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Some Phytogeographical Relationships of the Angiosperm Flora of the British Solomon Islands Protectorate

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Some phytogeographical relationships of the angiosperm flora of the British Solomon Islands Protectorate

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From the information at present available it would appear that the angiosperm flora of the Solomon Islands comprises representatives of about 700 genera, of which perhaps as many as 150 are known or suspected to be adventives of one kind or another, leaving some 550 native genera or 'aboriginal possessors of the soil'. These native genera contain roughly 1750 species, but perhaps as many as 100 of these also are adventive, leaving about 1650 native species, a figure giving almost exactly an average of three species per genus.

A simple analysis of the native genera on the basis of their over-all geographical distributions shows that they fall primarily into three broad categories. About 235 of them are subcosmopolitan or pantropical or palaeotropical in range: and almost as many, 210, are widely Indomalaysian in distribution, ranging from some part of the east Asiatic mainland, through the Malayan Archipelago and into the Australasian tropics: while the remaining hundred or so show various types of more restricted distribution. The first two of these categories constitute what may be thought of as that element of the flora which is to be expected simply from the longitudinal and latitudinal position of the Solomon Islands. The third category, though considerably smaller, is of special significance because it is amongst its genera that indications of the more particular relationships of the flora are to be found.

This third category is more difficult to break down concisely because of the great variety of detail in it, but most of the relevant aspects are covered by saying that its members fall roughly into four groups. The first of these, perhaps numbering some 20 genera, are genera found in the Asiatic and American sectors of the tropics but not in tropical Africa. They include such geographically interesting genera as *Eurya*, *Gunnera*, *Salacia*, *Saurauia*, *Styrax*, *Symplocos* and *Weinmannia* and perhaps *Heliconia*, and all deserve careful attention. The genera of the second group may be described as incompletely Indomalaysian in the sense that their relatively restricted distributions are either largely or wholly westwards from the Solomons. The third group is rather the reverse of the second being composed of genera which may be described as 'Polynesian' in the older and broader sense, New Guinea marking in general their western and northern limits. Lastly there are a few rather special cases, of which *Metrosideros*, *Nastus* and *Soulamea* are examples, and the three monotypic genera so far found only in the Solomons and forming its tiny endemic generic element, *Allowoodsonia*, *Kajeskiella* and *Homalocladium*.

Perhaps the most interesting point in this analysis is that it reveals nothing that can reasonably be called an Australian element in the flora of the Solomons. True, the names of some 10 genera suggest, at first sight, that such an element might exist, but when these genera are more closely examined it is clear that none can be construed as indicating any particular affinity between the flora of the islands and that of Australia. This conclusion merits mention, with some detail, of the genera concerned, which are as follows:

Acacia. A genus very characteristic of certain aspects of the Australian flora but in total ranging widely over the tropics. It is represented in the Solomons by *A. simplicifolia*, a specialized form found elsewhere only in New Caledonia, the New Hebrides, Fiji and the Hawaiian Islands.

Casuarina. Now often considered to consist of two distinct genera, *Casuarina* and *Gymnostoma*. The former is predominantly Australian but includes one wide Indomalaysian species, much planted elsewhere in the tropics. The latter has only one species in Australia and is otherwise Indomalaysian. The wide species of the former and one species of the latter are recorded from the Solomons and both are also in New Guinea. A fossil from South America has been attributed to *Gymnostoma*.

Dianella. A genus of Liliaceae with preponderance of species in Australia, but in total ranging over most of the tropics including the Hawaiian Islands.

Eustrephus and *Geitonoplesium*. Two closely related genera of Philesiaceae each with one polymorphic species only. First described from Australia but now known also from New Guinea, New Caledonia and the Solomons and the latter from the Philippines in addition. It is possible that they are not native in all parts of their ranges.

Gahnia. A genus of the cosmopolitan family Cyperaceae found widely in Indomalaysia and reaching the Hawaiian Islands. It has a preponderance of species in Australia but is represented in the Solomons by one of the more widespread.

Haloragis. This also has species preponderance in Australia but the genus ranges as far east as Rapa and the Juan Fernandez Islands and as far north as Japan. The only species in the Solomons is also in New Guinea.

Pittosporum. A genus widely distributed over the warmer parts of the Old World and the Hawaiian Islands, and with its highest species concentrations in New Caledonia and New Zealand. It is also well represented in Australia and the few other small genera of the family occur only there.

Scaevola. This belongs to a remarkable and characteristic Australian family, Goodeniaceae, and almost all its 100 or so species are found there, but it has also a few which range widely over the tropics as shore plants and its two species in the Solomon Islands are among these.

Schoenus. A genus of Cyperaceae with a wide total range but with a preponderance of species in Australia, though it is also well represented in South Africa and New Zealand. Its single species in the Solomon Islands is also in New Guinea.

