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ROOSEVELT'S 'REVEALING AND CONCEALING COLORATION IN BIRDS AND MAMMALS.'

BY J. A. ALLEN.

UNDER this title¹ Mr. Roosevelt presents a critical and extended review of the Messrs. G. H. and Abbott H. Thayer's book entitled 'Concealing-Coloration in the Animal Kingdom,' published early in 1910.² In this book, he says: "The doctrine of concealing coloration as an explanation of almost every kind of coloration in the animal kingdom has received its widest application. . . . In its extreme form as stated by these gentlemen, the doctrine seems to me to be pushed to such a fantastic extreme and to include such wild absurdities as to call for the application of common sense thereto. The Messrs. Thayer state their position in the most positive form. Fundamentally it is that, in the first place, all or practically all animals are concealingly colored, and in the next place, that while their patterns in all cases help thus to conceal them the chief factor in their concealment is the counter-gradation of shades, their inconspicuousness being due, not to their color being like that of the surrounding objects, but to this counter-gradation causing them to escape being seen at all. In order to show the sweeping claims made by the Messrs. Thayer, and accepted by their followers, I quote their exact language:" (Here follows a page or more of quotations from their book.)

"Before discussing these positions and the argument advanced on behalf of them by the Messrs. Thayer," continues Mr. Roosevelt, "I wish to call attention to certain arguments of theirs, both in the shape of pictures and in the shape of letter-press, which are really not arguments at all, properly so considered, but are simply misstatements of facts, or wild guesses put forward as facts. I do not for a moment suppose that the misstatements are intentional on the part of the Messrs. Thayer. I believe that they are due to the enthusiasm of a certain type of artistic temperament, an enthusiasm

¹ *Revealing and Concealing Coloration in Birds and Mammals.* By Theodore Roosevelt. Bull. Amer. Mus. Nat. Hist., Vol. XXX, pp. 119-231, August 23, 1911. Price, 60 cents. Address, Librarian, American Museum of Natural History.

² Noticed in this journal, Vol. XXVII, April, 1910, pp. 222-225.

also known to certain types of scientific and business temperaments, and which when it manifests itself in business is as sure to bring the owner into trouble as if he were guilty of deliberate misconduct." He then takes up these alleged misstatements and devotes some ten pages to them, criticising his pictures of the peacock, zebra, chickadee at nesting-hole, oyster-catcher, wood duck, flamingoes, spoonbills and ibises, and the accompanying text; also the "flank-markings" of ducks, the head, bill and leg markings in rapacious birds, and the effect of iridescence in birds.

As an example of the comment on these alleged misstatements we may cite (p. 131): "Again, Mr. Thayer says that the fact that the scarlet tanager's coloration 'divides it into two things, a black and a red thing,' shows that it is not 'meant to be conspicuous' because in that case it would be a 'monochrome.' But the summer red-bird and the cardinal are both monochrome! Mr. Thayer simply forgets this, and forgets that the argument he advances to show that one is inconspicuous, necessarily shows that the two others are conspicuous. As a matter of fact, of course the plumage of all three birds is highly advertising." In the way of general comment, in this connection, he says: "Mr. Thayer's book is for the most part filled with theories predicated upon observations made under conditions which are designedly abnormal. Any practical expert with colors knows that extraordinary effects can be wrought by a proper arrangement of lights and shadows. If seen against the horizon under certain conditions of light, all animals, no matter what their real color, will seem to be of the same color; and no color can be imagined which will not become inconspicuous, whether on an animal or off an animal, if against certain backgrounds."

The principle of countershading, as set forth by Mr. Thayer, is next considered, and admitted as a discovery of real merit, but "although important as a coloristic law, has a very limited application among birds and mammals so far as concealing them is concerned... It does, however, I believe, play a certain small part, in some cases, even with birds and mammals, and possibly a far greater part with lower forms of life; and Mr. Thayer is entitled to full credit for calling attention to this fact. Unfortunately as regards mammals and birds, he has given it a

thousand-fold more importance than that to which it is entitled." This, we believe, must be the ultimate conclusion of intelligent field observers of wide experience on serious examination of the facts in the case.

