

new plant is produced, which finally develops a trunk and runners. Thus large colonies are formed by vegetative increase alone.* One plant, for instance, may produce seven or more runners, and a whole colony yards in extent arise from one plant. The leaves not only come from near the apex, but from the sides of the trunk, and occasionally also from near its base. (Photo 8.)

5. PERSISTENT JUVENILE FORMS.

No account of the ecology of any New Zealand tree or shrub formation can be complete without some reference to those plants which have a juvenile form distinct from the adult and persisting for a long period, or making its reappearance on the adult as a reversion-shoot. Here only those plants peculiar to the Northern Floristic Province are specially dealt with, or others of the kauri forest, though not confined to it, which have received no mention hitherto in botanical literature. The following are the chief of the Waipoua Forest plants which exhibit dimorphism of the kind noted above: (Filices) *Blechnum filiforme*; (Taxaceæ) *Podocarpus dacrydioides*, *P. spicatus*, *Dacrydium cupressinum*, *D. Colensoi*, *D. Kirkii*; (Pinaceæ) *Agathis australis*, *Libocedrus Doniana*; (Moraceæ) *Paratrophis heterophylla*; (Proteaceæ) *Knightia excelsa*; (Polygonaceæ) *Muehlenbeckia complexa*; (Cunoniaceæ) *Weinmannia sylvicola*; (Rosaceæ) *Rubus schmidelioides*; (Rutaceæ) *Melicope simplex*; (Elæocarpaceæ) *Elæocarpus Hookerianus*, *E. dentatus*; (Malvaceæ) *Hoheria populnea*; (Araliaceæ) *Pseudopanax crassifolium*, *Nothopanax Edgerleyi*, *Schefflera digitata*; (Epacridaceæ) *Styphelia fasciculata*; (Myrsinaceæ) *Rapanea salina*; (Oleaceæ) *Olea lanceolata*, *O. montana*; (Apocynaceæ) the two species of *Parsonsia*.

This list, which would be considerably larger were the whole New Zealand flora under review, shows how diverse are the families which show this peculiarity. Also, the whole are forest-plants and not those xerophytes which elsewhere in the biological area change their form according to environment. Still, here even something of that sort takes place. *Schefflera digitata* is an araliad whose adult form is provided with thin, digitate, finely toothed leaves. Its seedlings are usually merely reduced forms of the adult, the leaves being only toothed. But in moist gullies of the Waipoua Forest, and even when of a considerable size, seedlings are common with deeply cut leaflets, reminding one closely of the cut-leaved forms of *Nothopanax simplex* and *N. Edgerleyi*. This is, in the first place, another example of one species having two seedling forms,† and, secondly, from the station of the seedling it looks as if the increased humidity of the atmosphere were the stimulus which produces this form. The phenomenon is striking enough, but its interest is enhanced from the analogous case of the other two araliads. *Styphelia fasciculata* is a common shrub, extending in its distribution from the Northern Floristic Province to the northern part of the Southern Province. The plant of the North of Auckland seems to be identical with the southern form, and yet the former has seedlings and juvenile plants with broad leaves, which become still broader in the forest. The southern plant, even in the Central Province, so far as I have observed, never assumes the broad-leaved form. Here is a case different from the above, since we may be dealing with two separate races, but at the same time we cannot neglect the supposition that the environment may be at the bottom of the matter.

Rubus schmidelioides, common in both Islands of New Zealand and Stewart Island, and found in the Waipoua Forest only in the wetter parts, has a juvenile form distinct from the adult, its leaves being thin, small, and much marked by reticulating venation. This form remains unchanged for many years, and frequently it is the only one to be found. It apparently does not flower.‡ It forms creeping masses, far-spreading over the surface of the ground, and is provided with adventitious roots. On the other hand, the adult has larger, stiff, and coriaceous leaves, not resembling the juvenile to any marked degree. It is a climbing plant, and except under exceptional circumstances is not a ground-plant. Here again is a relation between form and environment, but at the same time heredity comes into play.

The case of *Weinmannia sylvicola*, a shrub (occasionally blooming) of the open and a tall tree of the forest, has been called attention to. The species is closely related to *W. racemosa*, and may be perhaps considered as a fixed juvenile form of that species.

The juvenile form of the kauri has been dealt with in the section regarding life-forms. Here attention need only be called to its strong resemblance to the early stages of other Araucariaceæ. *Phyllocladus trichomanoides* has true leaves at an early stage of development, but no experiments have been published regarding the persistency of these under definite cultural conditions.

The monoao (*Dacrydium Kirkii*) has a juvenile form so different from the adult that one seeing the two for the first time could hardly believe them to be related, much less to be forms of the same species (see Photo 20). The juvenile stage persists for many years, trees 30 ft. tall, or even taller, and without a trace of the adult foliage, being not uncommon. The seedling and later juvenile leaves are linear, subacute, flat, coriaceous but flexible, pale or bright green, and $1\frac{1}{2}$ in. or more in length by $\frac{1}{2}$ in. broad, or thereabouts. They are close-set, spirally arranged, and pass off from the shoot-axis at about a right angle. The adult leaves, on the contrary, are of the cupressoid form, being thick and coriaceous, about $\frac{3}{8}$ in. long, quadrifariouly imbricating, and pressed very closely to the branchlet. The final stage appears all on a sudden, juvenile and adult leaves frequently forming parts of the same shoot, while intermediate forms are quite wanting. The adult may ultimately reach a height of 80 ft. or more, and will have a stout

* Where a forest has been cut into and more light is available, this fern increases very considerably.

† The case of *N. simplex* is discussed in the report on the Tongariro National Park and in Trans. N.Z. Inst., Vol. xxxi, p. 355.

‡ A non-climbing species of *Rubus* collected in Westland some years ago by the late Mr. S. Barker, of Christchurch, which I and others have cultivated under various conditions, and which is allied to *R. parvus*, cannot be induced to flower, and probably is a flowerless species.