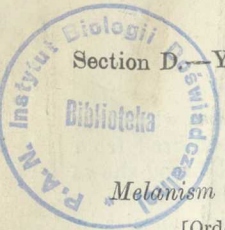


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Melanism in Yorkshire Lepidoptera. By G. T. PORRITT, F.L.S.

[Ordered by the General Committee to be printed *in extenso*.]

I HAVE undertaken to introduce the subject of melanism in Yorkshire Lepidoptera to the members of the Zoological Section, chiefly with a view to eliciting discussion on a subject which I feel, notwithstanding all that has been said and written upon it, we really know very little about. I may say at the outset, that I have no definite theory as to the cause of melanism to advance myself, and probably I have very little that is new to bring forward respecting it. But as Yorkshire, with parts of Lancashire, is essentially the home of this phenomenon, it was thought that a meeting of the British Association in the county ought not to be allowed to go by without some reference to it.

I need not explain to a zoological audience that by the term melanism as applied to Lepidoptera we mean an increase or substitution of black on the wings or body, or on both, at the expense of some other colour. Melanochroism, as you know, is the substitution or darkening of some colour other than black; but I have no intention of more than alluding to that, because we see comparatively little of it in Yorkshire; beyond the fact that species generally have a greater depth of colour than the same species elsewhere; but, so far as we know to the contrary, that has always been so. Some allusion will be made to leucochroism, which is the tendency in directly the opposite direction to melanism, because, although they are few, we have some marked examples, which must necessarily be taken into account in a discussion on melanism.

It is now five-and-twenty or more years since West Yorkshire lepidopterists began to notice that various species of which a black, or nearly black, specimen had occasionally been taken were producing these dark forms in increasing numbers, some of them rather rapidly. Years before then, indeed, a quite black form of the old familiar pepper moth, *Amphydasis betularia*, was well known; but although it had developed within the memory of the present generation of entomologists, it remained for years practically our only representative of real melanism. Even within my own collecting experience it was regarded as good fortune to find one among the ordinary black-and-white 'peppered' form. Now, it is not only the dominant form, but in the South-West Riding area has practically altogether ousted the original pale form. In the Huddersfield district I have only seen one pale specimen during the past nine or ten years, and a typical specimen is now quite a rarity compared with what the black form was even in my collecting experience. More recently the black form has spread all over Yorkshire and many parts of Lancashire, and is even occasionally taken in the South of England. It is most curious, too, that in this species the black form appears to have developed suddenly; *i.e.*, it was not a gradual darkening, as no intermediates were noticed in a wild state. True, our old ordinary form was rather more densely peppered, and so was darker, than was the southern type, and it often lacked the distinct zigzag black line which, to my mind, gives to many of the South of England specimens so much prettier an appearance; yet the fact remains that the specimens taken at large were, and still are, either black or, comparatively speaking, quite pale. I do

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not overlook the fact that our collections do contain specimens which are intermediate, but these I believe have mostly, if not all, been bred from the egg (I have bred some myself), and only an occasional brood shows them, and artificial conditions may have had something to do with it.

Besides *Betularia*, we have now in Yorkshire at least thirty species in which melanism has become so strongly developed that in various districts—chiefly in the south-west—black or nearly black specimens of species which in other districts are pale are now regularly obtained. These are :—

Odontopera bidentata	Acronycta megacephala
Phigalia pilosaria	Acronycta ligustri
Boarmia repandata	Acronycta rumicis
Tephrosia biundulata	Acronycta menyanthidis
Fidonia atomaria	Xylophasia polyodon
Venusia cambricaria	Apamea oculea
Hybernia progemmaria	Miana strigilis
Oporabia dilutata	Agrotis agathina
Larentia multistrigaria	Epunda viminalis
Eupithecia castigata	Hydrocampa nymphæalis
Eupithecia albipunctata	Scoparia mercurialis
Hypsipetes impluviata	Tortrix pyrastrana
Hypsipetes elutata	Sciaphila virgaureana
Cidaria russata	Sciaphila octomaculana
Cidaria immanata	Diurnea fagella