The main contention of Mr. Roosevelt's paper is that concealment in birds and mammals is due mainly to "cover and habits." Birds of many species, living in all kinds of environment, and embracing all the leading types of bird life as regards size, habits, and habitats, and of mammals, from elephants, giraffes, zebras, antelopes, lions, cougars, skunks, marmots, squirrels, field mice, shrews, etc., are discussed at length with reference to Mr. Thayer's points of view. A few excerpts will show the method of treatment adopted by Mr. Roosevelt: "Now as to the insistence Mr. Thayer puts on some of his propositions. When he says that 'the striking patterns' and 'the utmost contrasts of color' on animals 'make wholly for their obliteration,' really the only way of answering him is by a negative. The red-headed woodpecker exactly fulfils Mr. Thayer's description of an animal with such a pattern and contrast of color. If in Mr. Thayer's eyes a red-headed woodpecker in its normal surroundings is inconspicuous there is no more to be said than we would say to a man who asserted that a large house standing alone on the prairie and colored half black and half white, with a bright red roof, was inconspicuous . . . The red-headed woodpecker is one of the most conspicuous of all animate objects. Its habits are such that even a city-bred man must see this."

"Again, take what Mr. Thayer says of countershading, and of why a protectively colored animal escapes detection. Mr. Thayer insists that the animal escapes observation, not because its colors match its surroundings, or because it sits motionless like a stump, or clod, or some such inanimate thing, but purely because of its shading, which he says is rendered oblitative by the counter-gradation of shades, so that the eye does not recognize it as a solid object of any kind.' . . . This spring, once or twice after heavy rain I have seen meadow mice in unusually open spots where I could examine them having in view this matter of concealing coloration. When they move they are visible at once; when they are still they always crouch nearly flat—their short legs render this necessary—and there is then practically no effect of countershading; it is a

negligible element in concealing them; they are concealed because their dull colors, round contours, and absolute immobility make them look like lumps of mud, or other natural objects so that the eye fails to distinguish them from their surroundings, as one fails to distinguish a muddy tennis ball. On an absolutely flat and bare surface they are seen at once. . . . Where the color [white] is simply on the belly, it does not advertise the animal, merely because it is not seen; that is, instead of this coloration concealing the animal, the animal conceals the coloration, and it has no effect one way or the other."

The coloration of mammals in respect to their concealing or advertising qualities is discussed at great length (for about 40 pages), special attention being given to the larger species, as the giraffe, zebra, antelopes and deer of many species, and the carnivores, from the point of view of the author's wide personal experience as a field naturalist and hunter, with particular reference to such much-discussed species as the pronghorn, giraffe, zebra, lion, leopard, and cougar. In the course of this discussion he says: "The first, and by far the most important, fact brought home to any competent observer is that as regards the great majority of these animals the question of cover infinitely outweighs the question of coloration in the problem of concealment; this being so true that when there is no adequate cover most of the big animals do not trust to concealment at all, and concealment, whether of coloration or otherwise, plays no part in making their lives successful. Next comes the fact that there are some animals, chiefly cats, whose peculiar physical address in hiding and in stealthy approach and escape is such that their ability in this respect far outweighs the question of coloration, and even the question of cover, provided the cover is in any way adequate. Finally, there are some animals as to which it is possible that the coloration does have a concealing effect of some importance."

"The cougar," with which Mr. Roosevelt has had exceptional experience in its natural haunts, he views as "an interesting beast from every standpoint, including its coloration; and a study of the effect of its coloration from the 'concealing' standpoint is, or ought to be, illuminating, when taken in consideration with much that is written about the concealing quality of the coloration

of leopards, tigers and other cats. My experience, in accord with the experience of almost all other hunters and outdoor naturalists, is that the cougar is of all our American big animals the one most difficult to see and most rarely seen. The cougar's neutral-tinted, nearly unicolored, countershaded coat, unquestionably has a concealing quality, in the woods and among clay banks and rocks under ordinary conditions; and for a long time I, in common with most observers, accepted this as the chief element in explaining the way in which the cougar escapes observation. But when I came to think out the matter I realized that in many parts of its range the landscape is in winter snow covered, and that a totally different theory must be invoked for the cougar's invisibility when snow is on the ground." After detailing his experiences with cougars under these conditions he says: "This means that the cougar's coloration was really an insignificant and practically negligible factor in its concealment. The prime factors in keeping the cougar invisible were its nocturnal habits, its caution and wariness, its sharp senses, its wonderful ability to take even advantage of the scantiest cover, and its power of lying indefinitely motionless and of advancing with inconceivably noiseless and crouching stealth. . . . Furthermore the facts in the case of the cougar, an animal big enough to permit us to be certain just what the facts are, enable us to appreciate the real conditions which render it difficult to see so many smaller creatures."

