

Vol 5, No: 1.

June, 1935.

JOURNAL
OF THE
NEW ZEALAND INSTITUTE
OF
HORTICULTURE

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Journal of the New Zealand Institute of Horticulture

VOL. 5

WELLINGTON, JUNE, 1935

No. 1

NEW ZEALAND FERNS.

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On account of their graceful form and delicate, divided foliage, ferns are favourite plants for house and garden. They are, however, suitable only for situations with a good degree of shelter, and they are all the better for a moist atmosphere; in fact, for some it is absolutely essential. For these reasons special ferneries are usually constructed in which conditions of still, moist air and damp soil are maintained. There are very beautiful ferneries in the public gardens at Auckland, New Plymouth and Dunedin. The following notes, which do not claim to include anything new, but are intended to increase interest in ferns, give a brief account of the life-history of ferns and what are thought to be the salient points regarding the chief groups of New Zealand ferns.

Ferns form a very distinct class of plants known throughout almost the whole range of time for which fossils are preserved. True ferns are present in the late Devonian period and were abundant in the Carboniferous. There existed with them during these times a group of seed-bearing plants with fern-like leaves, the Pteridosperms, from which, apparently, flowering plants sprang. There is evidence to show that ferns originated from some class of algae. In one stage in the life cycle of ferns, namely, the prothallus, water is required, as in algae, for the process of fertilization, ciliate sperms actually swimming to the egg. Over 6,000 kinds of ferns have been described and many new species are still coming to light, especially in south-east Asia and South America.

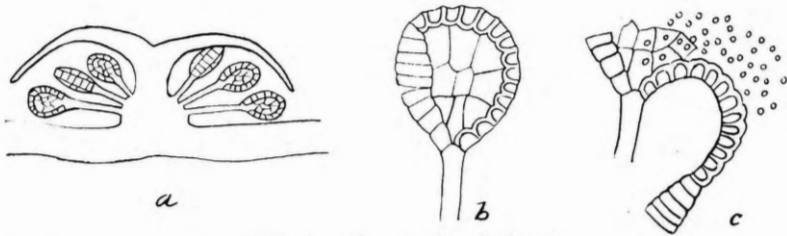


Fig. 1. Sporangia of Ferns.

(a) Sorus of *Dryopteris* with indusium covering several sporangia. (b) Sporangium. (c) Sporangium bursting to release the spores.

In ferns there is an alternation of generations, a spore-bearing one being succeeded by a sexual one, which, in turn, produces the spore-bearing plant. We will begin the account of the life cycle with the spore-bearing generation, which is the one with which we are familiar. Like the vegetative portion of a flowering plant it consists of roots, stem, and leaves. There is, however, nothing corresponding with the flowers of higher plants, and ferns do not produce seeds. On the under-surfaces of some of the leaves of mature ferns are brownish organs arranged in spots, lines or patches. Each of these is called a sorus and consists of a cluster of small spore-bearing organs or sporangia, usually on stalks. There is a complete or incomplete ring of thick-walled cells which by its hygroscopic action effects the splitting of the sporangia to release the spores. The characters of the ring are used to define the families of ferns. The sori, or groups of sporangia, are protected by membranes of various shapes called indusia. The different kinds of indusia are of great service in the recognition of the many generic groups into which ferns are divided. The sporangia can just be seen with the naked eye, and each produces a definite number of spores. On

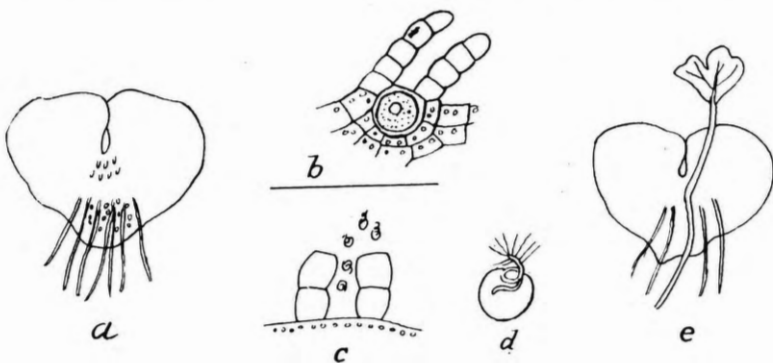


Fig. 2. Fern Prothallus.

(a) Under side of prothallus showing roots, archegonia near the base of the sinus and antheridia among the roots. (b) Archegonium with the egg. (c) Antheridium with sperms escaping. (d) Single sperm showing cilia. (e) Young fern, or spore-bearing generation, growing from the undersurface of a prothallus from the position of one of the archegonia.

damp soil the spores germinate and produce a minute plant called the prothallus. This stage in the life history of a fern is thus asexually produced, but itself bears the sexual organs. These are borne in distinct areas on the underside of the prothallus and consist of antheridia containing ciliate sperms and archegonia containing the eggs. The sperms are propelled by the cilia, but the eggs remain in place, and, after fertilization, grow into the fern plant, which is thus sexually produced but bears the spores which grow directly into the prothallus. There is accordingly in ferns a large spore-bearing (asexual) generation regularly alternating with a minute sexual generation. The fern plant corresponds with the ordinary flowering plant, but in this the sexual generation or prothallus, is reduced to a comparatively few cells not living an independent existence.

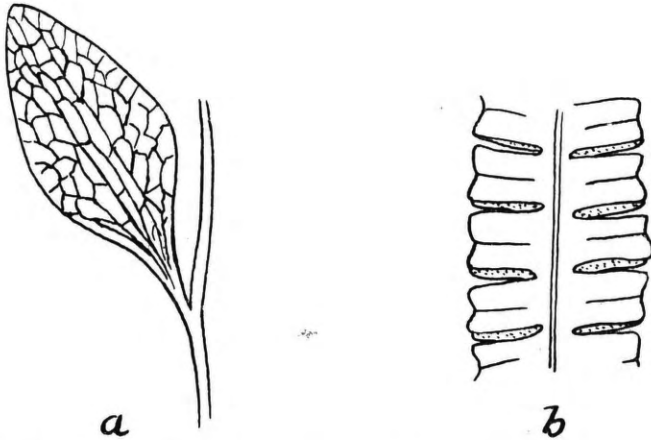
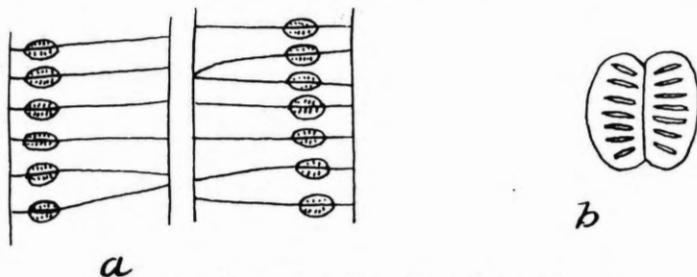


Fig. 3. Adder's Tongue Fern (*Ophioglossum pedunculatum*).
(a) Leaf. (b) Portion of fertile spike with sporangia open.

