

BOOK NOTICE

PRACTICAL AND THEORETICAL ASPECTS OF THE
SPECIES PROBLEM

Systematics and the Origin of Species from the Viewpoint of a Zoologist. By Ernst Mayr. New York, Columbia University Press, 1942. 334 pp. \$4.00.

Dr. Mayr begins his preface with the statement that "During the past fifty years animal taxonomy has undergone a revolution almost as fundamental as that which occurred in genetics after the rediscovery of Mendel's laws." This has mainly to do with the recognition of polytypic species: groups of populations which are visibly or recognizably different, but intergrade with others, forming a series of subspecies. The changed "species concept" of the modern systematist has resulted largely from increased knowledge and opportunity. To one who used to correspond constantly with W. H. Edwards, who knew Wallace very well indeed, and even saw Westwood preside (for the last time) at a meeting of the Entomological Society of London, the limitations of those earlier days seem to explain and justify the taxonomy of the period. When Edwards received a new butterfly from the west he described it as a species. This was the only practical thing to do; to call it a subspecies of something else was to assert what he did not and could not know, and of the group of perhaps a dozen members of a "polytypic species," as we understand the matter today, probably only two or three were then present in collections.

In the case of the birds, it may be said that the species and subspecies are mainly known, and yet supposedly new subspecies have been described from Britain very recently. In the case of the insects, even the butterflies, the large collections extant are not yet fully adequate, and some day the present time will be looked upon as one of relative ignorance.

I knew Lang at the time when he was preparing his book on the butterflies of Europe (he, being a clergyman, used to go out on Sundays with what appeared to be a bulky umbrella, but on

reaching the collecting ground it turned into a collecting net). It was supposed that the European butterflies were sufficiently known to be set forth in a manual, and for some years this satisfied the needs of collectors. But there came a time when very large series from many localities were collected, and it was realized that the species could be broken up into numerous races or subspecies, which at once became desiderata for collectors. One could take a brief holiday on the Continent, going to the Pyrenees or to the Tyrol, and perhaps come back with a new race of some well-known species of butterfly. However, as Mayr points out, this sort of thing could easily be carried to extremes. Almost any population, closely studied, was found to have some characters of its own, and the number of subspecies or microsubspecies could be increased almost indefinitely. Thus the genus *Erebia* was very recently monographed so elaborately, with so many illustrations, that nothing seemed lacking; yet just the other day a race from Scotland was described as new.

On the other hand, when the taxonomist is accused of emphasizing very small differences, it may be replied that the geneticist has done exactly this, with the most brilliant results. It was a mistake of the entomologists, conchologists and botanists to mix up individual and racial differences, so that the term "variety" stood for quite different things. But I think Mayr is wrong in stressing subspecies (populations), though poorly defined, but objecting to the naming of variations occurring within a population. In the Staudinger Catalogue of European Lepidoptera we used to read in certain cases "Var. et ab.," meaning that a particular form occurred in some regions as a race, in others as a variation (aberration) in the normal population.

Mutations, the materials out of which subspecies are built, are extraordinarily varied, as the work with *Drosophila* has shown. For the most part they are disadvantageous, and little suited to be the foundations of new subspecies. But, as has been shown especially in the case of plants, a population limited by climatic conditions may produce a mutation actually unsuited to the locality, but suited to a neighboring locality, into which it spreads. This, however, cannot often occur, in view of the numerous zonal species in the mountains, whose scattered seeds are every year

washed to lower levels, without producing a series of adjacent subspecies. I have found similar phenomena in the marine fauna of southern California.

Although birds and butterflies are so little related they have certain features in common in respect to their variations. They vary conspicuously in size, color and pattern. These diversities are more strongly marked in butterflies, which even show seasonal variation in many species. Among the moths, the most amazing exhibit I ever saw was that of Rothschild's collection of *Abraxas grossulariata*, the Currant Moth. Any one not informed concerning the origin of this series might easily have believed that he was looking at a group of several genera and numerous species. The genus *Abraxas* includes several additional genuine species, and some subspecies, but they are relatively commonplace. There is not, in the world, room for such diversity among the birds, but we do not know much about their individual variations except among domestic species, such as fowls and pigeons, which show many extreme types, for the most part unfitted for survival in the wild.