The 550 native genera of the Solomons can also be analysed according to their comparative distributions over the various land surfaces more immediately neighbouring those islands. This is more difficult because there are no convenient floral lists for the Bismarck Archipelago, the New Hebrides, Fiji or Tonga, but enough is known of the vegetation of these four to make it clear that their floras are, both in size and constitution, closely akin to that of the Solomon Islands and that they do not possess any much higher degree of richness or peculiarity. As for the rest an analysis reveals at once what, in general terms, is certainly the most striking feature in the flora of the Solomon Islands, namely that it consists almost entirely of genera found also in New Guinea. Out of all the 550 genera there

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it would seem that only nine, all small or very small, have not been recorded also from New Guinea. These nine are, with their approximate distributions:

Calycosia. Allied to *Psychotria* and, except for one species in the Solomons, confined to Fiji.

Clinostigma. A genus of palms which, according to Dr H. E. Moore jnr., is found in the Solomons, New Hebrides, Fiji, Samoa, Micronesia and the Bonin Islands.

Geissois. A genus of Cunoniaceae with most of its species in New Caledonia and Queensland but also in Fiji and Santa Cruz.

Joinvillea. A genus of Flagellariaceae which ranges from Malaysia to the Hawaiian Islands and New Caledonia.

Physokentia. A genus of palms confined, according to Moore, to the Solomons, New Hebrides and Fiji.

Scirpodendron. A monotypic genus of Cyperaceae known from parts of Malaysia, Australia and Polynesia.

And the three endemic genera of the Solomons already mentioned.

Although virtually all the native genera of the Solomons occur also in New Guinea the disparity in size between the two floras is such that no fewer than 75 of the families and 800 of the genera of New Guinea have not been recorded from the Solomon Islands. Naturally most, but by no means all, of these units are small and many of them may well be absent from the Solomons because of the absence of high mountains there but even allowing for this the discrepancy is remarkable and a more detailed study of it would certainly be rewarding in various ways.

As regards other neighbouring regions it would appear that about half of the 550 genera of the Solomons are found also in New Caledonia despite the fact that the latter is only just within the Tropic of Capricorn, and it is noteworthy that of these only *Geissois* and *Joinvillea* are not also in New Guinea.

More than 350 of the genera of the Solomons have been recorded from Australia but here again only two genera, *Geissois* and *Scirpodendron*, are not also in New Guinea. In other words, all the genera which are in the Solomon Islands and Australia occur also *either* in New Guinea *and* New Caledonia, *or* in one or other of these two. It must also be remembered that the representation of these 350 genera within the continent of Australia is often very limited and in many cases confined to northern Queensland.

Finally, taking into account the great difference of latitude between the two it is notable that of the genera in the Solomon Islands almost exactly 10 % (55) are found also in New Zealand, a fact which may well be related to the much higher percentage and number in New Caledonia.

Such is a very brief outline of an analysis of the flora of British Solomon Islands Protectorate and perhaps the first and most far-reaching conclusion to be drawn from it, from the point of view of the phytogeography of the Angiosperms as a whole, is that there is very little particularity in the flora, a state of affairs which expresses itself chiefly in two ways, in the number of species in the flora, and in the degree of its endemism.

As regards the first of these the estimated figure of about 1650 native species compares, among other tropical south Pacific floras, most closely with that for Fiji, and probably with

those for the Bismarck Archipelago and for the New Hebrides, and is likely to be notably larger than those for Tonga and Samoa. There is no convenient modern account of the floras of these last four but as has been said above they are at least sufficiently familiar to make it reasonably certain that they conform in general to the pattern described for the Solomons, and in particular that they do not still conceal any rich and highly endemic elements. Regarding endemism the lack of particularity is, as has been seen, especially clear in the genera, and it is still too early to estimate the number of endemic species accurately, but the average of three species to each genus in the flora would seem to preclude any high degree of specific endemism, and it seems likely that this will prove to be not more than 25 %, a proportion which scarcely calls for any special comment. It seems clear therefore that the flora of the Solomon Islands is not comparable either in richness or in degree of endemism with those of the three regions which have nicely been described as the 'Three Ns', namely New Guinea, New Caledonia and New Zealand. As to the last-named the actual number of species in the flora is, no doubt in correlation with its temperate latitude, no greater than that of the Solomons but the degree of endemism is very much higher, of the order of 75 %.

Another result of the analysis, and perhaps the most obvious, is to show that the flora of the Solomons resembles that of New Guinea to a most remarkable degree. Only a handful of the genera native in the Solomons are not also in New Guinea, but in addition to this there is the circumstance that, of the genera proportionately well-represented in both floras, none has more species in the Solomons than in New Guinea, the nearest approach to such a state apparently being the genus *Freycinetia* with 20-odd species in the Solomons and about 40 in New Guinea. Thus, not only is the flora of the Solomons very decidely a 'New Guinea' flora, but it is a notably attenuated version of the latter.

The nature of this attenuation is of considerable interest. It would be natural to find a great difference in richness between the flora of a large continental-type land area such as New Guinea and a group of comparatively small islands like the Solomons but, other things being equal such discrepancy should be more or less evenly expressed throughout the Angiosperms, as for instance is seen in general among the islands of Malaysia but in the case of the Solomons the disparity is not only very great but it is also uneven, quite a number of large families and genera conspicuous in New Guinea being almost or entirely absent from the Solomons. This, coupled with the low endemism in the Solomons, makes it seem reasonable to believe that the flora of the Solomons is not coeval with that of New Guinea but has been derived from it by processes of dissemination, and a more careful study of these differences between the two floras promises to throw considerable light on the possible sequence of events by which this has been accomplished.