Family Ophioglossaceae. Adder's Tongue Ferns.

The Adder's Tongue ferns possess such distinctive features that they are by some botanists kept in a class by themselves and so given rank equal to that of all other ferns. From a tuberous root a single leaf is expanded each season and dies down after bearing the fertile spike. This springs from the upper surface of the leaf and is either simple or much divided. The sporangia are partly embedded in the margins of the spike and discharge the spores through transverse slits. They have a ring of thick-walled cells. Two of the three groups into which this family is divided are represented in New Zealand. *Ophioglossum*, the ordinary Adder's tongue, has simple leaves with netted veins, and an undivided fertile spike. The numerous forms are generally considered to fall into two species. *Botrychium*, the Moonwort, has much-divided leaves with open venation. The fertile spike is also compound. One species is found

throughout New Zealand, and another is recorded only from Mount Torlesse, in Canterbury. In the family Ophioglossaceae the leaves do not unroll in the fashion of those of the more typical ferns.



a

Fig. 4. Horse-shoe Fern (*Marattia fraxinea*).

(a) Portion of leaflet showing the sori or synangia near the margin. (b) A single synangium.

Family Marattiaceae—Horse Shoe Ferns.

The Horse-shoe fern, or para of the Maoris (*Marattia fraxinea*) is easily distinguished from all other species of New Zealand ferns. It is often called the "King fern"; but this name is more properly applied to members of the family Osmundaceae. The stem of the para is an irregularly-shaped mass from which spring, at about ground level, large compound leaves up to 12 feet long and 5 feet broad. The leaflets are lanceolate with produced tips and serrulate margins. They may be up to six inches long and one inch broad. The sori, or synangia as they are called, are quite different in appearance from those of other ferns. Each consists of two opposed boat-shaped masses containing a row of sporangia opening by slits to release the spores. The Horse-shoe fern is found wild only in the North Island, but not south of Waitotara. It is now becoming rare in the forest as it is greedily eaten by introduced animals. It is a handsome plant for growing outside, or, if there is room, inside the fernery.



a

Fig. 5. Crape Fern (*Leptopteris hymenophylloides*).

(a) Portion of leaf. (b) Sporangium.

Family Osmundaceae—King Fern and Crape Ferns.

The two groups of ferns belonging to the family Osmundaceae are very different in appearance. One contains a single species, the

King Fern, *Todea barbara*, with thick, coriaceous leaves, and the other includes the two species of crape ferns (*Leptopteris*). The character that links these ferns into one family is the absence of any membrane (indusium) covering the sorus, and the indefinite subapical ring on the sporangium. *Todea* is found in South Africa, Australia, and Tasmania. In New Zealand it occurs only from Whangaroa northwards. It is a striking plant with a short trunk and dense tuft of compound leaves. The crape ferns are found only in wet or moderately wet forests. They have delicate, membranous leaves, finely divided; and in one species (*L. superba*), appropriately called Prince of Wales' Feather, the ultimate segments overlap, and this suggests its alternative name, double crape fern. It is, perhaps, the most beautiful of the ferns of New Zealand. In the other species, *L. hymenophylloides*, the lowest pinnae stop abruptly instead of gradually decreasing in size towards the base as in *L. superba*.

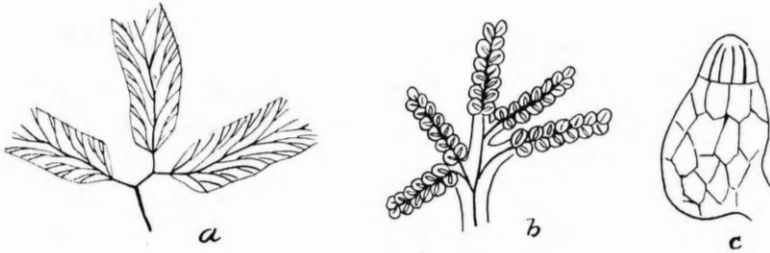


Fig. 6. Mangemange (*Lygodium articulatum*).
(a) Portion of leaf. (b) Fertile leaflets. (c) Sporangium.

Family Schizaeaceae.

In this family, which is represented in New Zealand by two genera, the sporangia are comparatively large and are disposed singly on special fertile segments. The ring is contracted and terminal. The mangemange (*Lygodium articulatum*) is a climbing fern whose leaves form tangled masses reaching to the tree-tops. The rhizome or underground stem is creeping. From it arise the leaves whose stalks and midribs form the climbing, wiry strands. At intervals are given off sterile or fertile leaflets, the latter with narrow segments bearing double rows of sporangia, each protected by a scale-like indusium. The wiry leaf-stalks of the mangemange were used by the Maori for binding the thatch on their huts and for making net-work fish-traps.

There are three species of *Schizaea* in New Zealand. The leaf stalks are erect and wiry without expanded blades. They may be simple (*S. fistulosa*), bifurcate (*S. bifida*), or repeatedly forked (*S. dichotoma*), the ends being modified into narrow segments pinnately arranged and bearing the sporangia protected by the incurved margins.

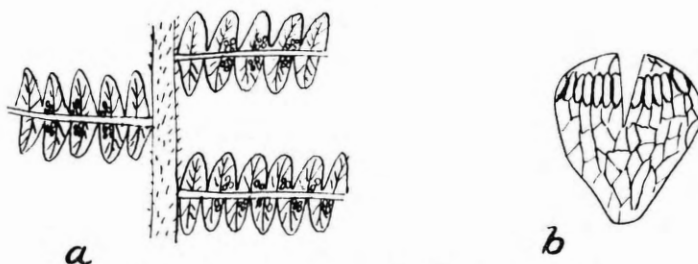


Fig. 7. Umbrella Fern (*Gleichenia circinata*).
 (a) Portion of leaf. (b) Sporangium.

Family Gleicheniaceae—Umbrella ferns.

The umbrella ferns are easily recognized by the erect, wiry leaf stalks with the foliage disposed in horizontal layers. The stem is creeping. The growth at the apex of the leaf is delayed while the side branches lengthen and a false appearance of dichotomy is given. The apex, however, is capable of continuous growth; and so several tiers of foliage are found on each leaf. The leaflet midribs are wiry and widely divaricating, and are fringed with small pinnules. The sori are small and unprotected by an indusium, and the sporangia have a broad transverse ring. The common species of swamp and bog, *G. circinata*, is rather wiry in appearance, having only minute leaf pinnules. In the others the pinnules are longer and more delicate. In the forest *G. Cunninghamii*, which belongs to the group with linear segments, is fairly common and often occurs in patches, giving a striking appearance to the undergrowth. *G. flabellata* is closely allied. It is common in the open country of the far north, scarce south of the Bay of Islands, and reaches its southern limit between Manukau Harbour and the Thames Estuary. A rather delicate species is the tropical *G. linearis*, occurring in New Zealand only near hot springs in the Auckland district.

Family Hymenophyllaceae—Filmy Ferns.

