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## CHAPTER IV

### Discontinuous distribution

### Destruction of transitions

The wide separation of plants with close structural relationships is very common, and has always presented difficulties. One may find in a monograph that a genus is placed for structural reasons in a position quite different from that to which its geographical relationships would point. Under any system of Evolution two structurally related things must usually have had some third, ancestral, thing in common, from which they perhaps derived their characters by selection of adaptational improvements. This ancestor would usually cover a fairly definite and continuous area, in all probability, and if it could be gradually changed into either of the other two, the matter would be simple enough. But for such change, in a definite direction, whether continuous or by small steps, there must be some force acting that will always pick out steps in that direction.

The only agency yet suggested that is likely to be able to do this is natural selection, ruthlessly acting upon the ever-present choice between (a) advantage and (b) non-advantage or disadvantage. Even then one must assume (*cf.* Testcase X, *Evol.*, p. 114) that the adaptational urge is so great that a character will be selected right through to the perfect state in which it usually appears. But for most structural differences, no one has ever been able to suggest any adaptational advantage, so that this argument has but little force. With it goes most of the value of the usual explanation of structural discontinuity, that the less valuable transitions have been killed out by better adapted things. Owing to the great production of offspring, there must always

be much destruction going on, but it is of ill-suited *individuals*, one of species A being killed out in one place, one of B in another, rarely or never of all individuals of species A by those of B. Each is judged upon its own total merits; all A are not superior to all B, though there has in recent years been a great recrudescence of this fallacy. It depends upon the immediate local conditions which of them shall win in any given place. This being so, geographical continuity of the area that a species or genus may occupy becomes of greater importance than has hitherto been given to it, and any discontinuity in it needs explanation.

*Real discontinuity.* Discontinuity ranges over all possible distances and directions, and can be no better defined than endemism. In a fairly uniform country like BRITAIN, with no high mountains, it is usually disregarded, but a species found only in the ALPS and the PYRENEES, for example, is regarded as discontinuous. Here we have many different plants showing the same thing, in the same way, and in the same places, while the climate and other conditions differ in the intervening country, so that there is formed what we may call a real discontinuity in more than one feature. A case like this, where the species, or at any rate the genus, is the same on both sides of the gap, cannot be thrust aside. It is usually supposed that at one time a colder climate allowed these plants to flourish in the plains, while they retreated higher in the mountains when it became warmer. This is a sound explanation, supported by geological evidence, and by such further cases as the *Diapensias* of the arctic region and the central chain of mountains of EURASIA. Another widespread case of discontinuity like this is of course the separation by wide expanses of ocean, but here one must not forget that in such cases as the occurrence of a couple of species of a genus in MADAGASCAR and the same in CEYLON, the genus may have reached both by land, even if the INDIAN OCEAN were already unbridged. One may see something like this in the case of some of the *Berberidaceae*, of *Epigaea*, of *Shortia*, and of other things, which occur with a species or two in eastern ASIA and in eastern NORTH AMERICA. It is usually supposed that in a warmer period they grew in the far north, and that when the cold began to come, the roads of retreat open to them led one to E. ASIA, one to E. NORTH AMERICA.

*Structural discontinuity.* There is also a much more common discontinuity that we may call structural. Here a genus, or more rarely a small group, is found to exist in a region far removed from that in which its nearest structural allies are to be found, as judged by taxonomical work, which at present is founded almost entirely upon structural resemblance. A few examples may be taken in the usual way from books lying upon the table.

In *Phytolaccaceae* (*PR*), tribe *Rivineae*, eight of the nine genera are tropical American, the ninth is in QUEENSLAND, NEW SOUTH WALES, and NEW CALEDONIA, a solitary species, separated from the rest of the *Rivineae* by the whole width of the PACIFIC. The subtribe *Barbeuinae* of *Phytolacceae* consists of a single genus *Barbeuia*, with one species on the east coast of MADAGASCAR, separated from the rest of the *Phytolacceae* on account of its two carpels (against 3 —  $\infty$ ) and capsular (against fleshy) fruit, two obvious mutation characters. The only other *Phytolacceae* in MADAGASCAR are two *Phytolaccas* living in the hills near TANANARIVO, and it is probably a direct descendant of one of these.

