BIOLOGY

Evolutionary Tendency of Relative Growth in Arthropods and Man

In a series of investigations dealing with the comparative studies of relative growth in various groups of arthropods and man[1-7] I have confirmed a tendency that the growth ratios of rapidly growing parts of the body tend to be more similar than those of slowly growing parts when two or more closely related forms (such as geographically isolated populations, subspecies, parthenogenetic and bisexual strains of the same arthropod species, interspecific-hybrid and very closely related species in arthropods, Negro and Caucasian children) are compared. This indicates that in incipient stages of structural divergence during evolution the slowly growing parts would tend to be more affected than rapidly growing parts.

This tendency appears, *a priori*, to be possible (Fig. 1). If the growth ratios of rapidly growing parts differ greatly between very closely related forms, the final (adult) sizes and shapes of these parts would tend to be greatly different, and these forms would scarcely appear to be closely related. Therefore, the growth ratios of rapidly growing parts are expected to be similar among very closely related forms. In the comparison of Negro and Caucasian children's growth (see ref. 9), the growth ratios of five out of six most rapidly growing parts (bitrochanteric breadth, upper arm length, lower arm length, thigh length, lower-leg length) are nearly identical between the two races. The same tendency may well hold true in similar comparisons in other groups of animals besides the arthropods and man.

If the growth ratios of slowly growing parts are considerably different (Fig. 1) while those of rapidly growing parts remain much the same, the adults of the closely related forms would tend to look similar in general size and shape while showing minor yet distinct structural divergences. This is exactly what taxonomists would expect to see in comparing closely related forms. This tendency has been abundantly proved in several groups of arthropods and the human races.

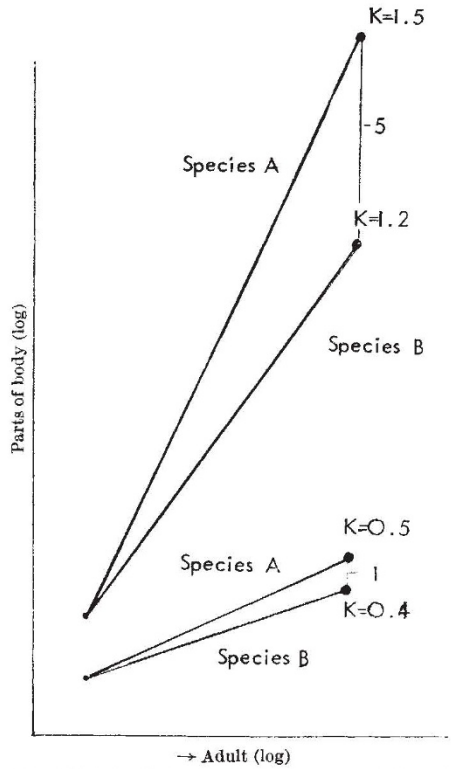

Fig. 1. A simplified model showing the difference in adult sizes in rapidly and slowly growing parts between two closely related species *A* and *B*. *K* is the growth ratio of allometric growth equation. The growth ratios of both rapidly and slowly growing parts in species *B* are assumed to be 80 per cent of the corresponding parts in species *A*. The final difference between rapidly growing parts here is five times greater than that between slowly growing parts

The modification of growth ratios of rapidly growing parts would tend to lead to the divergence at higher taxonomic units. The evolution of relative growth at higher levels of taxonomic unit in arthropods has been discussed earlier[8].

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Phytotoxin Production by *Verticillium albo-atrum* Reinke et Berthold

The physiology of vascular wilt diseases caused by *Fusarium* and *Verticillium* species has received considerable attention during recent years[1-4]. Of these organisms, less work has been carried out on *Verticillium*, and certain aspects of the disease syndrome caused by this fungus are not fully understood. Studies on symptom initiation have for the most part been concerned with the production by the fungus of pectolytic enzymes[5-11]. Numerous authors have mentioned the possible role of toxins in disease initiation, but little supporting experimental evidence has so far been produced. Moreover, from the lack of a precise definition, the toxins of some authors[12,13] might include extracellular pectolytic enzymes. Porter and Green[14] and Green[15] published the first authentic accounts of toxins produced in *Verticillium* culture filtrates. Bioassay of nearly all suspected disease-inducing agencies has been on cut shoots, in an attempt to simulate wilt conditions, in the naturally infected plant. In Nature, however, wilting symptoms usually develop after about 14 days, and experiments in this laboratory have shown that, in the case of seedling infection, growth inhibition rather than overall wilting is a more valid symptom of disease. Up to five weeks after infection in these plants wilting is a gradual basipetal desiccation while the leaf area of apparently turgid leaves is reduced by 80 per cent. This symptom is quite different from the general collapse of turgor common in mature infected plants and may be independent of it.

Experiments reported in this communication represent the preliminary findings of an attempt to isolate from *Verticillium* culture filtrates a growth-inhibiting substance other than a large protein molecule which could account for some of the naturally occurring stunting symptoms. A virulent strain of *V. albo-atrum* Reinke et Berth. was used, originally isolated from a wilting tomato plant by Dr. H. H. Glasscock of the National Agricultural Advisory Services, Wye, Kent. Still cultures consisting of 300 ml. of 'Seitz'-filtered tomato xylem exudate, supplemented with 1 per cent sucrose in horizontally placed 1-l. Thompson flasks, were grown at 22° C for 21 days in a dark incubator. The xylem exudate collected from tomato, cultivar 'Victory', had previously been stored at −20° C until required. Culture solutions were filtered once through several layers of fine cheese muslin and then twice through Whatman No. 1 paper. The filtrate was centrifuged at 16,000*g* for 15 min at 5° C and then reduced to small volume in a cyclone evaporator at 23° ± 5° C. The *p*H of the filtrate was adjusted to 2·5 with N hydrochloric