In the following of these—*Hypsipetes impluviata*, *Hypsipetes elutata*, *Acronycta rumicis*, *Xylophasia polyodon*, *Apamea oculea*, *Miana strigilis*, *Epunda viminalis*, and possibly one or two others—the melanism is *not* of recent development. They have been dark in Yorkshire ever since any interest was taken in Lepidoptera, and consequently, whether they were originally pale with us we are now unable to determine. The others have become dark, or at any rate the dark specimens have largely increased in numbers, during the collecting experience of many of our present-day lepidopterists. More than this, there are at the present time quite a number of species of which specimens so much darker than the typical forms are so frequently taken as to indicate that they too are being influenced towards the same end. These include :—

Hepialus hectus (the female)	Xylophasia rurea
Arctia fuliginosa	Agrotis segetum
Arctia mendica	Agrotis tritici
Arctia lubricipeda	Polia flavocincta
Bombyx quercus (var. callunæ)	Polia chi
Ennomos fuscantaria	Agriopsis Aprilina
Abraxas ulmata	Aplecta nebulosa
Hybernia aurantiaria	Hadena dentina
Hybernia defoliaria	Cloantha solidaginis
Eubolia palumbaria	Scoparia cembræ
Cymatophora diluta	

and probably many of the Micro-lepidoptera. In two or three of these, however (not more), the darkening is more melanochroic than truly melanic.

It is not necessary for our purpose to-day to detail the histories of all these melanic species; still, remarks on some of the more prominent may tend to elucidate the subject.

As before stated, melanism was known in *Amphydasis betularia* long before it was observed in any other species; then it seemed to develop in

several almost simultaneously. These were *Phigalia pilosaria*, *Tephrosia biundularia*, *Hybernia progemmaria*, and *Diurnea fagella*. In three of these, and probably in *Diurnea fagella* as well, the darkening was gradual, but fairly rapid; and in the case of two, and probably of all the three apterous species, the females were the first to succumb to the darkening influence. The melanism in these four species dates back probably to about 1880; but I am less sure about *Diurnea fagella* than the others, as, not being so much interested in Micro-lepidoptera, I had scarcely noticed this species critically for many years prior to 1886. Twenty years or so before then, however, *Fagella* was very familiar to me as the pale grey 'March Dagger' moth, the males of which sat in plenty on the tree trunks in our woods. But in the spring of 1886, wanting a series of the moth, I one evening (on April 27) went after dark into a small wood just outside the town of Huddersfield, and very soon picked off the oak trunks 120 specimens, of which probably 50 were females, and out of the lot two only, one of each sex, were of the pale type. Both sexes were in profusion on the tree trunks, but practically all dark. Of *Phigalia pilosaria* and *Hybernia progemmaria*, I fancy the females were almost all black for some time prior to 1886; but certain it is that they were so when we first began to notice that the males were rapidly becoming darker. At first the unicolorous black males were not common, but there were plenty intermediates, and year by year the dark ones increased, and now in the case of *Progemmaria* in some districts largely predominate, whilst in both species it is almost impossible to find one as pale as the southern forms. I believe the same remarks will apply to *Tephrosia biundularia*, but as the species occurs but very rarely in my own immediate district, I have not had the opportunity of noticing it so closely, and so am unable to say whether the females became dark before the males. In passing I wish you to note, because it will probably affect our discussion afterwards, that the apterous females of three of these species do not much affect tree trunks in the daytime. The males of two of them do, and of *Progemmaria* a very few do. An occasional female of any of them may now and again be found in such situation, but probably not near one per cent. of what may be found after dark with the aid of a lamp.