In *Amarantaceae*, tribe *Amaranthinae* (*PR*), which includes genera 6-17, 6 has one species in the CANARIES, one in CYPRUS, one in INDIA, 7 is AMERICAN, 8 INDO-MALAYAN, 9 HAWAIIAN Is., 10 the NILGIRIS (S. INDIA), 11 the ALDABRAS (north of MADAGASCAR), 12 is AFRO-MADAGASCARIAN, 13 (*Amarantus*) warm regions of the world, 14 N. AMERICAN, 15 western U. S., 16 INDO-MALAYAN and east AFRICAN, 17 SOMALILAND. The thinly spread *Amarantus* is the only one that could possibly be parental, and the structure and the geography do not harmonise over the twelve genera.

Or in *Santalaceae*, sub-family *Osyrideae* (*PR*) 3-7, forming a sub-tribe distinguished by mode of anther-dehiscence, are found in AUSTRALIA and INDO-MALAYA; 8 has one species only in S. BRAZIL, URUGUAY, ARGENTINA, 9 has four in PERU and ECUADOR, 10 has four in CHINA, JAPAN, and the southern U. S., 11 one in east AUSTRALIA, 12 one in the southern U. S., 13 the same, but also one in the HIMALAYA, 14 has seven MEDITERRANEAN to CHINA, 15 one U. S. to ALASKA; 16 has one on the DANUBE and five in N. AMERICA, while 17 has one in southern ARGENTINA and the FALKLANDS. If these had to be produced by selection, the destruction required is simply incredible, nor is there time, in the lifetime of this

group, for such land changes to have come about. Simple mutation would make all the changes here necessary between genus and genus, once *Amarantus* or *Thesium* or some other big genus had travelled to the place required.

Or let us take a somewhat larger group, the *Phyllanthaceae* in *Euphorbiaceae* (NP/2, p. 44). Their thirty genera are thus divided : 20 in *Antidesminae*, with a curve of sizes 160 (*Antidesma*) 70, 70, 25, 20, 12, 10, 6, 2, 2, 2, 2, 2, 1, 1, 1, 1, 1, 1, 1; 5 in *Glochidiinae*, with a curve of 280 (*Glochidion*), 30, 4, 1, 1; 5 in *Phyllanthinae*, with a curve of 480 (*Phyllanthus*), 20, 1, 1, 1, and so on giving a curve of 480, 280, 160, 70, 70, 30, 25, 20, 20, 12, 10, 6, 4, 2, 2, 2, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, which is quite a good hollow curve, suiting well enough the dichotomous formation of new genera which we have seen to be the rule, and once more showing how the taxonomic (structural) breaking up of allied genera into smaller and smaller groups produces more and more confusion both in their geographical and in their systematic grouping, to say nothing of the way in which it spoils the "hollow-curve" arrangements. It seems impossible, if the basis of taxonomic work is genetic, that the hollow curve, demanded by the dichotomous division rule of formation of new genera, should thus appear only when one adds up a few of the smaller groups, in which it does not show itself. Upon whatever principle one makes the small groups, they are headed by comparatively important genera, by reason of the principle of divergence; but the followers are not in any way such as are proportional to the leader, as one may see in the groups just quoted, though the three together add up to form a good hollow curve.

Not only do the *Phyllanthaceae* thus form a good curve only when all taken together, but the same is true of their geographical relations. Though in the *Antidesminae* the two leaders are Malayan, the group includes 20, 12, 4/2, 3/1 in WEST AFRICA, and so on. This is a phenomenon of very great frequency, and goes to show that the characters that took these genera into the *Antidesminae* were derived from ancestors (or more likely from the genus of 20, which was probably the parent of this group, and was not itself the offspring of one of the Malayan genera) that did not belong to that group of the *Euphorbiaceae*. The more we enquire into the geographical distribution, the greater seems the



probability of frequent polyphyletic origin of structurally similar characters. If we recognise this common origin of family characters, and that they are not due to later casual formation by selection of slight changes, it makes the whole position far simpler. One man thinks a genus most nearly allied to X, by reason of the characters A and B; another would ally it to Y because of C and D, and until we can find out what was its real parent, we shall get no further. One comes more and more nowadays upon such remarks as (apropos of the two families *Amarantaceae* and *Chenopodiaceae*) "Unterscheidung zwischen den beiden Familien fast unmöglich, die Trennung in zwei Familien überhaupt eine Convenienzsache." The more that taxonomic work improves, the more is it being realised that genera and families pass into one another; their characters are given to them by their ancestors by some system of permutations and combinations.

