SHORTER ARTICLES AND DISCUSSION

SURVIVAL VALUE OF VARIETAL CHARACTERS IN SNAKES

It is a recognized and a serious defect of biological theory that natural selection (an elimination of certain variants by diverse processes in the usual course of events; differential survival) has remained so much a matter of logical deduction and so little a matter of observation and of experiment. Robson and Richards (1936) cite only nineteen attempts to show that differential elimination takes place. Most of these are concerned more with showing a particular cause (preferences of particular predators, etc.) for differential elimination than in demonstrating the existence of a general process. All of them are severely, even devastatingly criticized by Robson and Richards.

I am concerned here with doing two things. First: to show that in snakes there may be at times and at places and in certain species very drastic selective elimination by natural causes not at all known or even inquired into; that this elimination affects characters subject to individual variation, but which are used by herpetologists in the discrimination of varieties, races, species and genera; and that much if not all of the variation subject to such elimination is hereditary and hence the elimination affects descent with modification. Second: to point out to my colleagues in herpetology a method which may produce results which will affect not only herpetology but also general biological theory.

In 1935 I had occasion to examine a collection of Conopsis nasus from Alvarez, San Luis Potosi, Mexico. I found considerable variation in the scalation of the head, and was surprised to note that this (a matter of reduction) was largely confined to the smallest specimens. It struck me at the time that this might prove an interesting and powerful method for demonstrating a selectional process in nature, that there might be already in print data which could be examined to see if the variation of the young differed from the variation of individuals of reproductive size, and that it might be well if other herpetologists were appraised of the possible existence of such a phenomenon and advised to distinguish between young and adults in variational studies.

1 Contributions from the Department of Biology, Haverford College, No. 55.
I discovered that three papers along this line were published over thirty years ago. Weldon (1901), working on the snail *Clausilia laminata*, found that the range of variability of the young exceeded that of the adults. The same author (1904) working on *Clausilia itala*, found no difference between the variability of young and adult specimens. Di Cesnola (1907), working on the snail *Helix arbustorum*, found that the range of variability of the young exceeded that of the adults.

These findings have been criticized by Robson and Richards (1936) on the grounds that the observed differences might be due to “greater plasticity of young as well as to selection”—whatever that may mean. The criticism, however, may indicate that snails are not suitable material for this sort of work.

The scalation of snakes is known not to be subject to environmental modification from birth on. The number of body vertebrae and tail vertebrae, which is reflected in the number of ventral and caudal scales, is possibly subject to prenatal environmental influence, since some correlations have been made between environments and counts which hold for many species, of which the most striking is that insular snakes have more caudals than their mainland relatives. Further investigation is needed, but constant differences in such counts, between related forms which exist in the same region, seem to indicate that the ventral and caudal count of snakes is hereditary and not subject to prenatal environmental influence.

Head scalation might also be subject to prenatal environmental influence. That this is not so is strongly indicated by the data in my first published paper (1915). In this I pointed out that a variation (double loreals) so rare that I am unaware of any other report of it, occurred in a female *Natrix fasciata sipedon* and in one third of her brood. The chances of this trait not being hereditary are negligible.

There have not been lacking hints that scale characters (or other characters closely connected with them) have some effect on viability.

Blanchard (1921, p. 202), dealing with the available specimens of *Lampropeltis triangulum triangulum* from the vicinity of the District of Colombia and the Coastal Plain to the east, which show “more or less reduction in scutellation and pattern” says “more than half of the specimens are very small, and perhaps some of the aberrant ones would have died a natural death if they
had not been found and preserved. It is a fact that some of the most aberrant individuals, [of Lampropeltis in general] described and not described, have been juveniles.”

Klauber (1936, p. 197) says of rattlesnakes: “broods... often seem to contain freaks... which probably would not survive in nature.” “... a defective juvenile female lucascensis with 170 ventrals; the lowest normal individual has 183.”

Smith (1938, p. 115) says of a brood of Parancia abacura abacura from Ft. Lauderdale, Florida, that it contained “nine” with “variations not found in adults or other young.”

A collection of 23 Conopsis uresus Günther, taken by Dr. Henry Pilsbry at Alvarez, San Luis Potosi, Mexico, in 1934, was studied by me in 1935. The variations in the head scales include: loss of the loreal; reduction of postoculars from 2 to 1; reduction of the upper labials (from the maximum and usual number of seven) to 6 or to 4.

Of the 23 specimens, eight, with head + body length of 85-117 mm, are considered juvenile. Fifteen, with head + body length of 160-260 mm, are considered adult. Eleven (73.3 per cent.) of the adults show no reduction; four (26.7 per cent.) show some reduction. Three (37.5 per cent.) of the young show no reduction; five (62.5 per cent.) show some reduction.

