Book Reviews

Evolutionary Patterns

Plant Speciation. VERNE GRANT. Columbia University Press, New York, 1971. xii, 436 pp., illus. $15.

This book is concerned with plant variation and evolution at or about the level of the Linnean species; it excludes any detailed consideration of infraspecific differentiation except insofar as this is significant for the origin of the species, and similarly does not attempt any appreciable treatment of phylogenetic or evolutionary matters at generic or higher levels. The subject matter is further restricted to the extent that "plant" implies principally phanerogam, barring an occasional reference to other groups. Within these limits Grant has achieved an effective coverage of the ground, providing a thorough and scholarly treatment of a great deal of scattered material not adequately dealt with in any recent volume. It can be said immediately, however, that in parts the picture presented is that of the early 1960's; fewer than 10 percent of the 600 or so references are post-1965, and presumably this means that the main literature review was completed then or shortly after. Insofar as many of the basic principles of plant speciation were well established by the mid-1960's, the book is none the worse; but in some contexts the absence of reference to more recent work is unfortunate.

The text comprises five sections. The first is devoted to the nature of plant species, dealing with various species concepts, the genetic basis of species difference, and reproductive isolation. The second concerns species divergence in plants, beginning with a consideration of patterns of relationship and proceeding to processes of primary speciation, chromosome repatterning, and the development of isolation mechanisms under natural selection—the last termed by Grant the "Wallace Effect." Part 3 covers aspects of species refusion through hybridization, and introduces various concepts of speciation dependent upon hybridity. Specialized genetic systems, including polyploidy and apomixis, are treated descriptively in part 4, and the fifth and last part deals with evolutionary phenomena in various complex situations arising from apomixis, clonal propagation, polyploidy, and the like.

The treatment presumes a substantial basic knowledge of cytogenetics, and indeed of taxonomic principles, so the book is aimed firmly at the graduate student or above. It is not, however, in any sense a work for the specialist. Certainly the fact that it is concerned with plants should not deter the zoological reader; indeed, one might urge that it should be required reading for courses in evolution in animal-oriented departments, for there is no doubt that a book like this offers a strikingly different flavor from those of animal evolutionists such as Mayr and Simpson. The recurrent emphasis in its pages on evolutionary convergence and reticulate variation patterns contrasts markedly with the assumption of continuous dichotomous differentiation underlying much of the discussion of animal speciation. Notwithstanding the fact that the role of convergence in animal evolution has been underestimated—a point stressed especially in recent years by Cain—there is no question that evolutionary patterns *are* different in the two kingdoms, reflecting real dissimilarities in plant and animal biology. Grant attributes much of the divergence to the simpler organization of plants. Undoubtedly this is a basic factor; the developmental complexity of higher animals must necessarily depend upon the close integration of gene systems in a way that can leave little scope for radical repatterning, be it through hybridization, far-reaching chromosomal changes including allopolyploidy, or other means. Evidently an open mode of growth, a generalized form of nutrition, and a sessile habit permit plants to get away with more, evolutionarily speaking. Certainly they do so in their genetic systems, which are as adventurous in their diversity as animal genetic systems, in general, tend to be boringly uniform, with their adherence to regular dioecy. And here, of course, we detect the source of much that can seem strange in plant evolutionary patterns for one brought up on a diet of animal literature—including what Grant calls the "quantum shifts" in ecological adaptation and the extraordinary patterns of repetitive specialization and despecialization commented upon by Good and others.

Some of the generalizations discussed in the earlier sections of Grant's book are, of course, necessarily derived from the arguments of animal evolutionists; and here one must confess to some unease. Certainly the treatments are businesslike, even to the point of dryness, but sometimes the subtlety of an argument is lost, and a concept is projected in such a manner as almost to miss the point. This is true even for so important—indeed central—an idea as that of the biological species itself. A good deal of lapidary work went into the refinement of the idea of the biological species in the 1950's, when the crudity of species definitions couched in raw genetical terms—like that of Winge of the 1930's, with its exclusive emphasis on the incidence of experimentally testable reproductive isolation—was revealed. Ernst Mayr's own expositions of the biological species idea repeatedly brought out the point that it is not a prescription for *defining* a species, but a way of understanding the nature of the variational unit most frequently dubbed a "species" in sexual groups. As Mayr pointed out, the biological species subsumes two concepts of rather different kinds, one derived from the criterion of reproductive isolation, but as revealed in *nature* by the failure of breeding between sympatric populations, and the other one of collectivity, inherent in such phrases as "species are groups of actually or potentially interbreeding populations." The test of the potential here turns out to be based usually upon comparative morphology—that is, upon the same criteria as those used in traditional taxonomy. Little of all this finesse emerges from Grant's chapter on the biological species, and indeed the definition he gives of a biological species as a "reproductively isolated system of breeding populations"

is not only simplistic, but even atavistic, unqualified; surprisingly, considering the author's other contributions in the field. A corresponding kind of simplification is to be seen in the section dealing with the "panmictic unit," defined as "a small local group within the whole population." This statement seems inevitably to convey the idea that, somehow, even *continuous* populations tend to break up into discrete, isolated subpopulations, the average sizes of which can be estimated with some accuracy. This was surely not the intention in Wright's original analysis, the probabilistic aspects of which scarcely emerge from so cut-and-dried a description.

