CATALOGUE OF THE SUB-CLASSES, FAMILIES, GENERA, SPECIES, VARIETIES AND PRINCIPAL SUB-VARIETIES, VOL. II: THE BRITISH NOCTUÆ AND THEIR VARIETIES

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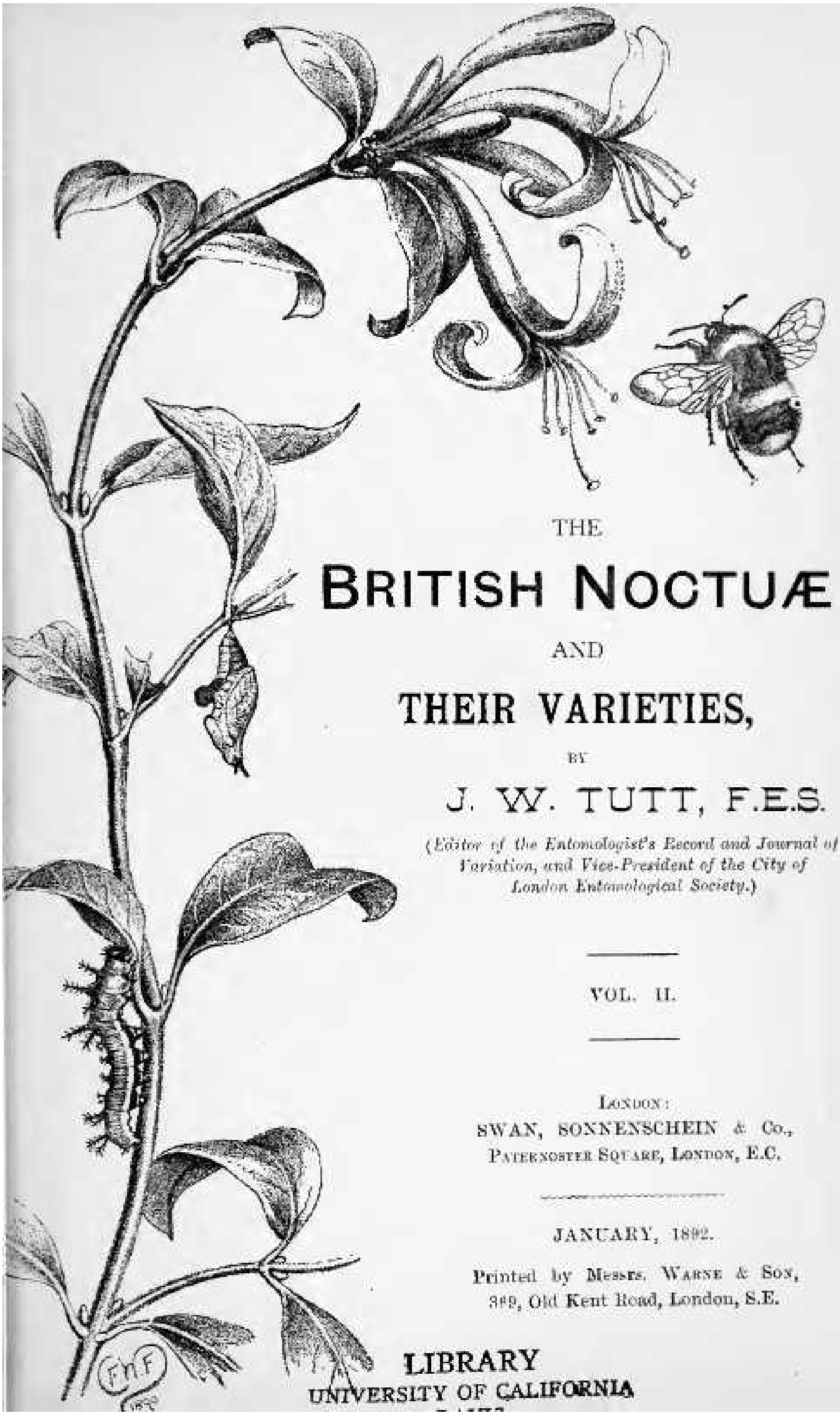

THE

BRITISH NOCTUÆ

AND

THEIR VARIETIES,

BY

J. W. TUTT, F.E.S.

(Editor of the Entomologist's Record and Journal of Variation, and Vice-President of the City of London Entomological Society.)