Filmy ferns occupy a very prominent place in the forests of New Zealand. They are present in such comparatively dry stations as the beech forests of the North Island lowlands, but are most conspicuous in damp forests. Here they cover the ground, fallen logs, tree trunks, and branches with a sheet of the most delicate and finely-divided of leaves. Particularly conspicuous is the reddish-brown drapery formed by *Hymenophyllum ferrugineum* on moist banks. Filmy ferns love a still, moist atmosphere, and, as if aware of the beauty of their foliage when sprinkled with water, in some cases, as in *H. ferrugineum*, have a covering of hairs which serves to retain moisture. The kidney fern, which can grow in such dry places as Rangitoto Island, rolls up its leaves when the air is dry.

The filmy ferns form a well-defined and easily-recognized family. They have their leaves usually only one cell, but sometimes three or four cells, in thickness. Their stems are wiry and form matted layers which spread beneath the soil or the surface of tree-fern trunks. The indusia are cup-like and are embedded in the

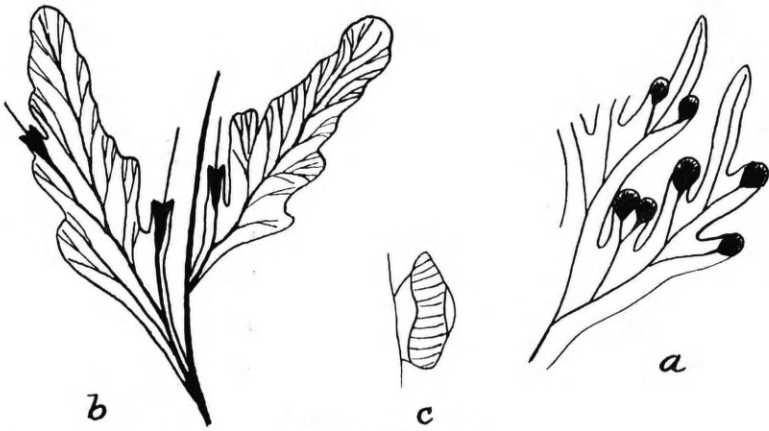


Fig. 8. Filmy Ferns.
 (a) *Hymenophyllum dilatatum*. (b) *Trichomanes venosum*. (c) Sporangium of *Cardiomanes reniforme*.

margin of the leaves. From the centre of the cup springs a stalk or receptacle on which the sporangia are borne. There are 26 species of filmy ferns in New Zealand divided into three groups, one with the indusium two-valved, and with the receptacle contained within it (*Hymenophyllum*) the second with it urn-shaped and with the receptacle projecting far beyond it (*Trichomanes*), and the third characterized by its cup-shaped indusium with projecting receptacle and undivided leaves, many cells thick (*Cardiomanes*).

The 19 species of *Hymenophyllum* range from the comparatively large *H. dilatatum* with leaves up to two feet in length, to the minute *H. Cheesemanii*, usually less than an inch in height. *H. dilatatum* is common in damp forests on tree-trunks and fallen logs. *H. scabrum* is another fairly large species with dark green leaves and jointed reddish-brown hairs on the leaf-stalks. Perhaps the most abundant species is *H. demissum*, which often forms a sward on the ground and extends equally thickly up tree and tree-fern trunks. *H. pulcherrimum* is a singularly beautiful fern which grows in clusters on tree trunks. *H. australe*, with its crisply-winged leaf-stalks, is also an attractive species. *H. sanguinolentum* and *H. multifidum* often grow in rather dry situations and then, in fine weather, their leaves curl tightly up, and so minimise loss of water. *H. rarum* and *H. flabellatum* form sheets on overhanging tree-trunks, and so also does the small cosmopolitan species *H. Tunbridgensis*. Two species with brown leaves covered with stellate hairs, *H. ferrugineum* and *H. Malingii*, form mats on tree-trunks and, in the case of *H. ferrugineum*, on moist banks as well.

The species of *Trichomanes* may be divided into two groups. In the first group are two upright, tufted species, *T. strictum* and *T. elongatum*. The latter species has dark-green leaves, often with moss growing on them. The second group includes three small

species—*T. Lyallii*, with scattered stellate hairs, *T. Endlicherianum* (*T. humile*), and *T. Colensoi*. In *Cardiomanes* is placed the kidney fern or kopakopa, *C. reniforme*, with kidney-shaped, undivided leaves with the sori set in a row along the edge. It often contributes largely to the covering of tree-fern trunks.

Family Loxsomaceae.

This family contains only *Loxsuma Cunninghamii*, from New Zealand and *Loxsomopsis*, with three species in tropical America. *Loxsuma* is a striking fern, two to four feet in height, with the undersurface of the leaves glaucous-white. The indusium is cup-shaped, resembling that of the filmy ferns, and the receptacle projects beyond the rim, but the sporangium has the ring more oblique, while the texture of the leaf is like that of ordinary ferns. *Loxsuma* is found from Te Aroha northwards, but is common in a few localities only.



Fig. 9. Dicksonioid Tree Ferns.
(a) Portion of leaflet of *Dicksonia squarrosa*. (b) Sporangium.

Family Dicksoniaceae—Dicksonioid Tree Ferns.

The species of tree ferns in New Zealand fall into two families of which the present one contains those with two-valved indusia on the margins of the leaves. The three New Zealand species all belong to the genus *Dicksonia*. Two of them have erect trunks up to 20 feet in height, but in the third, *D. lanata*, the trunk is slender and generally creeps along the ground, though in the north of Auckland it forms an erect stem a few feet in height. The wheki, *D. squarrosa*, is extremely abundant throughout New Zealand and in Stewart Island and the Chathams. It can be recognized by its rather slender blackish trunk covered with the bases of fallen leaves. The leaf stalks are quite rough with small tubercles. The sori are borne copiously and sometimes appear to cover the whole undersurface of the leaves. The stem lasts well in the ground and consequently was used by the Maoris for huts and fences. The wheki-ponga, *D. fibrosa*, is a beautiful species with a stout brown trunk. The crown consists of a large number of leaves below which hang many dead ones. The leaf stalks are smooth, and have their bases densely covered with reddish-brown scales, while soft brown hairs clothe both stalks and mid-ribs. *D. fibrosa* is common in forests but does not occur further north than Tauranga.

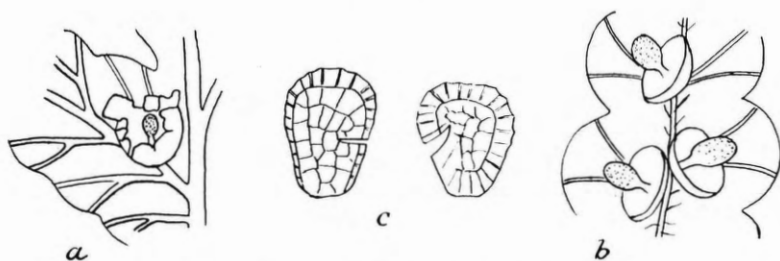


Fig. 10. Cyathoid Tree Ferns.

