Stereomorphism in Cryptic Coloration of Lepidoptera

CRYPTIC effect, that is, the inconspicuousness of the organism in its natural environment, depends upon three main causes: (1) the coloration of the cryptic organism should resemble that of the surroundings; (2) the body-shape is often modified to resemble environmental components (stick insects, etc.); (3) the effect is that of a quiescent organism and not of a moving one, and the attitude of rest and the bodily components are exactly adapted to each other. According to Oudemans' rule[1], the cryptic colours of resting Lepidoptera are the only visible ones, while all the bright telechromatic[2] areas are concealed. The above three groups of factors form a definite system independent in a way of other bodily systems and using the body, as it were, as a sort of substratum irrespective of its organs. The term 'cryptom' may be given to the system.

According to Thayer's principle of counter shading[3], the orderly distribution of colours is largely responsible for the effectiveness of the cryptom, the main result of the working of the principle being that the convex bodies, for example, of birds, are rendered visually flat. The cryptoms of Lepidoptera, and especially Rhopalocera, are mainly located on the wings. Because the latter are flat, Thayer's principle is not applicable to them. Using stereoscopic apparatus and the method of stereomodels, I was able to show[4] that cryptoms of this sort are governed by the principle of stereomorphism[5], that is, that on cryptic wings two-dimensional images are present, so that the relation of the flat cryptom to some hypothetical microlandscape corresponds to that of a photograph of a landscape and the landscape itself. On these stereomodels the pattern components are imitated by shadows cast by their sculptured non-coloured surface (see illustration). The relief of the latter may be very complicated according to the cryptom copied, and consists of a number of raised and lowered areas which are generally curved and often pass into one another by gentle alterations of their directions and inclinations.

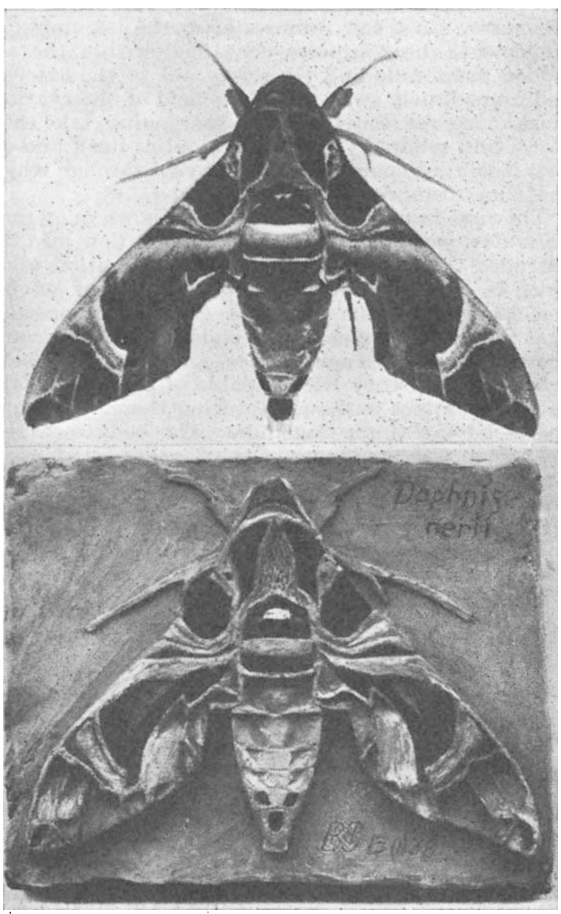

Fig. 1. (Above): A SPECIMEN OF THE HAWK MOTH, *Daphnis nerii* L. (Below): A CLAY MONOCHROME MODEL OF THE ABOVE MOTH IN WHICH THE COLOUR PATTERN IS IMITATED BY THE DISTRIBUTION OF SHADOWS ON THE SCULPTURED SURFACE OF THE MODEL. THE METHOD PROVES THAT THE COLOUR PATTERN OF THE MOTH REPRESENTS A TWO-DIMENSIONAL REPRODUCTION OF HYPOTHETICAL THREE-DIMENSIONAL BODIES. DUE TO THIS, THE CRYPTIC EFFECT OF THIS SORT OF COLORATION IS VERY STRONG.

But in Cott's excellent book[6] the above models are described as consisting of "different surfaces lying in the same plane but on different levels", and it is argued that the surfaces in question should be regarded as sloped and curved. My paper is illustrated by the model of *Erebia lappona* chosen as a very simple example of the method and consisting as a matter of fact of flat surfaces. But in the text, "protuberances and depressions of different shape and size" seen through stereoscopic devices are spoken of, and mention is made of the model of *Daphnis nerii* illustrated in the accompanying figure. This model consists of a number of variously sloped surfaces, many of them being curved. It was exhibited at a scientific meeting in 1939 and the photograph published in 1941[5]. The basic idea of the research in question is "that the wings of moths and butterflies imitate bark, leaves and the like"[4]. Because the typical surfaces of objects of this sort are curved, the surfaces of models could not be restricted to flat shapes. The latter should be regarded as a particular example of a surface normally curved. Thus Dr. Cott's interpretation of my models and my own view are at variance.

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Binucleate Oidia on Binucleate Mycelium of *Polystictus hirsutus* Fr.

BRODIE[1] remarked that the occurrence of binucleate oidia on binucleate mycelium of basidiomycetous fungi is rare. The only example cited so far seems that of *Pholiota aurivella* Batsch by Vandendries and Martens[2].

While carrying on pairing experiments with closely related species of Polypores on agar films on slides, I came across an oidial strain of *Polystictus hirsutus* which is heterothallic and bipolar[3]. This was paired with *Polystictus steinheilianus* Berk. and Lev. (a non-oidial one). Binucleate oidia in four or five short chains arising direct from binucleate hyphæ of *P. hirsutus* with clamp-connexions were obtained close to the line of demarcation between polysporous cultures of the two closely related species, and there