A welcome feature of the volume, especially well seen in the later chapters, is the wealth of exemplary cases quoted to support arguments and conclusions. Heavily theoretical treatments of speciation phenomena have been plentiful enough, but their didactic value is impaired when they are presented without case histories. Here we have accurate documentation adequate and full enough to permit the perceptive student to make his own judgments on interpretation, following the evidence back to its source if necessary, using a reference list that does better than most in the field to provide a world coverage of the various themes. The occasional shortcomings arise from the dated coverage of certain topics, already mentioned. The section on apomixis and related matters provides an example. This owes little to the literature later than Gustafsson's monograph of 1946–47, and falls short of providing a proper indication of the scope and significance of the phenomena. Thus table 5, purporting to list apomictic flowering plants, is inexcusably incomplete, not having been updated even to the extent of including groups mentioned elsewhere in the text.

The production of the volume is extremely good, and errors and misprints are essentially absent. Overall it is a worthy addition to the famous Columbia University Press library on evolution and related topics. It will fill an important gap in providing a lead to much—often rather neglected—plant evidence. But it has its defects, and hardly seems destined to become a classic in the same way as the volumes of Stebbins, Mayr, Simpson, and Dobzhansky.

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Paleoprimatology

Primate Evolution. An Introduction to Man's Place in Nature. ELWYN L. SIMONS. Macmillan, New York, 1972. xii, 322 pp. illus. Paper, $5.95. Macmillan Series in Physical Anthropology.

Paleoprimatologists, anthropologists, and other evolutionists should welcome this book by America's foremost authority on primates of the Tertiary Period. Elwyn Simons and his students and associates have reduced synonymy in many primate taxa and have provided new evidence on the beginnings and later radiations of the Anthropoidea, thereby facilitating considerably the tasks of contemporary textbook writers and students of primate phylogeny.

Primate Evolution contains inclusive discussions of numerous fossils that have been excluded from or have received only passing mention in previous textbooks. The lengthy renderings of Paleogene forms and of subfossil Malagasy lemurs will be especially useful to teachers and students of comparative and evolutionary biology. Most groups are well illustrated.

But those who would use *Primate Evolution* must be prepared to elaborate extensively on theoretic evolutionary and anthropological topics that are introduced at the beginning and end of the book and to piece together their own summaries and conclusions on most higher taxa. The bibliography is rather impoverished with regard to basic works of classic and contemporary theorists. Remarkably absent are T. H. Huxley, A. Keith, S. L. Washburn, F. C. Howell, O. J. Lewis, C. O. Lovejoy, and K. G. Heiple, among others. The abbreviated references and unbalanced discussions of available theories inadequately prepare the reader to explore alternative viewpoints, especially on hominoid evolution.

The introductory chapters probably will not enable most nonspecialists to follow the detailed discussions of particular forms in succeeding chapters. Morphological particularities are illustrated for the teeth of "higher primates" (pp. 62–63), but much of the text is concerned with dentitions in a wide variety of unique forms among which readers will have difficulty making meaningful comparisons. The introduction to postcranial structure and function is poorly related to subsequent discussions of particular fossils. Some information on postcranial morphology is misleading and erroneous. For example, figure 31 (p. 89) is a hodgepodge of incorrectly named and attached muscles. A curious muscle designated "quadratus" is located on the ventral aspect of the hindlimb in a "generalized quadrupedal primate," but it is dorsal in man. The rectus femoris muscle is shown attached to the shaft of the femur in the quadrupedal form. Fortunately, in the figure on man the distal attachments of most muscles are cropped off, further errors thus being precluded. Baboons are said to walk with their palms on the ground (p. 91) when in fact they are digitigrade. Sufficient detail about the thumb of hylobatid apes is not provided to correct the commonly repeated overgeneralization that "brachiators" characteristically possess reduced thumbs.

Primate Evolution does not fulfill the promise of its subtitle. Detailed discussions of hominid fossils stop short with *Ramapithecus*. Simons designates *Homo erectus* of the Middle Pleistocene as the "oldest man." Therefore the book might more properly be considered an introduction to nonhuman primate fossils. Yet anthropologists will find a few bones to pick with the author, particularly regarding his views and implications concerning the early phases of hominoid evolution. I will deal briefly with two such points here.

Not all authorities on hominoid evolution accept, as Simons does, the hominid status of *Ramapithecus*, though few would deny that *Ramapithecus* is the most likely candidate among available fossils for the superlative position of "earliest hominid."

Probably few scientists who are thoroughly acquainted with the comparative biology of extant apes and man will accept Simons's paradoxical implication that while certain features in man might evidence a heritage of "arm-swinging," counterpart features in the African apes evidence that they evolved on the ground (p. 58). Simons cites the limb proportions of an outsized Pleistocene gelada to prove that elongate forelimbs may develop in a terrestrial setting. He then implies that the African apes also may have evolved primarily on the ground. In order to support this unorthodox view, he resurrects the intermembral index, which already has been shown to be of dubious significance whether one does or does not wish to support brachiationist theories of troglodytian evolution. Gorillas and geladas probably possess relatively long forelimbs and short hindlimbs *in compari-*