If this is true of the Solomons it would seem likely to be true also of the generally comparable floras of the Bismarck Archipelago, the New Hebrides, Fiji and Tonga, and this in turn leads to the conclusion that there are no floras strictly comparable with those of New Guinea, New Caledonia and New Zealand nearer than those of Japan in a northerly direction and of the Hawaiian Islands to the north-east.

Caution must, however, be exercised in using the words derivation and attenuation. It is something of an axiom that any land surface newly exposed to subaerial conditions will, given the right climatic conditions, in due course come to bear a flora appropriate to its

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geographical position in the world in terms of latitude and longitude. Moreover if a sufficient length of time passes without disruption the flora will tend to develop towards a norm. If this is so then much floristic discrepancy, especially of the kind shown between New Guinea and the Solomon Islands, is to be attributed to factors of time and particularly to a lack of unbroken duration. On this argument it seems logical to suppose that the differences between the floras of the 'Three Ns' and those farther to the east is principally an expression of the fact that the latter land surfaces are geologically younger. That is to say that they have existed as colonizable areas for a briefer period, or to express it differently again, that they have been the scene of speciation for a shorter time. As far as our knowledge goes at present it would indeed appear that this is not only the case in general with the areas mentioned, but also that there is considerable difference of age among the various islands. In other words, the botanical evidence indicates strongly that the Solomon Islands came into being comparatively late in the history of the Angiosperms and much more recently than New Guinea, New Caledonia and New Zealand and, further, that they have received their flora from these much longer-existent land surfaces, and above all from the nearest of them, New Guinea.

This is consistent with the opinion expressed in more than one form and by more than one person in recent years, and perhaps first distinctly adumbrated by Hedley in 1893, that New Guinea, New Caledonia and New Zealand are the now widely separated remnants of what was once a larger land surface, usually referred to as the 'Melanesian continent' or 'foreland' the eastern edge of which is thought to be represented today by the andesite line, which runs just outside (namely north of) the Bismarck Archipelago, the Solomon Islands, the New Hebrides, Fiji and Tonga. Whether these five island groups do emerge from the eastern edge of an old continental shelf or not it seems plain that they have received their plant life from some much longer-existent source or sources to the west of them.

This idea of a once much larger Melanesian land surface is no doubt unexceptionable but the picture it outlines becomes much more vivid if this land is thought of, not so much as a continent in its own right, but rather as part of a greater continental extension south from Asia which once linked that continent much more completely with Antarctica, in the same way that the central and southern parts of America link North America today, and as Africa does, though now but partially, for Europe in the third sector of the tropics.

This threefold extension of land south from the vast northern ring into and across the tropics has always attracted attention and was an important foundation of the old tetrahedral theory associated with the name of Lowthian Green, which postulated that the continental surfaces of the world roughly occupy the corners and edges of a tetrahedron, such as may result from the shrinkage of a sphere. It is true that this idea is quite out of fashion today but this makes it no less arguable, and all neglected hypotheses can usefully be re-examined from time to time, so that plant-geographers may do well to bear it in mind.

At all events the concept of an old Melanesian continental surface affords a straightforward and comparatively simple explanation of many of the phytogeographical puzzles of Melanesia, but unfortunately it has, until recently, been obscured by traditional beliefs about the position and relationships of the continent of Australia and of its flora. This

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problem has been discussed at length elsewhere (Good 1961, 1964) but there is one aspect of it that is germane to the present discussion.

This is the circumstance that there is virtually no Australian element in the flora of the Solomon Islands. This is not in the least surprising if the hypothesis, advanced in the sources just mentioned, that New Guinea and Australia owe their present propinquity, not to a geological community of origin but to a gradual diminution of the once much greater distance between them, is true. If, on the other hand, Australia and New Guinea are, and have long been, parts of one and the same larger land-mass, then the almost total absence of properly styled Australian plants from the Solomons is hard to understand.

But this is not all. If, in accordance with the first of these two concepts, and as much evidence now suggests, Australia is a land-mass which has wandered far, its journey must have had a starting-point and there are good reasons for supposing that this point is unlikely to have been anywhere else than somewhere to the west of south of the present position of that continent. If this is so then its movement must have had the effect, not only of bringing it nearer to New Guinea and the rest of the Melanesian foreland, but of removing it farther and farther from the vicinity of southern Africa. May it not be possible then, that what is now called Australia once lay much closer to southern Africa and is, in origin, the missing southern portion of a land extension south across the tropics, in the longitude of Africa, which once linked that continent with Antarctica? It is at least worth remembering that this would not only help to solve some of the phytogeographical puzzles of Melanesia, but would also explain two of the most marked features in the present flora of Australia, namely its remarkable general relationship with the flora of the Cape Region of Southern Africa, and the presence in the south-east corner of the continent and in Tasmania, of an, 'Antarctic' element strongly related to similar elements in temperate South America and in New Zealand.

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