# THE STUDY OF COLOR PATTERN AND OTHER INTRA-SPECIFIC VARIATION IN COLEOPTERA

by

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The Editor of the Coleopterists' Bulletin has asked me to summarize my position on the study of color pattern and other types of intraspecific variation. I suspect he has done this because my views have been somewhat at variance with generally accepted American opinion on the subject.

I believe that my heterodoxy derived from the fact that I came to the study of beetles through an independent study of the literature without direct contact with very many other coleopterists. I owed a great deal to personal contacts with Mr. A. W. Andrews of Detroit and Dr. M. W. Blackman of Syracuse University, but Mr. Andrews was primarily a collector and the author of two or three local lists and Dr. Blackman was largely concerned with scolytids. Moreover, my training as a zoologist emphasized the biological phenomena themselves and tended to throw the nomenclatorial apparatus into perspective as nothing sacrosanct but as merely an imperfect tool for handling biological realities that far transcended it.

Finally, almost from the beginning I took a world-view of the matter. Interested as I was then in Silphids and Gyrinidae, with the ending of World War I I entered into communication with Winkler and Wagner of Vienna and with Staudinger and Bang-Haas of Dresden and eventually secured a large synoptic collection of European and a less extensive collection of general foreign Coleoptera. At the same time I put myself in touch with the European literature: Heyden, Reitter, and Weise, Catalogus Coleopterorum Europae: Schaufuss' Calwer's Kaferbuch ed. 6; Reitter's Fauna Germanica Käfer; the Junk-Schenkling Coleopterorum Catalogus; Kuhnt's Illustrierte Bestimmungstabellen der Käfer Deutschlands; Winker's Catalogus Coleopterorum Regionis Palaearcticae.

When I came to the matter of color variations, I found extensive European precedents for a detailed naming of the same. Especially in Nicrophorus, where I have made most extensive use of color variety nomenclature (Hatch 1927, 1940), the studies I modeled my own after were those of the Frenchman Gaston Portevin (1923-25, 1926).

Three stages may be traced in my own thinking about color-variety nomenclature. To begin with (Hatch 1927: 341-342) I held that taxonomy's purpose was to describe and that the naming of color varieties or aberrations was an integral part of that function. Later (Hatch 1940: 239 et seq.) I suggested that the chief requirement in referring to intra-specific variation was precision, and that whether names (with or without priority), letters, or numbers were used was secondary.

More recently (Hatch 1946) I undertook to see what actually was at issue between the color-variety-namers and their opponents and decided that it was a matter of basic assumptions. The color-variety-

namers have assumed that distinguishability is the basis for assigning names and that any variation that can be sharply distinguished is nameable. Their opponents assume a more sophisticated position. They wish the nomenclature to reflect not merely the way the specimens appear to the taxonomist but the populational units to which the individual specimens when alive were assignable. They also call attention to the pervasiveness of evolution and to the probability that no two individuals are ever precisely the same, so that the variety-namer would end up by assigning a separate designation to every specimen! In consequence I was led to suggest that the naming of non-populational classes "is not desirable and that such classes should be handled by a nomenclature that is entirely independent of and not continuous with that used to designate populational units".

Practical problems, however, remain.

My individual deflection from the ranks of the color-variety-namers does not affect the large number of continental coleopterists who still follow the practice. The present generation of taxonomists may well never live to see populational taxonomy so thoroughly established that some naming of color varieties will not occur. Nor does the current establishment of populational taxonomy affect the enormous color variety literature. Moreover, I regard as unwise any decision to deprive varietal or aberrational names of priority standing or to treat them otherwise than on a par with other trivial names. When aberrations or varieties are discovered to be species or geographical subspecies, the names employed should be those of the respective aberrations or varieties and should date from their original description as aberrations or varieties. Otherwise coleopterists run the danger of seeing two systems of names develop. Coleopterists are too few and Coleoptera are too numerous to allow any such schism of practice, sentiment, or feeling to develop in our ranks.

The populational taxonomists must adjust themselves to the continued use of color variety and aberrational names by some of their colleagues. When they see such names, if they are wise, they will not exhaust their emotional energy in decrying what is to them an outmoded nomenclatorial practice. Instead, they will proceed to a consideration of the facts with the same calm that they would if their author had merely called attention to some uncommon variants of the species in question without assigning them any names!

Populationalists, when they find it desirable to refer to the varietal names of others, might place such names in quotation marks as an indication of the incomplete acceptability of such names, e.g., var. "albinus J. Doe".