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INTRODUCTION.

In the introduction to Vol. I of this work, I referred shortly to the extent and probable causes of variation in the NOCTUÆ, and do not now propose to travel further in the same direction, but rather to extend the view over a few particular points not then dealt with. There are, however, one or two suggestions previously mentioned which have received valuable confirmation during the last few months, and to these I will briefly refer.

In the introduction to Vol. I., pp. xv-xvi., I referred cursorily to disease, as being a potent factor in producing variation, generally in a direction tending towards melanism. Mr. Merrifield, to whom we are greatly indebted for some valuable experiments relating to the influence of temperature on pupæ in producing colour variation in the resultant imagines, has made further experiments this year, one of the species operated on being *Vanessa urticæ*. I was fortunate in being present at the meeting of the London Entomological Society when these specimens were exhibited, and my idea that the darkening produced in Mr. Merrifield's experiments was due to some form of disease received the fullest confirmation. The specimens exhibited did, certainly, display a fair amount of variation, and those which had been exposed artificially to the greatest and most continued cold were the darkest, but, at the same time, with scarcely a single exception, were all more or less deformed. The result of the application of artificial cold here becomes self-evident. The suspense of the vital functions, at a time just previous to emergence, when they should be most active, undoubtedly affects injuriously the constitution of the pupæ, the resulting imagines, if any, being deformed, ill-developed as to scale structure, and may become rather paler, or darker according as the retrogression naturally tends towards a paler or darker coloration. The influence of excessive artificial cold, in producing variation is now comparatively clear. It appears to be entirely indirect, and simply acts by producing a diseased condition in the pupa, and a resultant imago more or less deformed. It also appears to prevent the proper formation of pigment and hence produces, as it were, an excess of non-pigmental scales at the expense of the normal ones. The general obsolescence of characteristic colour and markings, in those species which are essentially Arctic, is now explained, as we see that the vital functions are less active and therefore not so capable of developing scale and pigment. In some butterflies, the resulting influence differs from that in some moths, as the influence of "natural selection" is generally so essentially diverse in the two groups; and the result of retrogression is also different. As an illustration of what I mean, it may be safely assumed, that the red-brown of *polychloros* and the bright red of *urticæ* are both equally developed through yellow. Both are almost equally soluble as pigments, passing through yellow to white, and their pigments readily bleach, although the brighter red of *urticæ* is perhaps more rapidly soluble, showing that the greater elaboration tends to greater solubility. Strong ammonia dissolves the red of *urticæ* very speedily. It results, therefore, that the brighter colour of *urticæ* is due to a fuller, and probably more rapid, development of the pigment in the pupal stage, and that, if the formation in the pigment in *urticæ* be stopped in the process of its development from the pigment-producing material, that the less perfectly developed colour would result. Further than this, since we must assume that the waste product which is to form the pigment has been stored up in the larval stage, and simply undergoes elaboration in the pupal stage, it follows, that the less highly developed colour, *i.e.* the one which is produced by the least elaboration, must be the result in those instances where the vital processes are for the time being, stopped, as is undoubtedly the case when the pupæ are subjected artificially, or otherwise, to a very abnormally low temperature. This would readily account for the production of the dull coloration in the ill-developed *urticæ* before mentioned, and the tendency of the dark ground colour to occupy the space usually filled up by the pigmentary structures.

That the apparent result will not always be the same in different species, and that sometimes this incomplete development of pigment may tend to produce a duller (darker?) and sometimes a paler imago, is readily seen; but, it is clear, that in all cases, an obsolescence or tendency to obsolescence of positive markings must ensue. For example, the pigment may be produced in scales having a base or framework of white or black (or, in fact, any other colour). In other words, the colour of the scale is independent of the colour of the base. Now, if we dissolve all the pigment from the yellow portion of the wing of *Colias edusa*, the resultant wing is white, whereas, if we dissolve the pigment of *Vanessa io*, the resultant colour is black. Hence, a retrogression of, or failure to develop pigment in the former, must, I think, tend to produce dull, whitish specimens; the retrogression in the latter to produce black specimens with a more or less diaphanous tendency. The normal colour of the basement structure of the wing must, therefore, have a considerable influence on the net result.