(a) Portion of leaflet of *Cyathea medullaris*. (b) Portion of leaflet of *Hemitelia Smithii*. (c) Sporangia of *Cyathea medullaris*.

Family Cyatheaceae.—Cyathoid Tree ferns.

The tree ferns of this family are of distinct interest as they occupy a prominent position among the arboresecent vegetation. The smaller kinds, as with the Dicksoniaceae, are found in the lower tier of the forest, but the tall mamaku rears its head to a level with the main forest canopy. The sori are on the under surface of the leaves within the margin and the ring of the sporangium is complete and oblique. The three groups into which New Zealand Cyathoid tree-ferns fall are not difficult to distinguish if fertile leaves can be examined. The distinctive feature is the indusium or covering to the sori. It may be a complete sphere (*Cyathea*), the basal half only (*Hemitelia*), or quite absent (*Alsophila*).

Two well-known tree-ferns are included in the genus *Cyathea*. The mamaku or black tree fern (*C. medullaris*) is a magnificent species and the largest of the New Zealand kinds of tree-ferns. Tall examples may reach a height of over 50 feet. The trunk is black and marked with large scars of fallen leaves. The bases of the leaves are swollen and black. These characters serve to distinguish the mamaku from other kinds. It could be confused only with *C. Cunninghamii*, a rather rare species, separated from *C. medullaris* by its smaller size, paler colour, and smoother leaf stalks, with woolly tomentum on the upper surface. The pith of the trunk and lower part of the stalks of the leaves of the mamaku was formerly used by the Maoris for food. The silver tree-fern or ponga (*C. dealbata*) is very different in appearance from the mamaku. It is much smaller, with small crowded leaf bases on the trunk. The leaves are numerous and are green above and silvery white below. The leaves of very young plants are green on both surfaces. The ponga is exceedingly abundant throughout New Zealand, in some forests forming a large part of the undergrowth.

Two other species of *Cyathea* are found on Sunday Island, in the Kermadec Group, one, *C. Kermadecensis*, being an immense species comparable with the mamaku. The other species, *C. Milnei*, is smaller and more of the habit of the ponga.

Hemitelia Smithii has rather delicate leaves. The young ones are clothed with deciduous brown scales. This tree-fern extends

much further south than any of the other New Zealand species, being found in the Auckland Islands, in 50° 40' S. lat., this probably being the southern limit of tree ferns. *Alsophila Colensoi* differs from the other tree ferns in that the trunk is never erect but lies along or just under the surface of the ground, taking root here and there. This is a mountain species reaching its northern limit on Mount Egmont and Hikurangi. In the north of Otago and in Stewart Island it comes down to low altitudes.

Family Polypodiaceae.

The majority of living ferns belong to this family. Their habit of growth is very varied, while the characters of the sori and indusia are equally diverse. The indusium is a useful character for defining the generic groups. The constant feature of the family is the sporangium, which is girt by an incomplete vertical ring. When the spores are ripe the ring bursts about midway up on side. The longer portion then suddenly bends backwards, throwing out the spores. The New Zealand members of the Polypodiaceae fall into eight groups.



Fig. 11. *Hypolepis rugosula*.

Dennstaedtioid Ferns.

In this group the sori are marginal. *Leptolepia* has the indusium attached at the base to a vein, while its margin is free and irregularly-lobed. *Hypolepis* has no inner margin to the indusium, but the outer one is curved under the edge of the leaf, thus protecting the sporangia. *Leptolepia* includes only one species (*L. novaezealandiae*) and is confined to New Zealand. It is a beautiful species with very finely-divided leaves. *Hypolepis* comprises five species in New Zealand and several others in tropical and South Temperate regions. They are ferns with much-divided leaves arising from creeping stems. The commonest kind is *H. rugosula* (very similar to *H. punctata* and *H. tenuifolia*) in which the indusium varies from covering the sorus, at least in the young stage, to being absent altogether. This species is widely distributed both within and without New Zealand. *H. millifolium* has the pinnules more finely-divided and deeply-cut than *H. rugosula*, while *H. distens* has the pinnae widely spaced and is much less hairy than *H. rugosula*.

Fig 12. *Lindsaya cuneata*.

Davallioid Ferns.

Four New Zealand genera of ferns are placed in this group. The position of the sorus is variable. In *Davallia* it is on the margin of the leaf and the indusium is cup-shaped, the lower side being fused to the leaf. *D. Tasmani* is the only species in the New Zealand region and is confined to the Three Kings Islands where it appears to have been cleared off the main island by goats. *Nephrolepis* has pinnate leaves with the sori either marginal or superficial. The indusium forms a pocket attached by a broad base. The cuckoo's tail fern, *N. cordifolia*, grows in dense clusters of narrow, upright leaves. It is a tropical species and in New Zealand is found only in ground heated by warm water. It is quite common on the steaming cliffs at Lake Rotomahana. *N. cordifolia* is common in cultivation as an indoor fern. The larger *N. exaltata* is in the New Zealand region found only in the Kermadec Islands. *Arthropteris* has pinnate leaves but much fewer pinnae than in *Nephrolepis*. The New Zealand species, *A. tenella*, has a long, wiry stem which climbs over rocks and up tree-trunks. The sori are near the margin of the leaves and there is no indusium. In *Lindsaya* the indusia, which are marginal and two-valved, are fused so as to form a continuous line, opening outwards. In *L. linearis*, which grows on clay hills and in swampy places, the leaves are narrow and pinnate. In the other two species the leaves are divided into wedge-shaped or obovate segments with rounded tips. *L. cuneata* is common, but the more delicate and finely-divided *L. viridis* is more local and prefers places near dripping water.

Pteroid ferns.

The ferns of this group are much like one another in general appearance, all the members being obviously related to the commonest species, namely, the ubiquitous bracken fern. The rhizome or underground stem is usually creeping and the leaves have erect, woody stalks bearing much-divided blades. The sori are continuous along the leaf margin and have upper and usually lower indusia. The southern bracken fern (*Pteridium esculentum*) differs from its relative in the northern hemisphere (*P. aquilinum*) in the thick and narrow leaf segments. It is remarkable in being one of the most successful of living plants. It seems to be able to hold its own against most plants of its own size. The root of the bracken fern was an important article of food for the Maori. The best kinds, for different varieties were recognized, were dug at the proper season,

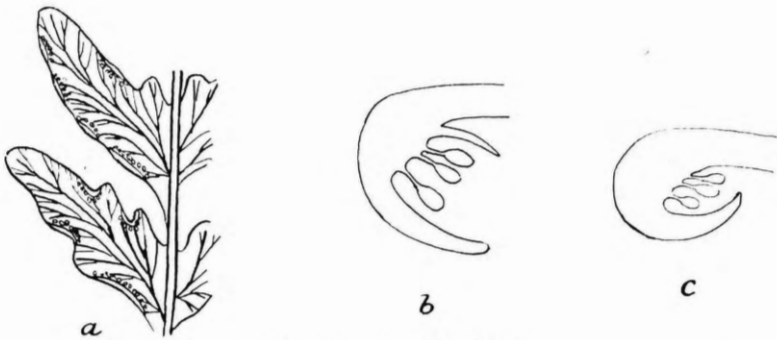


Fig. 13. Pteroid Ferns.
 (a) Portion of leaf of *Histiopteris incisae*. (b) Sorus of *Pteridium*. (c) Sorus of *Pteris*.