The author presents his 'conclusions' (pp. 212-220) under eleven general statements, which we have not space here even to summarize. The ground is broadly covered, however, in statement 11, which we here transcribe:

"(11) In short, as one might anticipate, when we deal with the coloration of birds and mammals we deal not with any one cause, but with a varied and complex tissue of causes. Forces have been at work to develop concealing coloration in many species, and countervailing forces have worked with greater or less strength to counteract the influence of the first, in some species completely succeeding and in others partially succeeding. Some birds and mammals are so colored that normally or at certain important times their coloration helps to obliterate them from the sight of their foes. Others are so colored that their coloration under all normal conditions and from every viewpoint, and at the most

critical periods of their lives, tends to reveal them to their foes. In others the coloration is of little consequence, one way or the other. Birds and mammals living under precisely the same conditions have totally different types of coloration, and display totally different traits and habits when seeking to escape from enemies or to capture prey. No universal laws can be laid down. Tentatively, it is possible to give adherence to the conclusions which I have sketched in loose outline above. We know that many birds and mammals are concealingly colored. It is hard to say, at least in some cases, whether this concealing coloration has been produced by natural selection, or whether, however produced, it has merely then been taken advantage of by the animals, which have conformed their habits thereto, so as to get the utmost benefit from it. In many birds and mammals sexual selection or some similar principle has completely obscured in one sex the workings of the law which tends to produce concealing coloration. In many other birds and mammals both sexes are advertisingly colored, and whatever be the cause that has produced this advertising coloration it is evident that the circumstances of their lives are such, that their habits and traits of mind are such, as to render the question of concealing coloration a negligible element in their development.

“The species of birds and mammals with a complete oblitative, or concealing, or protective, coloration, are few in number compared to those which possess (either all the time, or part of the time, or in one sex for all the time or part of the time) a conspicuous or revealing or advertising coloration, and to those in which the coloration is neither especially advertising nor especially concealing. As regards the great majority of the species, the coloration, whether concealing or not, is of slight importance from the standpoint of jeopardizing or preserving the bird's or mammal's life, compared to its cunning, wariness, ferocity, speed, ability to take advantage of cover and other traits and habits, and compared to the character of its surroundings.”

In an Appendix of ten pages Mr. Roosevelt takes occasion to reply to Mr. Thayer's criticisms of Roosevelt's 'African Game Trails,' in one of the appendixes to which the author takes exceptions to Mr. Thayer's statements in his 'Concealing-Coloration

in the Animal Kingdom,' these strictures being characterized by Mr. Thayer as an "extraordinary tirade." Mr. Thayer's paper appeared in the July issue of the 'Popular Science Monthly,' after Mr. Roosevelt's article was already in type. Both papers are of course controversial and need not be further mentioned in this connection but both should be read by those especially interested in the problems of animal coloration.

In our mention of Mr. Thayer's book, 'Concealing-Coloration in Animals,' published in the April number, 1910, of this magazine (Vol. XXVII, pp. 222-225), the notice was purposely descriptive, from the view-point of the author, and non-critical. At the time it was written there had been time to give it only perfunctory examination, and while certain seemingly extravagant claims were noticed, there was then neither time nor opportunity to take up the work critically, owing to pressure of other duties. It was recognized, however, that to discuss the merits and demerits of the work would require not only a considerable outlay of time but an indefinite and very large amount of space for their presentation. Later it became evident, on further study of the work, that to review it on its merits would require the space of a booklet and a large expenditure of time. It seems therefore opportune that the task has been undertaken by a field naturalist of recognized fitness, through an experience with both large and small game of unequalled extent, amid not only natural but the most diversified surroundings. The tone of Mr. Roosevelt's paper is judicial and fair, personally kind toward Mr. Thayer, but outspoken and emphatic in criticising what he considers errors in his methods and conclusions. He does not lay claim to final judgment on points where it seems to him our knowledge is incomplete, and in such cases frankly says, 'I do not know,' and appeals to naturalist to further investigate doubtful points. He has endeavored to apply "common sense" to evident misstatements and the misapplication or misinterpretation of facts.