Since the characters so generally used to distinguish races of birds and butterflies are not present, or hardly indicated, in many groups of animals, the question arises whether there are in fact numerous cryptosubspecies, differing in ways not appreciable in cabinet specimens. Mayr cites such cases, and I could add several others, relating to food plants, relating to parasites, and other diversities among insects, which are often of practical importance to the economic entomologist and so are receiving increasing attention. These considerations tend to increase our belief in the frequency, one may say the normality, of polytypic species.

There are, however, notable exceptions. Last spring, my wife and I were in charge of the little Desert Museum at Palm Springs, but the Museum shut up for the summer on May 15 on account of the tropical heat of the summer months in that locality. Shortly before this I saw every morning a handsome butterfly flying before my front door. Was it some California species, or perchance a visitor from Mexico? By no means, it was *Euwanessa antiopa*, the Mourning Cloak, or the Camberwell

Beauty of English collectors, who esteem themselves fortunate to catch one in England in a lifetime. In central Africa I found the Painted Lady, *Pyrameis cardui*, precisely the same butterfly as occurs in Europe and the United States. Diversity of environment is slow to act in many cases. Thus the Cabbage Butterfly, *Pieris rapae*, introduced into America not much less than a century ago, is singularly uniform, and decidedly less variable than it is in Europe.

Mayr discusses all these matters in relation to birds, with many interesting examples. On page 231 he cites the case of the Hornbill, *Dichoceros bicornis*. It abounds in the tropical forests of Burma, Siam and a narrow strip in north India, but all of central India is unsuited for it yet it appears again quite unmodified, in a strip of forest country parallel with the coast from Bombay southward. Mayr does not suggest such a thing, but from seeing these birds flying strongly over the trees in Siam, I can imagine that they might sometimes cross India and join the southern colony.

A much disputed question has to do with the taxonomic status of similar forms, apparently of subspecific rank, but kept separate by physical barriers. Thus, for instance, in various groups of islands there are closely allied birds and mammals, sufficiently different to be recognizable, yet differing only in very minor characters. Such, for example, are the foxes on the islands off the coast of California. The yellow Columbine, *Aquilegia chrysanthe*, is universally considered a good species by botanists, yet in gardens it crosses freely with the blue Columbine, *A. cærulea*, producing fertile hybrids. No one doubts that if these two species were not separated by a physical barrier, they would soon cease to be specifically separable. Mayr holds that we must use our judgment in all such cases, and are justified in recording forms as subspecies, though we have no direct evidence of mixing.

Mayr gives a very interesting discussion of what he calls sibling species. These are good species, in the sense of being biologically isolated, which nevertheless show few or practically no external diagnostic marks. In Lepidoptera such cases are occasionally found; thus in Britain we have two species of *Acronycta*, so similar that it is doubtful whether the ablest experts can distinguish

them, yet undoubtedly distinct species, as the larvæ are quite distinct. Mayr cites at some length the sibling birds, some of which caused great confusion until their nature was understood. Some of the examples of siblings in other groups I should not so consider—for example, *Pieris napi*, *rapæ* and *brassicæ*. The “biological races” of the malaria mosquito, *Anopheles maculipennis* are considered sibling species, distinguished principally, but by no means entirely, by the character of their egg-floats. It is obvious that the existence of siblings may be of great consequence to economic entomologists. Thus the common mussel scale has a form which attacks apples, while another does not; the red scale has a form which does not attack citrus plants, as I observed in Jamaica all such cases must be critically studied, and no doubt siblings will be shown to exist, sometimes when the morphological differences are so slight that no one has ventured to give them any taxonomic rank whatever. The birds, being so well known and comparatively few, deserve to be considered by all Zoologists, and for this reason Mayr’s book will be most instructive to entomologists and others. It must be said, however, that the insects present much greater variety, and in many cases much closer adaptations to the environment. Among the bees which I have studied, I will cite the genus of small prettily-colored bees called *Perdita*, confined to North America, and mainly to the west, with one species found by my wife as far south as Guatemala. New species of *Perdita* are continually being discovered, and it seems quite possible that five hundred exist in nature. They are nearly all oligotropic, confined in their visits to one species of flower, or one group of closely allied flowers. In the dry regions of the southwest the sight of a plant new to the entomologist always arouses hopes of a new *Perdita*, and very often the expected bee is found. Now it would be absurd to group these species into “polytypic” groups, except in the sense of subgenus, or some would say closely related genera. They exist as distinct entities in nature, and although many species will be found in a single locality, they are not mixed, but are found on different plants, or in some cases at different times of the year. But occasionally exceptions occur. Many years ago, when on the way to visit the celebrated botanists, Mr. and Mrs. Brandegee, then living at San