Numerous alternatives to a direct extension of populational nomenclature to non-populational classes may be suggested*. Most objec-

*Some may suggest that all intraspecific nomenclature is impossible, since if, as suggested above, there are no two individuals the same, there is no place to stop short of separately designating every specimen! Without questioning the theoretical validity of such an observation, I suggest that the classification of color varieties in practice falls far short of such a result, although just how far short depends on the varying observational techniques the taxonomist elects to employ.

tional are those proposals to use Latin names which are to be entirely free from the operation of priority or other nomenclatorial rules. Such are the "formae" of Blaisdell and the "Kennworten" of Heikertinger (Hatch 1940, p. 238). Such names are too similar to regular names, they lend themselves too readily to citation in the traditional fashion to be fully acceptable. Despite these considerations, however, individual authors will probably continue to employ them!

More acceptable would be names in some non-Latin language, but such names sometimes simulate Latin names, especially when written in French.

Most satisfactory in my opinion is a system of letters, or numbers, or spot formulae. Such a system is never in any danger of being confused with the regular system, yet variations so designated can be cited with all the precision desired.

As an example, I refer to the system I set up for the 26 or 27 color variations then known to me of the chrysomelid Orsodacne atra Ahr. (Hatch 1924: 306-307: Hatch and Beller, 1932: 103; Beller and Hatch 1932: 75). O. atra Ahr. var. B. Hatch 1924: 307 and others can be cited with complete precision and yet in complete independence of the regular system. Moreover, var. B. J. Doe would be nomenclatorially independent of var. B Hatch, although it might or might not zoologically be a synonym of it.

The matter becomes acute in an extremely variable group like the Coccinellidae. In a study of the Coccinellidae of Washington that Mrs. Helen Houk and I are engaged upon, we have finally elected to number the varieties of each species or geographical subspecies from "1" up. Each number is followed by a description of the variety, usually by means of a color pattern formula, as is usual among students of the group, and this description is accompanied by the citation of such other names or lettered or numbered varieties as appear to have been given this variety by other authors. Thus var. 1 Houk and Hatch of a particular species may be the same as var. A. J. Smith or var "immaculata J. Doe"! We believe that this combines a proper deemphasis on the varieties with continued ease and certainty of citation. Just what would be the results, however, of attempting to combine into one listing the results of half a dozen or a dozen authors' work on a single complexly varying species, only the future can decide for certain. It might, however, read somewhat as follows, the three dots in each case standing for the rest of the citation:

var. "immaculata J. Doe" ...; var. A J. Smith ...; var. 1 Houk and Hatch ...; var. 7 J. Jones ...; etc.

So much for how I propose to study color varieties. There remains the problem of "Why study them?"

The first and most important reason for studying color varieties that I have always insisted upon is that they represent an intergral part of the taxonomist's descriptive analysis of his material. Furthermore, color varieties frequently simulate species and it is desirable to have them on record so that they may not be confused with species.

The study of color varieties is likewise important for those who are interested in what may be called the dynamics of species. They frequently represent a part of the variation out of which the populational units - the species and subspecies - are themselves compounded.

For example, in the chrysomelid Orsodacne the American atra Ahr. and the European cerasi L. are rather similar morphologically, but their color variations are in two entirely different directions. Similarly, Nicrophorus vespilloides Hbst. is a Holarctic species occuring in both Eurasia and North America. The common form and one or two of the commonest color variants are the same in the two continents, but the greater number of the color varieties in the two regions is quite different. Color variations is thus a specific and subspecific character of moment, and sometimes it will not be until the variations are tabulated and their relative frequency and distribution studied that the full import of the variation will be appreciated.

Again, the color variation of an introduced species may be far less in the area of its introduction than it is in its native land. I have noted this particularly in the coccinelled Adalia bipunctata L., which is extraordinarily variable in Europe, but the same thing seems to be true of the American populations of some of the introduced species of oniscoid isopods or sow-bugs.

The more critical student of intraspecific variation will, where his material permits, not only report the different color variations present but will indicate their relative abundance in different geographical areas or even at different times of the year (as with the butterflies).

The ultimate analysis of a population is, of course, in terms of genes. Perhaps, when this is accomplished for a species, other cruder approaches to the study of its variation may be forgotten. But this is proving to be an extremely complicated affair. First methods must be discovered for the indefinite rearing of the animals in the laboratory. Thus Shull (1944:332) in his study of the very interestingly variable coccinelled Hippodamia has been unable to maintain his strains for more than 7 or 8 generations. Moreover he finds frequently that a single spot seems to be influenced not only by a single allelomorphic pair of genes but by numerous modifying genes (Shull 1944, 1945) so that the entire picture is extremely confused. In general we seem to be about at the point where we can almost say that even minute differences between individuals that are not obviously malformations are much more likely to be due to heritable factors than otherwise. The upshot is that most of the variations that the student of color variation notes is probably genetic and not environmental in origin. Furthermore, the differences are likely to be due not to single pairs of genes but to complexes of modifying genes.

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