THE RELATIVE AGE OF ENDEMIC SPECIES

IN my previous reviews of the studies of J. C. Willis on endemic species I have explained his thesis that they are, as a rule, the youngest components of a flora and that their special condition is due to the circumstance that they have not yet had time to spread. This conclusion was based chiefly on statistical studies of the angiospermous floras of Ceylon and New Zealand.

It was to be expected that this contention would not escape contradiction, since among the older botanists the opinion prevails that endemic species are everywhere the relics of an old flora which is now rapidly disappearing. There is no doubt that in some countries this may be the case, and that even in the islands studied by Willis some few species are in this condition. But the number of these relics is so small that whenever a flora is studied statistically, they have no visible effect on the figures, provided that the species are dealt with in groups of about twenty or more.

The arguments against the hypothesis of the relative youth of endemics have been collected and brought forward in a recent article by H. N. Ridley and replied to by Willis.[1] In the first place it is claimed that it is difficult to show from which other species of the same flora the endemics should have been evolved. But Willis answers that most of them have "wides" of the same genus in their neighborhood, the "wides" being those species which also occur in adjoining countries, and are usually widely spread. A study of the diagnostical differences of the endemics with these goes to prove that in most cases they can easily be derived from them. Moreover it shows that these characters are by no means of an adaptive nature since they do not betray any relation to the life conditions of the local environment.

Ridley is an adherent of the Darwinian principle that organisms produce varieties, which if more suitable to the surrounding condition than the parent form are selected. This thesis, of course, is the basis of all evolutionary theories. But the question whether the production goes by infinitesimal steps or by larger changes, makes the difference between the theory of natural selection and that of mutation. On this point his criticisms clearly show that the more narrowly one looks into the actual facts the larger becomes the evidence against the older view. The reader will find a valuable review of the arguments in the papers of both antagonists, but it would take me too far to consider them here.

The main point of Willis's position, however, has been left unattacked. It is the statistical result that the endemics and the widely distributed species in a country are arranged in graduated series, showing an increase in number in opposite directions, the endemics increasing from those of wide to those of narrower distribution, the wides in the other direction. Or, in other words, the endemics of a flora are the more numerous the smaller their area is, whereas among the species occurring also outside the special flora studied, those with a wide distribution within it, prevail. The regularity with which these facts appear from the tables made for different islands and different botanical groups can not be explained on the old view. Neither is this possible for the fact that endemics have mostly contiguous areas, whereas the dying out of species should lead us to expect the occurrence of their last relics on sundry spots and on distant points of their original habitat.

This law of distribution, which Willis calls his law of "age and area" is then tested for some other floras, besides those already mentioned.[2] The orchids of Jamaica give a very convincing instance. Dividing the island into 19 equal squares and comparing the endemic orchids with those found also in Cuba, and

[1] H. N. Ridley, "Endemism and the Mutation Theory," *Ann. Bot.*, Vol. XXX., 1916, p. 551, and J. C. Willis, "The Relative Age of Endemic Species and Other Controversial Points," in the same journal, Vol. XXXI., 1917, p. 189. See also some other articles of the same authors in that journal, and my reviews in SCIENCE, N. S., Vol. 43, No. 1118, pp. 785–787, June, 1916, and Vol. 45, No. 1173, pp. 641–642, June, 1917.

[2] J. G. Willis, "Further Evidence for Age and Area, its Applicability to the Ferns, etc.," *Ann. Bot.*, Vol. XXXI., 1917, p. 335.

with those of still wider distribution, the tables show that their range goes in the order: Endemics least, Jamaica-Cuba species next, wides greatest. Then the angiospermous flora of the Hawaii archipelago, which comprises seven islands, is tested, and it is found that the wides range much more than the endemics, of which more than one half is found on one island only. These latter must be the youngest, the remaining having originated before the splitting up of the region into separate isles.

A study of *Callitris* in Australia shows that the law holds good for Conifers also, and the fern floras of Hawaii and New Zealand give ample material to prove that the endemic species, although following the same rule, show a much greater range than the endemic angiosperms, a result to be expected on Willis's hypothesis, but contrary to what one would expect if endemics were dying out, since ferns are generally considered as a much older group than the flowering plants. A last argument is given by the outlying islands around New Zealand. Starting from his hypothesis Willis predicted that the most widespread plants in the two main islands would be those that reach the outlying isles also, and that those which do not reach them, are less widespread. The figures given in the tables bear out this fact in a striking way, both in the case of wides and endemics.

From these results it seems clear that all over the earth and in every systematical group of plants the rule prevails that the most widespread species are the oldest, whereas the others are the younger, the smaller their area is. This law would provide us with a new method of constructing pedigrees and of judging the relative age of diagnostic characters, and it seems evident that these points would be of paramount importance in the study of the real relationships and the common origin of species.

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SCIENTIFIC EVENTS

THE CHICAGO MEETING OF THE AMERICAN MEDICAL ASSOCIATION[1]

The sixty-ninth annual session of the American Medical Association, held in Chicago last week, was one of the most important the Association has ever held. This statement is made as the meetings, the exhibits, the addresses and the results of the past week pass in retrospect before us. The House of Delegates considered many topics of current war interest and passed a number of resolutions of important, timely character, conspicuous among them being those on animal experimentation, on universal military training, on welfare work among children, on the use of enemy manufactured pharmaceutic products, and on the work of Surgeon-General Gorgas.

The opening meeting of the Scientific Assembly, held in the Auditorium Theater, was greeted by an audience of over 4,500 persons, every seat and available space in the theater being occupied. Unfortunately, many who desired to attend were unable to find accommodations because of late arrival. The music for this session was provided by the Fort Riley Band, which was a conspicuous feature of the annual session, and aided in arousing military enthusiasm. At this meeting, as in all of the night meetings, the medical officers in uniform were seated on the stage, and added military tone and color to the picture. The scientific programs began on Wednesday and contained numerous papers of military interest, as well as those of a strictly scientific character.

An unusual feature of the session was the replacing of the president's reception by a medical war meeting held in Medinah Temple, the report of which appears elsewhere in this issue. The local committee on arrangements had done notable work in staging this meeting. Every seat in the immense auditorium was filled, over 6,000 persons being present. The speakers were the noted foreign guests, the surgeon-generals, the president of Leland Stanford University and Major Alexander Lambert, of the American National Red Cross. The enthusiasm of the audience can not be depicted by words, every speaker and patriotic enunciation being greeted with an ovation. With the introduction of each foreign guest the audience, led by a local choral organization and accompanied by the music

[1] From the *Journal* of the American Medical Association.