while burning-off was also done at the proper time. The root was dried, soaked, roasted, and crushed with a wooden club. A close relation of the bracken is the silver bracken (*Paesia scaberula*), one of the worst weeds of the native flora. Like the common bracken, its creeping rhizomes enable it quickly to take possession of ground which the farmer desires to be occupied by grass. The silver bracken fern is, however, a pretty little species, smaller than the common bracken and of a more yellowish-green colour. As in *Pteridium* there is a lower as well as an upper indusium and the veins are not netted, but they are quite obscure. A large species of bracken with delicate leaves is *Histiopteris incisae*. The leaf segments are wide and have netted veins. This plant grows in swamps and damp places, and is especially abundant near hot springs. The three species of *Ptaris* found in New Zealand are common enough in the forest undergrowth. Like *Histiopteris* they have netted veins and no lower indusium. *P. comans*, with broad leaf segments, is not found south of the Bay of Plenty, while *P. macilentia* and *P. tremula* occur as far south as Nelson and Marlborough.

Gymnogrammoid Ferns.

This is rather a heterogeneous assemblage of ferns that have the sori on the lower surface of the leaves. They are placed quite near the margin, however, and are covered by the reflexed edge of the leaf so that they appear to be marginal, and, in fact, when continuous, look much like the sori in the Pteroid ferns. The principal genus is *Adiantum*, the well-known maiden-hair ferns, of which there are six species in New Zealand. One, *A. aethiopicum*, belongs to the group having delicate pale-green leaflets with even-sided bases. Most of the cultivated kinds of *Adiantum* belong to this group. *A. aethiopicum* is found in nearly all warm countries. In New Zealand it does not occur south of Taranaki and Hawke's Bay. In the remaining species the leaflet stalks are attached to one corner of an oblong blade. The commonest kind is *A. affine*, with black leaf stalks. Closely related but of much larger size is *A. formosum*. This

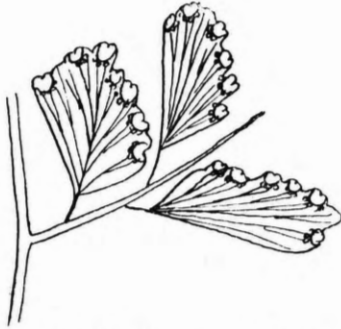


Fig. 14. Maiden Hair Fern (*Adiantum affine*).

is known only from near the Northern Wairoa and lower Manawatu Rivers. Another near ally of *A. affine* is *A. fulvum*. It is more branched and has longer leaflets. *A. hispidulum* is distinguished by its regularly bifurcating branches. The smallest New Zealand species is *A. diaphanum*. As its name implies, it is a delicate species. The leaves branch little, in fact, they are frequently simply pinnate. This fern affects damp, shady situations.

There are two species of *Pallaea* in New Zealand, very closely allied. They have long, narrow, pinnate leaves with orbicular or oblong segments. *P. rotundifolia* is found throughout New Zealand but *P. falcata* has not been recorded south of Nelson. Growing usually in open dry places are three species of ferns with narrow, upright leaves, generally under a foot tall. Though the leaves are finely-divided they do not spread, and hence the habit is strict and compact. *Notholaena distans* is densely-sealy beneath. This character enables it to be distinguished from the species of *Cheilanthes*, of similar habit. Placed with the *Gymnogrammoid* ferns is the small, rare, annual species *Anogramma leptophylla*.

Dryopteroid Ferns.

In this group the sori are separate and placed on the lower surface of the leaf. The indusium is a small, circular or kidney-shaped disc, with a central stalk round the base of which cluster the sporangia. But in *Cystopteris* the indusium is attached by a broad base and bends over the sorus. In many species in the Dryopteroid ferns the indusium is absent altogether.

There are five or six species of *Polystichum* in New Zealand. They have compound, rather hard leaves, and the sori are circular and protected by disc-like indusia. *P. vestitum*, recognized by its sealy leaf-stalks, is the most abundant species. In beech forests it sometimes forms the chief undergrowth. *P. cystostegia* is a small alpine species which dies down in the winter. Its delicate pale-green leaves spring up in dense clusters sometimes close beside the snow-drifts on the mountain sides. *P. hispidum*, as its name implies, has the leaf-stalks covered with linear hispid bristles. *P. adianti-*

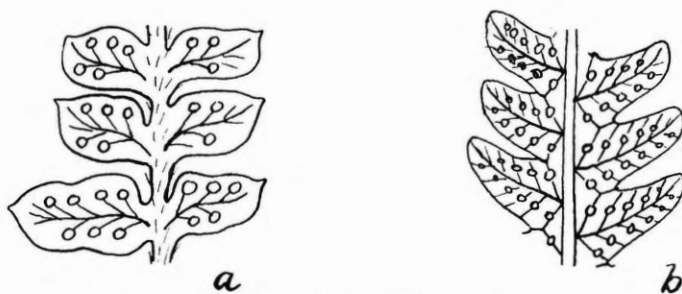


Fig 15. Dryopteroid Ferns.
 (a) *Polystichum Richardi*. (b) *Dryopteris pennigera*.

forme is quite a handsome species with a climbing stem. A common species especially in coastal forests is *P. Richardi*. It has rigid leaves with sharply-toothed segments. *Dryopteris* includes a rather heterogeneous assemblage and hence it is difficult to define. The indusium is kidney-shaped or absent. Of those species with oblong, pinnate leaves, *D. pennigera* is the largest and most common. It may even have a trunk one or two feet in height and the leaves reach a length of five feet. Two smaller species, *D. parasitica* and *D. gongyloides* are essentially tropical species and in New Zealand are found chiefly in the vicinity of thermal springs. *D. Thelypteris* is somewhat similar in form, but this is a widely-distributed temperate species, in New Zealand being found in swamps in the North Island. The other New Zealand species of *Dryopteris*, *D. decomposita*, *D. glabella* and *D. velutina*, have deltoid, much-divided leaves. *Cystopteris fragilis*, as the same implies, has semi-membraneous leaves which are pale-green in colour. It is found in mountain districts, chiefly in the South Island.

Asplenioid Ferns.