If each separate loss or fusion of a scale is counted as a separate variation, there are four cases of loss of loreal, on one side only, in the adults, and no reduction at all in postocular or supralabial count. There are, in the eight young specimens, ten labial reductions, three postocular reductions, and one loreal loss: a total of twelve aberrations. At this rate at least twenty-two aberrations in fifteen adults might be expected: actually there are four.

The fairly strong variational tendency towards reduction, evident in the young of this species in this locality, is scarcely noticeable in the adults. It would seem that a majority of the young with these variations do not become adults, and the minority of the young (with the opposite variations) form the majority of the adults.

Linsdale (1936, p. 233) reports without comment on a collection of 46 Chilomeniscus straminus from Eureka, Baja California. Of twenty-three males, 17 had length from snout to vent 150-200 mm; 6 had 96-148.5 mm. The former lot showed a range of ventral counts of 107-114; the smaller specimens showed a range of 103-113, and 50 per cent. of them had less than 107. Of twenty-
three females, 16 had head-body length 160-215; seven a length of 84-157. The ventral count of the larger lot ranged from 112-122; that of the smaller was 107-116, and four (57 per cent.) were below 112.

In this snake, at this place, at least half of the young are of a variety which is not represented in the adult population.

Stuart (1941, p. 18, f. 1) points out that 30 per cent. of the smaller (below 400 mm total length) specimens of Dryadophis boddaerti boddaerti, at Medellin, Colombia, belong to a variety which is not represented in the population of larger individuals. Six of these young have 238-262 vertebrae (ventral and caudal counts combined); 14 small and 12 larger (400-1000 mm) have 265-293 vertebrae. Stuart draws the inference that the variety with fewer vertebrae does not live to reach maturity.

Dr. Joseph Bailey and myself examined the heads of 190 Dryadophis melanolomus alternatus from the lower Tuira valley in Darien, but found no notable differences in the variation of young and adult. The head scalation is very constant. In 337 heads of Chironius carinatus from the lower Tuira we also found constant head scalation and no notable difference between young and adult.

Scale differences of the sort mentioned above are, as is well known, not only matters of individual variation, but also are used in discriminating between races, species and genera of snakes. These characters are, therefore, not unimportant to the student of the evolution and phylogeny of snakes. Individual variation in these characters has long been known, and it is now obvious that variation may, in some way which I do not attempt to explain, affect the survival of the individual animal.

A demonstration that selective elimination of certain variants may occur in nature would, of course, be considerably enhanced by data as to how and why these variants are eliminated, but facts or speculations as to the method or the cause of the elimination are really irrelevant to any demonstration that a selective elimination takes place. Indeed, it is irrelevant to such a demonstration to prove that a character is hereditary. It is only necessary to show that the elimination is not an illusion caused by one variant turning into the other.

It may be that the obvious scale characters which distinguish the survivors from those eliminated are only outward and visible signs which accompany (by close linkage or as partial effects)
more serious and unseen differences. Long study of snakes in
the field has convinced me that many of these scale characters are
in themselves important to the life of the animal. There is a
great deal of definite correlation between the type of scalation
(whether of head or of body) with the habitat, with the type of
food normally taken, and with the means employed to take and
engulf that food. I regard many of the features of snake scalation
as definitely adaptive; as adaptive as the fin arrangements
of aquatic vertebrates or the dentition of mammals.

It would be of great interest to compare by this method two
populations of the same form from two different environments or
areas, and to compare two different races of the same species.
Young and adults should not be compared unless the whole lot
comes from the same place or from one topographic and climatic
unit area.

Most of the published information on variation in snakes makes
no mention of size of specimen. Authors have been demonstra-
ting areal or spatial variation quite successfully, but have usually
left out information that might have shown trends of variation
and selection in one or another or all the areas concerned. It is
to be hoped that this may be remedied in the future. It is pos-
sible that systematic workers might actually find that more
distinguishable adult populations exist than are recognized at
present, since the present practise of including all specimens in
variational counts may tend to conceal real differences in the
reproductive populations. The adult populations may differ,
although the juvenile populations are indistinguishable.

Emmett Reid Dunn

LITERATURE CITED

Blanchard, F. N.
di Cesnola, A. P.
Dunn, E. R.
Klauber, L. M.
Lindsdale, J.
Robson, G. C., and O. W. Richards
Green and Co.
No. 762] SHORTER ARTICLES AND DISCUSSION 109

Smith, H.

Stuart, L. C.

Weldon, W. F. R.