The next species to startle us was *Boarmia repandata*, in 1887. In that case Mr. George Kilner Crosland and myself, when working one afternoon in a pine wood near Netherton, Huddersfield, found the species freely on the pine trunks, a large proportion of the specimens evidently having been black, but, having been out some time had then a somewhat shabby appearance about them. From specimens boxed, however, eggs were obtained, which produced in 1888 a series of moths which, without any exaggeration, were as black as ink, though a large number of the brood were of a very dark brown colour. Since then the black form has become quite common in several woods in South-west Yorkshire, and larvæ collected indiscriminately in these woods in spring now produce, I believe, a considerable preponderance of black or nearly black moths. I must state here, however, that this form was certainly not new in 1887, for in a store-box of Huddersfield-collected moths, and which I have no doubt were quite fifty years old, I found some years ago two worn specimens of what undoubtedly had been black *Repandata*. The man who collected them (now dead) had a cabinet and collection, but I believe I am right in saying that all the specimens of *Repandata* in his series were ordinary; and whether these two dark ones had been considered as too bad to put

in, or had been in and afterwards thrown out, I do not know. But it proves, at any rate, that there was long ago a latent tendency in the species to become melanic, and that it is quite possible it may even have been common long before we noticed it.¹

A moth which for thirty years of my collecting experience was always regarded as one of our most constant species, showing little colour variation, was *Odontopera bidentata*, the Yorkshire form being of a soft, rather pale greyish brown colour. But about ten years ago came the report from Wakefield that a quite black specimen had been taken there, followed during the next several years by a few others. Now, at Wakefield, and at Methley some six miles away, it is quite plentiful, so much so that Mr. George Parkin, who resides in the city of Wakefield, told me that last year, in one week, out of the only five specimens which flew into his house, attracted by the light, four were black, and that so rapidly is the form increasing, he thinks that in a few more years the pale form will be quite eliminated! This, too, may be regarded as a sudden rather than a gradual change, for although a few rather darker than ordinary examples do occur, they cannot be regarded as even intermediate forms. In 1904, from a few eggs deposited by a captured black moth, I bred nine specimens, six of which were black and three ordinary. From the black moths in the following year, 1905, I reared a very large brood, about 75 per cent. of which were black; and from them again this year I bred a considerable number, of which the percentage of black was still greater. Three generations thus produced an almost entirely black race, which proves that the hereditary tendency towards melanism must be remarkably strong.

The history of the melanism of *Polia chi* shows a gradual darkening from almost white to dark slate colour, and is interesting as occurring in the first Noctua we have yet considered. It is, too, a case of specially local melanism, inasmuch as in my own district, at any rate, although occurring very markedly on the walls all around the town and surrounding villages of Huddersfield; on the equally black, or even blacker, walls bordering our high moors, only half a dozen or so miles away, almost all the specimens are of the palest form and can readily be seen from a considerable distance. This fact should be noted for our after-discussion.

Perhaps the most rapid case of change in colour we have yet noticed has been in *Larentia multistrigaria*. The species has always occurred in abundance in my own district, but up to about 1895 a dark specimen had never been observed in it, although a single black example—and one only—was known to have emanated from the district. Now nearly forty years ago the late Henry Doubleday wrote to the late James Varley, formerly a prominent lepidopterist in Huddersfield, for eggs of *Multistrigaria*, and I distinctly remember Varley telling me that from the eggs he had sent him Mr. Doubleday had bred a black *Multistrigaria*, and the specimen, I believe, is still in the Doubleday Collection at Bethnal Green Museum. Here we have another instance of the latent tendency to melanism, which in this species was not really developed until over thirty years afterwards.

In ten years' time the black form has so increased in numbers that Mr. Morley tells us that in some parts of the Skelmanthorpe district the

¹ Cf. Porritt, *Trans. Ent. Soc. London*, 1889, pl. 441, p. xiv., on melanism in *Arctia mendica* near Huddersfield.

race will evidently soon be entirely black ; and my own experience in another part of the Huddersfield district strongly supports Mr. Morley's opinion. In captivity, as in *Bidentata*, three generations have almost entirely eliminated the typical form, for of some seventy specimens I bred in the spring of this year only five or six were pale. Now mark, *Multistrigaria* does not affect either tree trunks or walls in the daytime. Indeed, there are no trees on the spot I collect it at Huddersfield. It frequents old meadow hillsides overgrown with its food-plant, the white-flowering *Galium saxatile*, and although at night with the aid of a lamp many may be found sitting on the boundary walls, only a very occasional specimen can be found in such situation in the daytime, probably not one in five hundred of the specimens which we know are actually in the immediate neighbourhood. They hide apparently among or underneath the *Galium* and surrounding grasses, and are absolutely out of evidence until dusk.