In this group, which centres round the well-known spleenworts, the sori are separate and placed near the veins. One edge of the indusium is attached to the vein, the other edge being free. In the small and rare *Pleurosorus rutaefolia* there is no indusium at all. In the typical genus *Asplenium* the indusia are linear and open towards the midrib. There are twelve species of this genus in New Zealand. Most common is *A. bulbiferum*, a favourite fern in cultivation and easily recognized by its finely-divided leaves which produce bulbils on the upper surface. These grow into young plants while still attached. An allied species, very common as an epiphyte, but also found on the ground, is *A. flaccidum*. When the leaves are pendant they are long with distant narrow segments; when upright they are much shorter, with short segments, and in dry situations and on coastal cliffs are more or less fleshy. *A. Hookerianum* has much-divided leaves with short leaflets; its variety *Colensoi* has smaller and more deeply-divided leaflets. A very handsome species with long, pendant, pinnate leaves with lanceolate acuminate leaflets is *A. adiantoides*. In the forest it commonly grows in the epiphytic

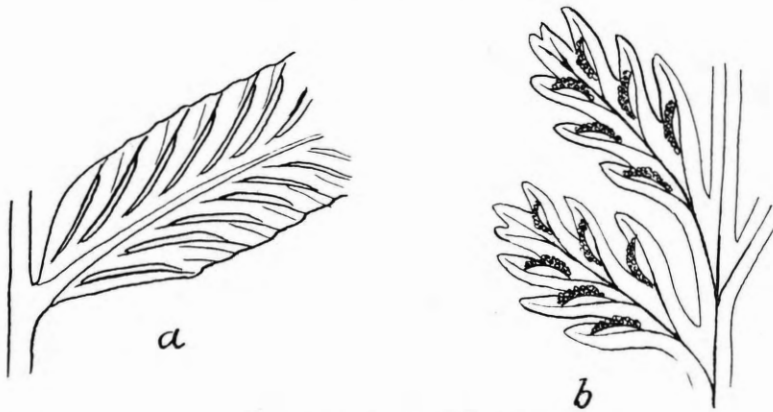


Fig. 16. Asplenoid Ferns.
 (a) *Asplenium lucidum*. (b) *A. bulbiferum*.

clusters of *Astelia*. Other pinnate species with more oblong leaflets are the common *A. lucidum* and the maritime *A. obtusatum*. The leaflets of these two species are so similar that it is sometimes difficult to separate them. Mention may be made of two species of *Asplenium* with narrow, pinnate leaves. One is the widely-dispersed *A. Trichomanes* found in most parts of the world, the other is the rat-tail fern, *A. flabellifolium*, with trailing leaves ending in a naked midrib which takes root at its apex. In the allied genus *Diplazium*, with one species, *D. japonicum*, found in a few localities in the North Island, the indusia on the lower pinnac are in pairs opening in opposite directions. *Athyrium umbrosum* is likewise not common in New Zealand. Its indusia are swollen and have jagged edges. Sometimes two are placed back to back as in *Diplazium*.

Blechnoid ferns.

In ferns belonging to this group the sori are usually fused into a linear series on either side of the midrib and parallel to it. This is the case in the large genus *Blechnum*. In the other genus of this group occurring in New Zealand, *Doodia*, the sori are separate, and may be in two rows each side of the midrib. In all cases, as in the Asplenoid ferns, the indusia open towards the midrib. All the New Zealand species of *Blechnum* belong to the section *Lomaria* in which the fertile leaf segments are much narrower than the sterile ones; there is in fact no leaf expansion beyond the indusia. All the species are pinnate with simple leaflets, except *B. Fraseri*, which is bipinnate, and *B. Patersoni* which is better described as deeply-divided. One of the most widely-distributed ferns in New Zealand is the korokio, *B. procerum*, which is especially luxuriant along the banks of streams. Here its leaves may be ten feet or more in length. This fern was used by the Maoris to cover their hangis or cooking-pits. Characteristic of damp forests is the piupiu, *B. discolor*, which has stout, erect trunks up to a foot tall, surmounted by a crown of leaves. In shady valleys in forests is the dark-leaved *B. Patersoni*, a low fern with broad, deeply-divided leaves. Several other species

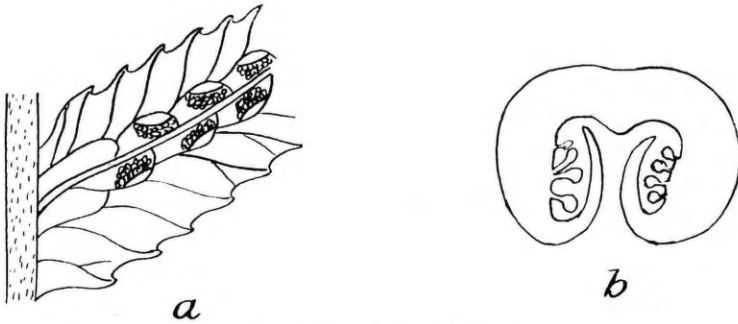


Fig. 17. Blechnoid Ferns.
 (a) *Doodia media*. (b) Cross section of indusia of Section *Lomaria* of *Blechnum*.

are common in the forest. *B. lanceolatum*, often drapes the banks of streams with its lanceolate pendant leaves. *B. filiforme* is a climbing fern that bears small sterile leaves on the lower parts of its stems, which often creep over the ground, and much larger fertile and sterile ones on the upper parts. *B. Fraseri* forms little colonies in the forest. Its leaves are bipinnate and are borne at the top of a very slender trunk, two or three feet in height. *B. pennamarina* has very narrow erect leaves. It is often found in mountain bogs. *B. durum* is a sea-shore species, most common in Otago and the islands further south. The species of *Doodia* are recognized by their harsh leaves with separate sori sometimes in two rows. They are most common in the north of the North Island.

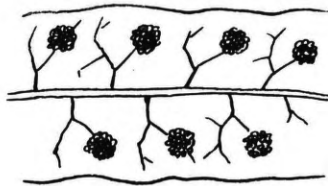


Fig. 18. *Polypodium diversifolium*.

Polypodioid Ferns.

The New Zealand members of this group may be recognized by the numerous rounded or oval sori scattered over the lower surface of the leaf without any trace of indusia. The common polypody of New Zealand is *Polypodium diversifolium*. Its stout green stems creep over ground, logs and rocks, or they climb tree-trunks and branches. The leaves are sometimes simple but more commonly are deeply and regularly divided. A rarer kind with larger leaves and creeping stems densely covered with brown scales is *P. novae zealandiae*. *P. pustulatum* is a creeping species with slender stems and thin, narrow leaves. The other species of *Polypodium* are small

with the leaves clustered. They are found on tree-trunks or on the ground. *P. dictyopteris* has simple, lanceolate leaves with netted veins; *P. australe* has very small and narrow simple leaves and *P. grammitidis* is recognized by its lanceolate, deeply-divided leaves. In the two last species the veins are free. The common creeping fern of dry situations such as rocks, exposed ground, and trunks and branches of trees is *Cyclophorus serpens*. It may be recognized by its slender stems covered with scales and its spatulate, erect leaves, the undersurfaces of which are densely clothed with stellate hairs. The undersurface of the fertile leaves, or at least the terminal portion, often appears to be continuously covered by the naked sori.

Water Ferns.

