MELANISM AND MELANOCHROISM IN BRITISH LEPIDOPTERA

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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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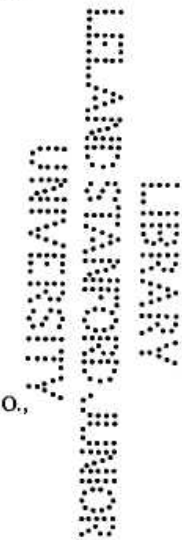

MELANISM AND MELANOCHROISM IN BRITISH LEPIDOPTERA.

"MELANISM" in Lepidoptera is a subject which has now and again been brought before the entomological public, and discussions as to its origin and distribution have occasionally taken place in the British entomological journals. In these discussions, the subject was generally treated from an insular point of view, until Mr. Dobrée (*Entom.* xx., pp. 25–28) endeavoured, by comparing our melanic forms with the forms of the same species obtained on the Continent, to correlate the facts obtained, and to show the real relation that not only our melanic, but also our ordinary forms bore to the Palæarctic lepidopterous fauna, and to deduce reasons for the melanism so prevalent in our British forms. In dealing with melanism it is advisable in the first place to bear in mind what we include in that term. Melanism, properly speaking, refers only to an increase in the quantity of actually *black* markings at the expense of any other colour. It has not been customary, however, to base or confine our arguments to this restricted view of the subject, but any darkening of the ground colour, whether black or not, has been included in a general way in the term. However, as this was not strictly correct, Dr. F. Buchanan White (*Ent. Mo. Mag.*, vol. xiii., p. 145) suggested for this general darkening of the ground colour the term "melanochroism," whilst the opposite phase of variation, the development of a paler pigment at the expense of a darker, he called "leucochroism." Thus, *Amphidasys betularia* var. *doubledayaria*, is a case of true "melanism." The development of buff and yellow coloration, instead of white, in *Arctia menthastri* is a case of "melanochroism." It will be seen that most of the cases referred to in the discussions on "melanism" are really not true melanic forms, but really melanochroic forms, because

the species are but rarely suffused actually with black, although there may be a great deepening in the ground colour, the depth of the colour being, however, frequently increased by a colour other than black. A good example of "leucochroism" is that of *Arctia plantaginis* var. *hospita*. In this variety the orange of both the anterior and posterior wings is replaced by white.

I believe Mr. Cockerell was the first entomologist who attempted directly to connect certain forms of melanic variation with an excess of moisture, although in the *Ent. Mo. Mag.*, vol. xiii., p. 148, Dr. Buchanan White stated most explicitly that he believed the exciting cause of melanism was to be looked for in certain meteorological conditions. However, a paper that Mr. Cockerell read before the members of the South London Ent. and Nat. History Society (*Transactions S.L.E. and N.H.S.*, 1887, pp. 103, 104) caused me first to give particular attention to it. It struck me at once that a great deal of the melanism and melanochroism of our Islands could be better explained by this theory—in combination with "natural selection,"—than by any other that had been presented to us. Our greatest authority on Continental NOCTUÆ, Mr. N. F. Dobrée, wrote an article (*Entom.* xx., pp. 25–28), previously referred to, disproving the general notion that melanism was characteristic of high latitudes, and pointing out the following facts:—(1). That melanism scarcely ever occurred in such latitudes. (2). That at any latitude, dry open areas produced more brightly and clearly marked forms of lepidoptera, and (3). That the North of Europe produced, practically, no melanic forms, neither did the South, but that the melanism of the Continent was confined almost entirely to certain Alpine districts. This was followed up (*Entom.* xx., pp. 58, 59) by a short article from Mr. Cockerell, who, of necessity accepting Mr. Dobrée's facts, disagreed with that gentleman's deductions and conclusions, and suggested, that the areas where melanism was prevalent were more or less humid, and that humidity had probably more to do with melanism than food or any other cause. Since I have devoted my attention to the matter, the information I have been able to gather helps to confirm Mr. Cockerell's view.