One of the most recent cases of melanism, so far as our knowledge goes, is that in *Venusia cambricaria*, and it is specially interesting because it takes two distinct forms in widely separate districts. The form first noticed was by Mr. T. A. Lofthouse in a wood in the Cleveland district, and consisted in a large increase in the black on the ordinary pale ground of the anterior wings, the hind wings being almost normal. Mr. L. S. Brady afterwards turned up in a wood near Sheffield a form in which the markings are normal, but on a deep lead ground colour, which colour pertains to both fore and hind wings. Mr. Brady took me to this wood last year, when the moth was out in plenty, and I think quite 80 per cent. were of the melanic form ; the percentage of the Cleveland form I understand is almost as large. Both forms are distinctly melanic, but it is curious and remarkable that the melanism should take altogether different directions in the two districts.

Our most recent find of melanism is that of *Agrotis agathina*, which was only noticed last year. In June, on a small isolated heath on the outskirts of Huddersfield, Mr. B. Morley collected a number of larvæ of the species, and from them he bred fifteen moths which were altogether much darker than anything we previously knew in the species. That particular piece of moorland had never previously been worked, consequently we know nothing as to how long *Agathina* had been black on it.

Certainly one of our most puzzling cases of melanism is that of *Acronycta menyanthidis*. The normal form of the species is greyish white with black markings, but on the heaths near Selby and York, where there is little other melanism, a quite black form is plentiful. The curious feature is that although the species is abundant right in the area of the most pronounced melanism in South-west Yorkshire, the specimens there are invariably of the palest form we know, and a black one is never seen. Mr. Samuel Walker tells me that at York no specimen is ever seen so pale as the West Yorkshire moth.

Before leaving the cases of Yorkshire melanism I ought to allude to one—one also of our oldest—in which there has been *no* increase in numbers. I mean *Abraxas grossulariata*. A very striking, almost black, form of this abundant and well-known moth (our common garden Magpie Moth) was bred in some numbers by Mr. James Varley, of Huddersfield, as long ago as 1864, and has occurred very sparingly in the same and other South-west Yorkshire districts ever since, but is still as rare as it was forty-two years ago. Indeed, the variety *Varleyata*, for

such it was afterwards named, is to-day one of the greatest prizes a lepidopterist can obtain.

Unless melanism is a distinct disadvantage to this moth, there seems to be no apparent reason why it should not have increased as much and as rapidly as any of our melanic species, because I have proved, only this season, that its hereditary tendency is stronger than in any other with which I have experimented. At the end of June last year I was fortunate enough to get a pairing from fine examples of the variety, bred from wild larvæ, and from the eggs deposited, in June this year I reared a considerable brood of the moth. Every specimen, without exception, was of the extreme form of *Varleyata*. Now, even in its few known localities (for it does not appear to occur at all in most places, even in the districts which have produced it), the specimens reared by collectors only average about three for every thousand larvæ; so it is highly improbable that both parents of my last year's pair of moths were variety *Varleyata*—possibly neither of them were; yet not a single specimen from my brood showed the slightest inclination to revert to the ordinary or any other form than *Varleyata*. This has never occurred to me in any other species.