Besides the ferns thus briefly described above there are two families of water ferns with representatives in New Zealand. They are not at all fern-like in appearance, but their method of reproduction indicates that they belong to the same class as the ordinary ferns. It is a case of profound alterations taking place in response to an aquatic environment. To the family *Salviniaceae* belongs the floating fern *Azolla rubra*. In this the leaves are minute and densely imbricating. This plant forms a continuous reddish or green film on the surface of the water. Sometimes small lakes are completely covered. The family *Marsileaceae* is represented in New Zealand only by the rare *Pilularia novae-zealandiae*. This is a small plant with filiform leaves less than two inches in length arising from a creeping stem.

QUARTERLY ISSUE OF JOURNAL.

Conference 1934 Remit No. 6 was as follows:

“That Conference approves of the Executive Council giving favourable consideration to the question of reverting to quarterly publication of Journal.” (Executive).

This was carried by Conference with a recommendation for quarterly publication if finances permit. The Executive Council decided that the Publications and Finances Committees should consider this matter, but action had to be postponed pending a balance of the accounts for the year ended 31st March last.

A meeting was held in Mr. Campbell's office on Tuesday, 7th May when the following were present:—Mr. Pope (Chair), Dr. Oliver, Mr. Hyde and the Secretary.

The Secretary submitted an Income and Expenditure Account and Balance Sheet for the year ended 31/3/35 and compared it with the previous year.

After some discussion on the accounts, the following resolution was carried unanimously on the motion of Dr. Oliver:

“That it be a recommendation to the Executive Council that the Journal be issued quarterly, at a yearly cost not exceeding £60, and that this recommendation is made, notwithstanding that the accumulated funds may be touched upon to some extent by this proposed arrangement.”

The Executive Council, at its meeting on the 23rd May, adopted this recommendation, and the current issue is the first one under the new arrangement. It is trusted that members will appreciate the reversion to quarterly publication and will make it known to prospective members.

REVIEW.

GARDEN PESTS IN NEW ZEALAND.

A Popular Manual for Practical Gardeners, Farmers and
Schools.

By

DR. D. MILLER, Ph.D., M.Sc., F.R.S.N.Z., F.R.E.S.

This popular book of 84 pages deals with insects and other common garden pests, and constitutes a useful compendium of practical information compiled from personal observation and from some very scattered literature. The long experience of the author in connection with entomological problems generally in New Zealand is well known, and the information in this manual fulfils admirably the purpose for which it was written. It begins with a review of the animal kingdom and the conditions in New Zealand prior to the

advent of the white man, and the big changes brought about through an altered environment consequent on agricultural development. The information dealing with insect structures and life-histories, is very well suited for helping the beginner to understand some important facts necessary to an orderly knowledge of the subject. Chapters 5 to 7 inclusive, deal with all of the most important insect pests met with by the horticulturists in New Zealand. The idea of dealing with the insects under the heading "Sucking insects," "Leaf feeding insects," and "Boring and underground insects" is a useful method of classification from the control point of view.

The concluding chapters deal with miscellaneous pests such as mites, slugs, etc., and the principles of pest control.

In conclusion, the index which refers to each pest under its technical name, common name and host plant, will be found most useful to all users of the book.

J. MUGGERIDGE.

NOTE:—The publication reviewed above was originally compiled by the author, at the request of the Institute, for the use of students preparing for the Institute's Examinations.

PLANT REGISTRATION.

LEE'S RED COX ORANGE PIPPIN APPLE, RAISED BY MR. GEORGE LEE,
TEMPLETON, CANTERBURY.

Raiser's Description:—"The Red Cox is an improved fruit and so far keeps better and no bitter pit has shown on the apples."

In a covering letter the raiser states:—"The Red Cox Orange ripens fully as early as the ordinary Cox or perhaps a little earlier."

"OMEGA" PLUM, RAISED BY MRS. ALMA TERRILL, "THE CAVES,"

RAPPAHANNOCK, R. M. MURCHISON.

Raiser's Description:—Stem very thin and tapering. Leaves about 2½ inches in length. Flowers November (mid-season) and holds fruit till middle of June. Fruit can be picked from end of March, a slow ripener. Fruit borne in clusters. Spreading habit. Strong grower. Height 15ft. Hardy constitution. Grown over 1500 ft. above sea-level. Colour yellow, ripening to a mottled red—flesh yellow—and equally good preserve or dessert.

EXAMINATION PAPERS, NOVEMBER, 1934.

JUNIOR EXAMINATION (Syllabus No. 1.)

HORTICULTURAL BOTANY.

(Time allowed—Three Hours).

Note.—*Six only* of the following questions are to be answered—including No. 8, which is compulsory.

1. Describe the form and structure of the chief types of stems of flowering plants.
2. Describe the process of respiration in plants, and its function.
3. Describe the way in which leaves manufacture starch and sugar. Where are the raw materials derived from?
4. How are ferns, conifers, monocotyledons and dictotyledons distinguished from one another?
5. Give an account of any two of the families Cruciferae, Rosaceae, Solanaceae, Labiatae, referring to genera of horticultural value.
6. How are the following genera recognised: Geranium, Myrtus, Antirrhinum, Campanula, Bellis.
7. What is the purpose of partial sterilization of soil? How is it carried out.
8. Describe in technical language the botanical specimen supplied by the supervisor. (Single Anemone.)

JUNIOR EXAMINATION (Syllabus No. 1.)

PRINCIPLES OF PLANT PROTECTION.

(Time allowed—Three Hours).

Note.—*Six only* of the following questions are to be answered—
Use diagrams freely.

1. Describe the morphology and life-history of any aphid of horticultural importance.
2. Describe the morphology and life-history of any mould, or of an agaric.
3. Discuss the methods of preparation, strengths used for different purposes, and times of application of bordeaux mixture or lead arsenate.
4. What are the purposes for which the following sprays are used: Nicotine; oil; and sulphur?
At what times are they applied?
5. Give an account of glasshouse sterilization and fumigation.
6. What part of plants are given the "hot-water" treatment, and how is it applied?
7. What is meant by plant hygiene? Give illustrations of its practice in horticulture.
8. How is disease control in glasshouses affected by temperature, humidity and soil moisture?

INTERMEDIATE EXAMINATION (Syllabus No. 2.)
PRINCIPLES OF HORTICULTURE.

(Time allowed—Three Hours).

Note.—*Six only* of the following questions are to be answered—

1. What are the advantages of pipe-draining a clay soil? What special precautions are necessary? How would you proceed with the work?
2. Under a system of intensive cropping on considerable areas of moderately light land it is difficult to maintain the necessary supply of humus in the soil. How would you deal with this problem?
3. What are the methods and purposes of summer pruning? Describe any particular hedge with which you are acquainted and your pruning treatment for its development and maintenance so as to obtain the best results over a long period.
4. What are the necessary soil conditions before sowing down a lawn? When and how may it be done successfully in your district? What kind or kinds and what quantity or quantities of seeds would you use?
5. How would you maintain high strain and vitality in the production of seeds of annual plants? Describe your method of dealing with any particular kind.
6. What measures would you use to prevent grass-grub damaging a lawn? How should a lawn be treated after damage has taken place?
7. Describe a plant association of fruit, ornamental and shelter trees quite suitable for, and taking full advantage of, the soil and climate in any particular locality with which you are acquainted. Briefly describe a suitable arrangement.
8. What are the respective merits of the different kinds of phosphatic manures?