These examples might be much extended, for one can find similar cases everywhere. But to find remarkable geographical connections, one need not go outside of one genus. By kind permission of the Linnean Society, I extract the following quotation from (151). "In *Cardamine*, for example, species No 70 is in NEW ZEALAND and POLYNESIA, 71 in the AZORES, 72 in CHILE. In *Euphorbia* one finds allied species in VENEZUELA and in CAPE COLONY, in PERSIA and in AFRICA, in central ASIA and in N. AMERICA, and so on. If in the *Drabeae* of *Cruciferae*, one join up the allied and consecutive genera by a line, one crosses the ATLANTIC five times and the PACIFIC once, and usually goes well into the continent also (151). In the *Arabideae* the crossings are seven and six respectively, and in the *Lepideae* the whole map is covered with a web of lines." To obtain discontinuous distribution such as this, upon the Darwinian supposition, there would have to have been land connections in almost every possible direction, and for long periods in many directions, and we have no evidence for such, nor for the truly fantastic contortions through which the land would have to go to bring them about. The destruction shows in some plants or in others, at all kinds of ages, in every direction, and to any distance. How all this destruction could be effected does not seem to have been properly thought out. Why did the stages between two genera of *Agrostideae* (Nos 143, 144 in *NP/1*)

die out over so vast a space, between the MEDITERRANEAN on one side, and VICTORIA and TASMANIA on the other, a space which lies on both sides of the equator, involving so many and so great changes of climate. And what was gained (as one must always ask when selection is concerned) by leaving the completed genera so far apart? If there were a few other examples of this particular separation, some explanation might be required, but this is just what does not happen; it rarely occurs twice except by accident. The only connecting links (if any) that occur in most cases of structural discontinuity are the large and widespread genera that sometimes cover both places. Under mutation of specific rank, which we have been upholding for a very long time, though A, B, and C may be the closest possible genetic allies, they need not necessarily also be the closest possible structural allies, and it is here that genetics comes into the matter, with chromosome numbers and other phenomena which we have not yet fitted into the mosaic of taxonomy and dispersal, but which must evidently find a place there. It is becoming ever clearer that geographical and genetic relationships must be taken into consideration as much as structural.

If the two structurally allied forms are to be derived by selection from a common parent, that parent must have occupied positions upon both sides of what is now the gap. The differences between the genera under consideration are very commonly divergent to such an extent that they could not both be derived from a parent that only showed one of them. Either the common parent—and there must be one somewhere in the line of descent—carried both characters, or neither. Of this choice it is clear that the first is enormously more probable. If this conception be carried out to its logical conclusion, it follows, therefore, that the first genus of a simple family must have been carrying all the characters of the family, or more probably the potentiality of producing them under certain circumstances. This conclusion is strongly supported by the fact that the separation is often very wide, while the genera themselves are usually small (young) and there is no evidence to show that they were ever united, other than by some large genus of the family that overrides both localities, or some *two or more* that do this. The explanation which we suggest for this structural discontinuity, that the “neutrality” of the parents is simply due

to the fact that they carry a Pandora's box from which any newcomer may take any of the characters that appear in that family (at least), is a far simpler one than the idea that they were derived by selection.

In some of these cases of structural discontinuity, which incidentally seem to become more marked in each successive monograph, there are genera like *Amarantus* above, found in or near most places where the structurally related small genera occur. They therefore may have been, as we have suggested, the direct and immediate parents of the small genera, though even then one can hardly bring in selection, for the separation is so often by such markedly mutational characters as could not be the subject of selection. It is much simpler to derive two genera that are closely related structurally, but A in one place and B in another a long way off, from a common generic, or even family, ancestor that happened to mutate in a similar way in both places.

The important point for the present is to remember the distinction between real and structural discontinuity. The former, if the separation is great, and by deep oceans, usually goes back to far off times (reflected in large size of the genus), when the aid of geology is required to ascertain what were likely to be the conditions of life. The barriers that now divide them were formed after they had spread to either side. The structural discontinuity, however, usually applies to small and local things, which could not have had a common and direct ancestor unless they were formed by separate, though similar, mutations, of some genus (or even two allied genera) that covered both their localities. The genus in common is a frequent enough phenomenon, but at times it belongs to some other taxonomic division.

This must suffice for our present purpose of explaining some of the circumstances and phenomena that frequently appear in a further consideration of endemism.