Taking into account the physical geography of Europe, what do we find are its broad, general, meteorological and climatic characters? (1). That the great central plain, comprising Russia, Northern Germany, Holland, Belgium, and

Northern France, is swept by the prevalent east winds, which, having traversed Siberia, are totally devoid of moisture, and that consequently this area has a comparatively small rainfall, and has exceptionally dry air.

(2). That the great central mountain chain, the Alpine-Carpathian range, running through Europe, east and west, has a much heavier rainfall and moister atmosphere, due to condensation, than the great central plain.

(3). That the district south of the central mountain chain, which may be said to border the Mediterranean littoral, is subject occasionally to heavy rainfalls, but has an atmosphere remarkably clear.

Here, then, we have two great areas, one north and the other south of the great central chain, where the air is comparatively dry and clear, and in these areas we find little or no traces of melanochroism, or darkening of colour; but in the more humid mountainous districts we get forms closely resembling our own melanic (but not extreme) forms, as the term "alpine," so frequently applied to mountain forms from the Continent, and to the ordinary forms obtained in this country, testifies.

I would now call attention to the general facts mentioned by Mr. Dobrée (*Entom.* xx., pp. 25–28), where, after citing numerous examples, he states in his excellent paper:—"This at once fixes the fact that melanism is of purely British occurrence, thereby upsetting the assumption of our theorists, that darker colouring and smaller size is a feature of high latitudes," etc. "If we once more return to our starting point—in Central and Southern Germany—and turn our eyes southwards, it will be found that the prominent features of lighter colour and fainter markings of high northern latitudes again become apparent," etc. "The absence of melanism in Continental Europe is not, however, without its exceptions, for in the high Alps of Switzerland, Styria, and Carniola it occasionally appears," etc. "The inference can be drawn, that melanism is primarily due to the peculiar geographical position of these Islands."

Before dealing with the peculiarities of the meteorology and physical geography of the British Islands, I should like to quote a remark made by Dr. White (*Ent. Mo. Mag.* iv., p. 248), where he speaks of the peculiarity of the fauna and flora of Western Scotland, although not then referring to variation. He writes:—"No one who has studied the

'*Manual*' can have failed to have noticed a great similarity between the fauna in the Lake District of England and that of Rannoch in Scotland. In the Lake District we have a similar elevated region of lakes and mountains, with a like western situation. . . . . Another fact worth noticing about Rannoch is, that while it seems to appropriate to itself most of the Alpine and boreal insects, yet it possesses but few (and these the commonest) Alpine plants; while the neighbouring district of Breadalbane, lying immediately to the south, has more Alpine and boreal plants than any other place in Britain, and yet but few Alpine and boreal insects. Breadalbane, however, has higher mountains and less wood, which may perhaps account for the difference." I would point out how conclusively in this extract Dr. White proves that food has nothing to do with the peculiarity of the Rannoch, or, in a wider sense, the Alpine fauna. Generalising, we find Dr. White again writing:—"Botanists are aware that the plants of the west coast are less brilliantly coloured than those of the east; and I think that it is in the west rather than the north that melanochroism in British insects may best be studied."

The excellence of these observers is beyond question, and the extracts quoted will, I believe, help me to make clear my argument.

I have already given a brief summary of the general meteorological and climatic conditions of the Continent, and shown the limited extent of melanism existing there. I would now turn to our own country and examine its peculiar climatic and meteorological conditions, and compare them with those of the Continent. The following appear to be the chief points to which attention should be directed:—

(1). The first thing that we must notice is the fact that our climate is strictly insular, with an average temperature of 40° to 60° F., with very few extremes of either excessive heat or cold. On the Continent great extremes are registered.[1]

(2). The meteorological conditions of our Islands are governed almost entirely by the influence of the Gulf Stream.

[1] In Keith Johnston's *Physical Geography*, pp. 52 and 53, we find:—"Our climate in the British Isles is a decidedly maritime one; its average temperature ranging from about 40° F. to 60° F. In Central Asia, however, in the same latitude, and at the same height above the sea, the average temperature ranges from about 0° F. in winter to about 70° F. in summer. The temperature of the British Isles surrounded by the sea thus varies only 20° on an average during the year, but that of the centre of the Continent in the same latitude changes to the extent of 70°."