INTERMEDIATE EXAMINATION (Syllabus No. 2.)
PRACTICE OF HORTICULTURE.

(Time allowed—Three Hours including Special Subject.)

Note.—*Three only* of the following questions are to be answered, also *three only* of the questions in the Special Subject nominated.

1. How may a lawn be kept free from weeds and in vigorous condition in your district?
2. What ornamental shrubs require pruning? When and how should it be done?
3. Write an essay on the pot culture of one of the following crops—Cyclamen; Cineraria; Begonia; Calceolaria.
4. Describe a suitable method of lifting, reconditioning and re-planting a herbaceous border.
5. Write an essay on the importation and acclimatisation of narcissus bulbs.
6. What class of land would you select for an apple orchard, for an asparagus plantation, and for a celery crop respectively? How should the land in each case be broken in and prepared?

INTERMEDIATE EXAMINATION (Syllabus No. 2.)

SPECIAL SUBJECT: GLASSHOUSE MANAGEMENT.

(Time allowed—Three Hours including Practice of Horticulture.)

Note.—*Three only* of the following questions are to be answered, also *three only* from the paper on "Practice of Horticulture."

1. Describe your method of propagating hardy shrubby *Calceolarias* (*C. amplexicaulis*) and subsequent treatment till planting time.
2. Choose three distinct types of orchids and describe your cultural methods with respect to potting: potting medium: time of flowering and resting period.
3. It is desired to grow a batch of *Hydrangeas* in pots. How would you proceed from cuttings to flowering stage?
4. Give three methods of fern propagation: naming the ferns to which each method is applicable.
5. What is your ideal of a propagating house? Explain your meaning by diagrams.
6. How may *Carnations* be flowered during the winter months? Give time of cutting, insertion, pinching back and potting on.

INSTITUTE NOTES.

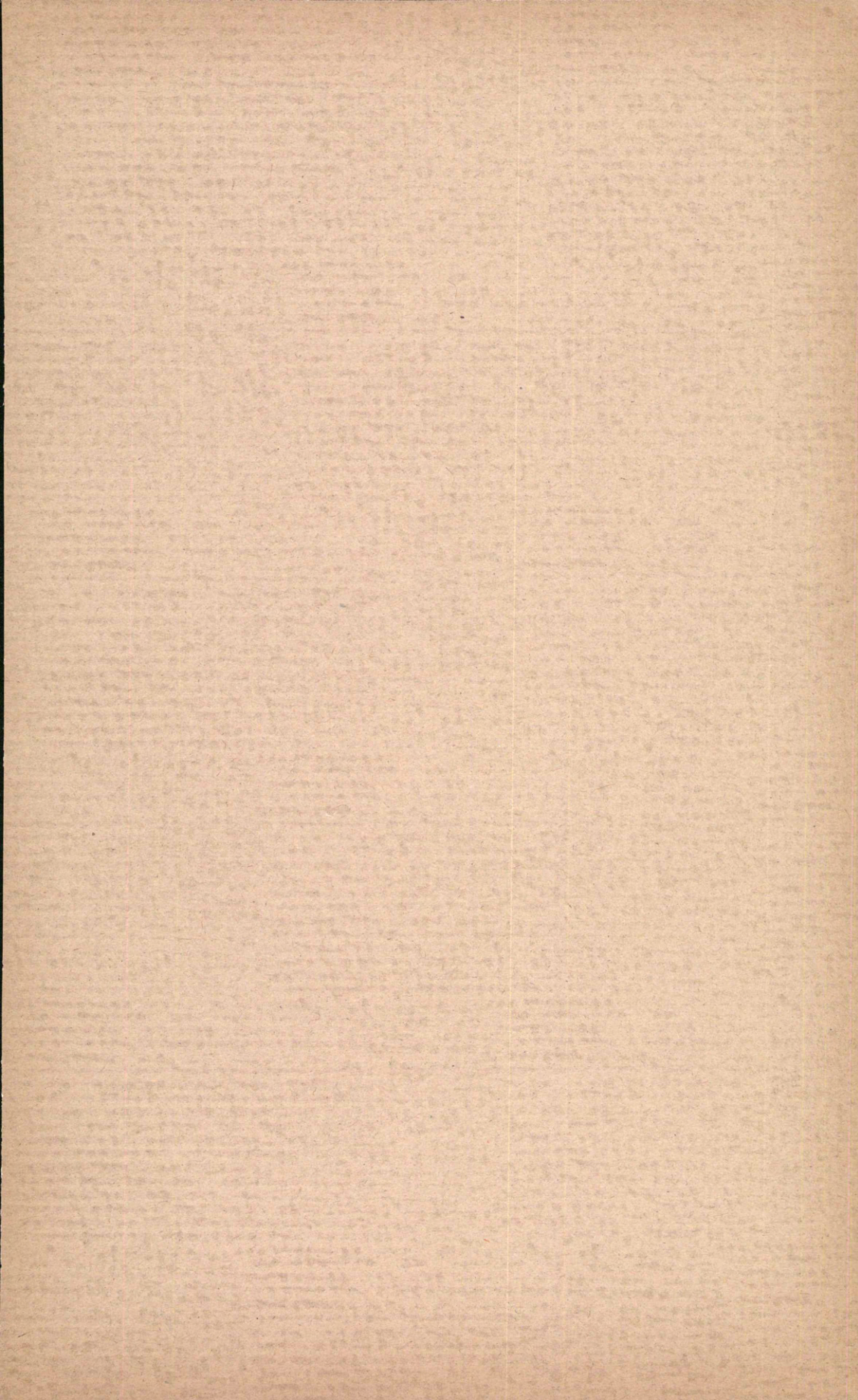
Vice-Regal.—The Institute highly appreciates the acceptance of its Patronship by their Excellencies, Viscount Galway and Lady Galway. Lord and Lady Bledisloe, its former Patron and Patroness, will be greatly missed both personally and horticulturally.

National Conference and Flower Show.—The Permanent Committee appointed at the 1935 National Conference to make arrangements for Horticultural Week 1936 has agreed to the holding of this, under special circumstances, in the last week in February, 1936, at Auckland, but the programme has not yet been finalised.

Educational:—1934 Examinations.—The following passes were recorded:—Junior Certificate: Messrs E. W. Campbell, J. T. Drummond, G. A. R. Petrie, H. P. Thomas (Invercargil), F. J. Melhuish (Palmerston North), R. A. Reece (Christchurch). Intermediate Certificate: Miss C. G. Williams (Dunedin), Messrs R. W. Baleh (Christchurch) and F. J. Melhuish (Palmerston North).

Victorian Horticultural Council.—Information regarding the Institute has been forwarded in connection with the proposed formation of a Victorian Centenary Horticultural Council.

Seedsman's and Florists' Certificate.—Schemes of training and examination for these certificates are now available.



NEW ZEALAND INSTITUTE OF HORTICULTURE

(INCORPORATED.)

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