In the same way, it results that retrogression in the case of *Vanessa urticæ* ends in darkening the ground colour, in other words, of increasing the dark at the expense of the bright colours of the wing, and also frequently in the simultaneous change of the bright *urticæ*-red into an approach to the duller *polychloros*-red. On the other hand, I consider the black form the most highly developed pigment coloration, in a species like *Tæniocampa instabilis*. It has reached this form through brown, red and ochreous from white. Here, then, retrogression would tend to produce a pallid coloration, thereby having a diametrically opposite tendency, in a gradual change, from what results in *Vanessa urticæ*.

To refer to another point. In the Introduction to Vol. i., p. xiv. I just mentioned that Lord Walsingham had suggested that any cause tending to lessen the proportion of chemical rays of the sun reaching the earth in any particular locality, might influence the colour of lepidoptera. Mr. Merrifield, by feeding larvæ under differently coloured glasses, and by filtering light through bisulphide of carbon &c., attempted to get some results in this direction. When giving an account of his experiments to the Entomological Society of London on December 2nd last, he said his results were absolutely *nil*. Mr. Poulton, who had similarly experimented on larvæ of *Gnophos obscurata*, reported equally negative results. This fully bears out my supposition when I stated in my work on 'Melanism and Melanochroism in British Lepidoptera,' p. 50,—"At present I am unable to see any connection between cause and effect in this direction."

With regard to the coloration of lepidoptera, we now come to a most interesting branch of our study, and, at the outset, we may classify the colours under two heads. The colours produced simply by interference &c., of light waves on the surface of the wings = non-pigment colours; those produced by the light entering the scales and being partly absorbed and partly reflected, the resultant colour being given by the reflected portion = pigment colours. I have seen the unhappy term "physical," occasionally applied to the former class, as if both classes be not in reality physical colours. It is probable that every shade of colour exists in some insect or other, both as a pigment and non-pigment colour, not even excluding white and black, and that although in almost all cases the natural evolution of colour has been from white, the result is frequently obscured by the colour being developed in or on normally black scales, or in or on a scale which is normally some other colour than white, and where retrogression in colour appears to travel not towards white, but undoubtedly towards black, and hence the essentially different results frequently met with, when our premises appear to warrant us with expecting at any rate a somewhat similar result. It is difficult, too, at times to differentiate clearly between a pigmentary and non-pigmentary colour, and transitions are very frequent in a state of nature, *i.e.*, of essentially non-pigmentary coloured species presenting traces of pigmentary development, and it is not always clear whether this should be looked upon as a progressive or retrogressive development. But I think, in almost every instance, it is a progressive development, when normally non-pigmentary species (or rather scales) develop pigmentary matter.

Pigment is now generally considered to be essentially a waste product. The excess, or otherwise, of the food may, in this way, have some direct action on the general coloration, especially in the shade &c., developed. The kind of food, so far as relates to its chemical composition, I believe to have but little, if any, action whatever, and this I fully explained some time since in 'Melanism and Melanochroism in British Lepidoptera,' pp. 58-60. It seems impossible that this should be so, because the vital processes of assimilation taking place in the larva, change the vegetable into animal tissues and thus decompose the food into its various constituents, elaborating that required into its own tissues, and excreting the remainder as waste. When we come to consider the quality and quantity it is different, and an excess of food with a consequent excess of waste in the tissues may, and probably does in most instances, become converted into pigment-producing matter. An illustration of this kind has come under my observation. Some years ago, I bred and interbred *Selenia illustraria*, and I must own that I was very careless as to food (both quantity and quality). The result was that the brood "ran out," became very small, and what should have been the richly coloured spring brood, differed but little in coloration from the less highly coloured summer brood. I know of