When in November, 1896, at a meeting of the American Ornithologists' Union in Cambridge, Massachusetts, Mr. Thayer gave a demonstration of his discovery of the effect of countershading,¹

¹ See Auk, XIV, 1896, pp. 85, 86.

those who witnessed it were profoundly impressed and somewhat startled by what they witnessed. It was easy to recognize that Mr. Thayer had discovered a hitherto overlooked principle in optics which seemed to explain how the white underparts of terrestrial birds and mammals rendered them protectively colored. If objects like sweet potatoes suspended a few inches above the ground on a green lawn could be rendered invisible by painting their lower surface white, such markings on the ventral surface of animals must, it would seem, tend to their concealment. But when we come to study such animals in life it becomes apparent that their manner of living greatly qualifies its effectiveness for their concealment, especially in short-legged and crouching animals that live on the ground. Later, however, Mr. Thayer extended his experiments to the pattern markings of animals, and with artificially constructed backgrounds, or with favorably chosen natural backgrounds, was able to demonstrate the practical disappearance of animals with color patterns. This was all very striking and very interesting, and very few who witnessed his demonstrations reflected that the effects were produced through artificial environment, and really proved very little as to the effect of color patterns as a means of concealment in living animals in the actual or natural environment of the species. It showed possibilities that might never happen in life, or so rarely as to be negligible as a means of protection at even vital moments in an animal's career. Discovery of the possibility of finding backgrounds that will match the coloration of any or of every bird or mammal *when motionless* does not necessarily have an important bearing on protective coloration in animals, as has been well-shown in Mr. Roosevelt's illuminating paper. It is here that Mr. Thayer has been misled in his later investigations, as shown in his book on *Animal Coloration* and in his later papers in reply to his critics. This is unfortunate and to be greatly regretted, for only personal friendship has deterred many of his friends who differ from his conclusions and believe his methods of proof are seriously defective, from openly assuming the rôle of critic. For him to say he is misunderstood by his critics, and that they do not agree with him because they do not understand the 'laws of optics,' is a lame defense for the misconceptions with which his book and recent papers abound.

In an article by Mr. Thayer printed in the present number of this magazine (*antea*, pp. 460-464) we get perhaps a clearer view of what he *now* claims for his investigations than can be obtained from his book and previous papers. He says (*l. c.*, p. 463): "The oft-repeated objection that the wearers of these costumes perpetually reveal themselves by motion, and that consequently my tests give a wrong impression, is just what shows lack of taking in what my investigation is. My whole assertion is that the *costumes* of these creatures are not what reveal them, and the objector's repeated declaration that the real animal moves and shows himself simply backs me up. The use of motionless stuffed skins is the pure method of studying the effect of the patterns *apart* from that of motion. . . . The inevitability of *detection* through motion has made people suppose it was the *patterns* that caused the detection. What they *do* cause is *identification after detection*."

If animals with conspicuous patterns and contrasting colors were always *motionless*, and always chose for resting places backgrounds that match their patterns and conspicuous colors, Mr. Thayer's experiments with stuffed skins and carefully chosen or artificially prepared backgrounds would have some direct bearing on the question of the effect of such patterns and conspicuous and contrasting colors. But since an animal or bird however colored is apt to remain unseen if motionless, especially if physically screened in the least degree, and since most conspicuously colored animals invariably pass a large part of their time in the open and in motion, without the aid of any matching backgrounds, but exposed to an ever varying background, the utility of Mr. Thayer's "pure method of studying the effect of the patterns apart from that of motion" does not seem very evident, a point repeatedly urged by Mr. Roosevelt in the paper here under review.