Geographical Relationships of New Zealand Fern Flora

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THEORETICAL DISCUSSIONS on the relationships of the New Zealand flora have been confined mainly to the classical works of Hooker (1853), Oliver (1925), and Skottsberg (1915), and in these little reference was made to the nonflowering plants. Cockayne (1928) included fern species in his various lists of elements and associations, but did not deal with the fern flora as a unit. Cheeseman (1925) and the revised edition of Dobbie (1951) listed distributions outside New Zealand for the individual fern species.

When looking at fern relationships the admittedly ancient groups, the Eusporangiatae, Osmundaceae, Schizaeaceae, and Gleicheniaceae, are of little use, partly because of their widespread distributions and partly because of their long geological history. In addition to this it is now felt that the existing genera in these groups represent isolated remnants of successive fern floras each as diverse as the modern fern groups. In other words, the units we look on as genera may be as distinct from one another as the various families or subsections of what has been known as the Polypodiaceae *sens. lat.*

Even within those groups of ferns which seem to have developed most recently, the genus is an unsuitable unit to use in relationship patterns because few fern genera are of restricted distribution. An extreme example of this is shown by the genus *Asplenium* which, although apparently still undergoing specific evolution almost everywhere, is cosmopolitan. It is best then to study distribution patterns of species or of obviously closely related groups of species.

In analysing the New Zealand ferns it is necessary only to consider the nearest land areas—Australia, the islands to the north, and to a lesser extent the subantarctic part of South America. In the single example of extremely discontinuous distribution, that of the local variety of *Thelypteris palustris* Schott., which is said to occur elsewhere only in parts of tropical Africa, the accuracy of the identification is immediately open to doubt. It is a fact that the genus *Thelypteris* is very much in need of revision in the whole Pacific area.

The revised edition of Dobbie admits 153 species of ferns, but for the purposes of this paper I have reduced the number to 143 by omitting the ones confined to the Kermadecs and also a few species of doubtful occurrence in New Zealand. When compared with neighbouring areas we find the following distributions:

	SPECIES
Found in New Zealand, Australia, and widespread	16
Found in New Zealand, Australia, and one or more of the islands to the north of New Zealand	19
Found in New Zealand, Australia, and South America	6
Found in New Zealand, Australia, and widely distributed around the subantarctic	2
Found in New Zealand and Australia only	32
Total species in common between New Zealand and Australia	75
Found in New Zealand and one or more of the islands to the north	9
Found in New Zealand and SE Polynesia	2
Found in New Zealand and subantarctic South America	3
Found in New Zealand and tropical Africa	1
Endemic in the main islands	53

It will be seen from these figures that somewhat more than 50% of the species of ferns

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found in New Zealand occur also in Australia, particularly in the southeastern region and in Tasmania. In addition to this total a number listed as endemics, such as *Hymenophyllum revolutum* Col. and *Dicksonia fibrosa* Col., are so close to the Australian species *Hymenophyllum cupressiforme* Lab. and *Dicksonia antarctica* Lab. as to be doubtfully distinct. A comparable situation is seen in the fact that of the 67 fern species listed by Wakefield (1957) for Tasmania, 47 are also found in New Zealand. In the light of the prevailing wind direction, it seems probable that a large percentage of the New Zealand fern flora has been distributed by wind from Australia. This parallels the situation already noted in the Orchidaceae. It should be observed, however, that the picture as seen by van Steenis (1934–36) in the temperate mountain floras of Malaya could not be explained by wind dispersal, even in the case of plant groups with minute diaspores.

The bulk of the ferns common to the two regions appears to be derived from the Malaysian area. In the South Pacific the general picture is a gradual decrease in fern species from New Guinea southwards and eastwards, but the whole forming a closely related assemblage.

When looking at New Zealand as a possible source of distribution, the only close association to the east is with the Kermadecs and the Chathams. In the former, 24 of the 31 species are identical with those on the main islands, while all the species of the Chathams are found in New Zealand. However, a small element in the fern flora of SE Polynesia (Rapa and the Australs) may be derived from this country. Examples are *Asplenium obtusatus* Forst., *Trichomanes endlicherianum* Pr., and a fern identical with or very much similar to *Polystichum richardi* (Hk.) J. Sm.

Although only two species are confined to New Zealand and South America (*Hymenophyllum ferrugineum* Colla and *Grammitis crassa* Fee), there appears to be an element in the flora with a wider distribution around the Antarctic. This includes those species common to New Zealand–Australia and South America, and those found around the subantarctic islands. These appear to be maritime ferns, such as *Asplenium obtusatum,* or those found most abundantly in the southern beech forests—*Polystichum vestitum* (Sw.) Pr. and *Grammitis billardieri* Willd.

There is a small number of ferns found in the northern parts of North Island and otherwise only in the rather unusual ecological situation of warm ground in the thermal area. As all the species in this group, one each of *Dicranopteris* and *Nephrolepis* and two of *Cyclosorus,* are widespread throughout the Pacific islands, it is possible that they may be accidental Polynesian introductions. Also, the two areas where they occur were both centres of Maori settlement. To this group may also belong the local representative of *Marattia,* which had as one variant Maori name *para-tawhiti* (Best, 1942). This can be taken to mean the "*para* from abroad" or, more definitely, the "*para* from Tahiti."

Lovis (1959) agrees with the relationships described above but prefers to lean heavily on the Continental Drift hypothesis to explain them. However, the scale of geological time seems ample to allow for chance dispersal from Australia to New Zealand and to account for the very marked likeness between the ferns of the two regions. The Orchidaceae, which can be dispersed in a similar manner, show an even greater degree of similarity. Taylor (1954) in his study of Macquarie Island believes that long-distance dispersal is the only method by which plants could have recolonised that completely glaciated island, and presumably this applies to a large extent to all the subantarctic islands.

Endemism is most apparent in the Hymenophyllaceae with 17 species, and in the Aspleniaceae, a group which everywhere appears to be undergoing speciation. Most of the older groups, such as *Leptopteris* and *Lygodium,* are represented by endemic species, and *Loxsoma* appears to be a relic of another old group. The heterogeneous older group with marginal sori which was distinguished by Manton (1958) is represented by *Leptolepia novae-zealandiae* and *Sphenomeris viridis.* Of the remaining endemics most are closely related to other local species or to species in neighbouring areas.

From all this it seems that the fern flora of New Zealand shows a much closer relationship with that of southeastern Australia and Tasmania than with that of any other region, and

that endemism is most apparent in those groups which diversified earliest and those which diversified most recently.

SUMMARY

At the specific level slightly more than 50% of the fern flora of New Zealand is found also in SE Australia, suggesting dispersal in the manner postulated for many of the orchids. A small group of species is widespread around the cool parts of the Southern Hemisphere, with extensions into eastern Polynesia. A few species with unique distribution within New Zealand, but widespread in Polynesia, may be Maori introductions.

The greatest degree of endemism is exhibited in the Hymenophyllaceae.

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