutukawa, the mangrove, and certain other well-known plants extend much further to the south than is the case? The answer which would at once suggest itself is that they are prevented doing so by the colder climate of the south. This answer, doubtless, is quite correct so far as certain of the endemic plants are concerned, but it certainly does not meet the case with regard to the kauri, *Pittosporum crassifolium*, *Corokia buddleoides*, *Metrosideros tomentosa*, *Persoonia toru*, and other plants which are certainly quite hardy in the neighbourhood of Wellington and some of them even in Christchurch, one of the coldest places in winter at a low altitude in the whole biological area, not excluding the subantarctic islands. At the same time, in order to comprehend the matter more clearly, it is necessary to bear in mind the behaviour of certain southern plants which only reach a certain distance north, such as *Veronica elliptica*, a most abundant coastal shrub from the Campbell Islands to a little north of Dunedin on the east, and a native also of Fuegia. It forms also thickets at the West Coast Sounds and finally is more or less abundant in north-west Nelson, and crossing Cook Strait appears again at Titahi Bay, Wellington. So, too, with *Senecio rotundifolius*, which does not extend quite so far to the north, and with the small coastal herb *Crassula moschata*, which extends from Macquarie Island to the northern shores of Cook Strait. In these instances it is no case of cold, but excess of heat that might be urged were it not for the fact that *Veronica elliptica* and *Senecio rotundifolius* can both be cultivated with ease in the kauri region. Without going further into the matter here I may quote what I have already written on the subject in dealing with the distribution of New Zealand coastal plant (5, pp. 325, 326, 327):—

"It seems evident that extremes of climate is only one of the factors with regard to the distribution of coastal plants in New Zealand. Rather, perhaps, than heat or cold alone is the matter one of the ecological optimum of any special plant. Many plants would extend farther to the north or the south, but they encounter competitors better equipped for the struggle—i.e., more in harmony with the surroundings than themselves. A plant which is slightly more suited than another for a particular station must evidently become the victor in the struggle for existence, although both outwardly may appear equally matched in every particular. The distribution of *Sophora chathamica* is an interesting case in point. Judging from the behaviour of the closely allied *S. microphylla* on the volcanic hills of Banks Peninsula, where this plant is abundant, one would conclude that similar hills on Chatham Island would be the habitat of *S. chathamica*. On the contrary, it is quite absent in such stations, being evidently not able to cope with the lowland forest-plants, and it is confined to a narrow strip of limestone country near the margin of the great lagoon. In this place the difference of soil evidently equalises the struggle, and it and the other lowland forest-trees there exist side by side. . . . Finally, to sum up the matter, all that can be said about the distribution of the New Zealand coastal plants is that it is the resultant of a large number of causes. The historical factor and evolution determine the species, climate and soil sort them out into groups, and the struggle for existence, which is governed by the life-forms and constitutions of the competitors, finally fixes the formation—that is, so far as a formation may be termed a fixed entity."

Now, the above explanation is not much of a one after all, and leaves the matter almost as at first. Rather perhaps does the history of the land-surface, and with this the history of the vegetation, come to our aid. Here I do not go into details; they are to be found in the geological writings of Hutton and others, and are for the most part in the Transactions of the New Zealand Institute.