Diego, I came across a sumach (*Rhus*) bush full of small bees, all females. They were described as *Perdita rhois*. Some years later, Timberlake collected at Whittier, on quite a different plant, some males, and these I described as new, without any doubt as to their distinctness. Now it turns out that this species, *Perdita rhois*, is common in southern California on many kinds of plants, and the Whittier bee is its male. Are there no subspecific groups in *Perdita*? Timberlake, in his unpublished manuscript, has recorded some. My wife and I collected a new *Perdita* visiting *Layia*, at San Miguel Island, California. Some years later we found at Santa Tomas, Lower California, a species, also on *Layia*, differing by the markings. This I am regarding as a subspecies. Thus it is evident that the intensive study of any insect group is likely to yield facts of great biological interest and illustrate in some measure the origin of species.

Mayr has at the end of his book a discussion of the "higher categories," particularly genera. He considers that generic subdivision has been overdone. He takes the fourth edition of the check list of the American Ornithologists' Union, and enumerates forty-two "genera" which "could well be dispensed with and will probably disappear eventually from later editions." Among the insects a similar reduction is possible, although critical studies often bring out differences not at first noticed. In the case of the bees, I have been puzzled by the phenomena of "Emergent Evolution." It is apparent that even then the species, and perhaps genera, are of relatively recent origin, the gene-modifications from which they are built up may be much older. The various recombinations of these genes give rise to new types. It results from this that we have what has been called "Kaleidoscope Variation," and it is practically impossible to tell what was the exact cause of evolution. Thus the very numerous African bees of the genus *Megachile* could be arranged in subgenera, or even genera, on the basis of quite different characters. I do not at present see how to make the appropriate choices with any assurance that they represent natural groups. More intensive studies will probably result in a classification which can be accepted with confidence.

It will readily be seen that Mayr has written a most interest-

ing book. The practical moral is that good biological results come from intensive studies, and yet such studies, without a broad background of knowledge, may be largely sterile. There is indeed a wonderful opportunity for the younger generation, standing on the shoulders of the older folks, to do what they could never do.

Should the question be raised, what is the "practical value" of all this, several things may be said. In the first place, as we have indicated, the knowledge of variation and of sibling species may be of first class importance to the economic entomologist, whether in the agricultural or the medical field. The cultural side, the pleasure which may be derived from the study of nature, cannot be ignored. People pay immense sums, in the aggregate, for not too good entertainment; here is, available to all, the clean, beautiful, never ending drama of nature, to be had without price, or rather at the price of having learned to appreciate it. As a result of the present war, more and more wounded men will come back to us, the more numerous because the splendid medical discoveries of recent times have made it possible to save so many who would formerly have perished. In England they are stressing the crafts as a means of "occupational therapy," but probably, for those so inclined, some entomological hobby is no less valuable. A collector who makes little or no pretense to scientific knowledge may make valuable contributions to the subject with suitable guidance, as I could set forth at considerable length.

Finally, science is international, and so far as it goes, it will help to heal the wounds of war. Today we are horrified at the actions of the Nazis, and yet I have a picture in my mind of a meeting of the Entomological Society of Bremen, to which I was invited not long after the first world war. Exhibiting and discussing their specimens (I remember especially the exquisitely mounted microlepidoptera) these men appeared to have attained a high level of humanity, and I felt very much at home with them. It is difficult to believe—I do not believe—that they have the faults which people today ascribe to the Germans, and it is perhaps largely through the coming together of such people from all countries, all worshippers of the beauty, variety and incident of nature, that we may find a basis for the salvation of mankind.—T. D. A. COCKERELL.



Cockerell, Theodore D. A. 1943. "Practical and Theoretical Aspects of the Species Problem." *Journal of the New York Entomological Society* 51, 277–283.

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