This Stream, which is a warm current with an average temperature of 30° F. above the surrounding ocean, is a branch of the Atlantic equatorial current. After passing round the Gulf of Mexico, the Gulf Stream runs round Florida into the Atlantic Ocean, skirts the eastern coast of the United States for some distance, and then strikes off in a north-westerly direction across the Atlantic towards Britain and Scandinavia. As I have stated, its temperature is generally much higher than the surrounding ocean, hence there is always a great deal of vapour rising from it. This vapour, therefore, affects the atmosphere over this current, and renders it moist and humid.

(3). The prevailing winds in Britain are from the south-west. These winds blow over the Gulf Stream; hence in their course they become exceedingly humid, and laden with moisture before they strike our western shores.

(4). The easterly winds, which blow from the icy plains of Siberia, are so extremely cold that almost all the moisture has been condensed before they cross the Continent of Europe. The North Sea is too narrow to modify them to any very great extent; hence they strike on our shores as dry, piercing winds, and thus affect our eastern coast in a contrary direction to the prevailing south-west winds, and so help to counteract and modify the influence of the latter.

Now let us combine Nos. 2 and 3 above. The moisture which has been obtained by the south-west winds in their passage across the Gulf Stream is driven by them over our western shores. The air has to rise to cross our hills and mountains, and falls as rain. As the wind comes on, it loses more and more of its moisture, until, by the time it reaches our eastern shores, the quantity of moisture is comparatively small. Hence we find that the west coasts of our Islands have excessive annual rainfalls—sometimes from 70 to 80 inches—whilst the average of the south coast is less than 20. Not only is the rainfall of our west coasts heavy, but the air is much more humid than that of the east.

But it must not be supposed that the climate of the east coast is not modified at all by the Gulf Stream. The humidity of the air on the east coast is much greater than on the Continent, where the prevailing winds are east or north-east, and even the easterly winds are slightly less dry than when they cross the Continent, as the North Sea, narrow as it is, has some little effect in modifying them in this way.

Summarising the result, we find—(1). That North and North-western Scotland and Ireland are the most humid districts in Britain; Eastern and Southern Scotland, North-western England and Wales following; the Midlands next; and the South and Eastern parts of England least humid of all. (2). That our least humid areas are much more humid than areas in corresponding latitudes on the Continent, and all high-lying areas have a greater rainfall than low-lying areas in the same districts.

I would now direct attention to a few facts relative to the distribution of melanism in this country.

Mr. Percy Russ has shown us that a very great number of remarkable cases occur on the west coast of Ireland. At Sligo a very large number of species are melanic, and probably this is more noticeable among the NOCTUÆ than any other group. The greater part of Ireland is comparatively unworked. Collectors have from time to time stayed at different places, and have at various times compiled lists of the different species that have come under their notice, but this method fails almost entirely in giving us scientific results. The energy of our professional collectors has opened up to us the wonderful melanic variation so frequent in the Hebrides and other islands of our western shores, and also those from the Northern Shetlands and Orkneys, where moisture reigns supreme. Professionals and amateurs alike have recorded the variation and general tendency to melanism in the Rannoch district. Aberdeen, Perth, Dundee, and Glasgow have each their own body of active workers, and Lancashire and Yorkshire have long boasted a large proportion of the leading lepidopterists of the United Kingdom, and these have given us an immense mass of information relative to the melanic variation in their various districts. Most of these districts have an exceedingly humid atmosphere, and they produce a greater or less number of melanic forms, but the most intense forms are undoubtedly from the west coast of Ireland, the Scotch Islands and Highlands, where the humidity of the atmosphere is most excessive. There is a great deal of difference between the degree of melanism on the east and west coasts of Scotland. Repeatedly we hear that "the fauna of the east coast is less Alpine than that of the west." With regard to the distribution of melanic forms in Britain, I will again quote Dr. White. He writes:—"That there is frequently a difference between *South* England and