Of course melanism is not confined to Yorkshire and Lancashire. There is plenty of it in Scotland, although generally, Scotch insects are paler than the same species in Yorkshire. *Rusina tenebrosa* at Rannoch is much darker and smaller than is the Yorkshire insect. Black *Xylophasia polyodon* are more plentiful in Scotland than in Yorkshire. Several species are melanic in the Shetland Isles which are normal in Yorkshire—notably *Noctua glareosa*, which, almost black there, is pale slaty grey or pale pink or rosy in Yorkshire. I have seen one Yorkshire specimen, taken near Barnsley, of exactly the darkest Shetland form, so possibly the species here is in process of development towards melanism. I can only say, however, that, with the exception of the specimen alluded to, I can see no difference as yet in the species compared with what it was thirty years ago. Melanic *Dianthæcia conspersa* are common in the Shetland Isles, but quite normal in Yorkshire; the species, however, does not occur in the south-west of our county, and so not in the area of melanism. In Delamere Forest, Cheshire, a black form of *Aplecta nebulosa* has been known as plentiful for some years, but although the species has apparently been increasing in depth of colour for some time, the extreme black Delamere form, variety *Robsoni*, was only noted here for the first time last year, when a specimen was captured by Mr. Arthur Whitaker in Haw Park, Wakefield. Delamere Forest, too, produces a very fine melanic form of *Macaria liturata*, which as yet has not been found at all in either Yorkshire or Lancashire, though the species occurs right in the melanic area. Even the extreme south of England has its representatives of melanism. In a wood near Maidstone, Kent, Mr. Goodwin takes a quite black form of *Tephrosia consonaria*, and in the same wood almost black *Boarmia consortaria*, neither of which species are known to be melanic anywhere else. They do not, however, occur in Yorkshire at all; had they done so it is fair to assume they would probably have become black long before they did so in Kent. The genera *Boarmia* and *Tephrosia*, indeed, seem particularly prone to melanism, as, besides the species already alluded to, it occurs in *Boarmia rhomboidaria*, *Boarmia abietaria*, *Boarmia roboraria*, and I have seen it in all the British species of *Tephrosia* except *punctulata*. London has its

own special cases of melanism, the most recent and noteworthy being the fine purple-black form of *Hemerophila abruptaria*, at present almost confined to North London. The black variety of *Eupithecia rectangulata*, black *Boarmia rhomboidaria*, and the darkest *Acronycta psi* are largely London forms, though the West Yorkshire *Rhomboidaria* (variety *Perfumaria*) does strongly approach the London moth.

A few words on Yorkshire leucochroism, inasmuch as it must be considered in its bearings on local melanism, and we will pass on to the immediate object of our meeting this morning. There is little of it in our county, but with the main tendency so strongly in the opposite direction, why should there be any at all?

Perhaps our most remarkable example is *Cidaria suffumata*. A melanic form of the species, variety *piceata*, occurs pretty commonly in Scotland, and ought, judging from all our experience with other species, to be still commoner in West Yorkshire. But it is not—scarcely occurs at all. Indeed, the only West Yorkshire record I know is by Mr. Arthur Whitaker, who found a specimen at Worsbrough, near Barnsley; and it is almost as rare in the other parts of the county. The tendency of the species is distinctly to become paler. Mr. B. Morley, who for many years has had great experience with the species, puts the matter so very clearly that I cannot do better than quote his remarks. He says: 'Last spring I netted a few *Suffumata*, using no discrimination whatever, only for those in the best condition. In due time, when pinned in the cabinet, the difference in comparison with others taken on the same hedgerow seven years ago was very striking indeed. The lighter parts of the wings were more clear, and the central band darker. In the same locality a brighter (*i.e.*, paler) form than this is frequently taken, and very rarely the extreme pale form, variety *Porrittii*, is obtained also. It seems probable that the extreme form, now so rare, is in reality the forerunner of what the species will become locally. It may be of interest to note that the dark variety *Piceata*, which occurs in some parts of the north of the county, has never been recorded here. One would expect that the dark form would be the natural variation of the species in this district, where melanism predominates, in comparison with any other variation, especially when it is remembered that the dark variety *Piceata* is by far the commonest form of variation in the species in these islands.' The only locality in Britain, besides the West Riding district, where the pale forms are known to occur is Dover, and it seems unaccountable that in so common and widely distributed a species the variety should not occur between Yorkshire and Kent.

Another Yorkshire leucochroic species is the familiar pine-frequenting *Fidonia piniaria*. Here, and indeed throughout the north of Britain, the ground colour of the wings of the male is pure white, whereas in the south of England woods it is yellow. The species abounds all over the melanic area of West Yorkshire, yet seems to be absolutely proof against any tendency to darkening. Why is this? The same thing occurs with a somewhat closely allied species, *Strenia clathrata*, which, however, does not occur in South-West Yorkshire. It is abundant on the coast at Scarborough, the ground colour, in my experience, being always white, whereas in the south of England it is yellow. Yet that there is a tendency in the genus *Fidonia* to melanism is proved by the common *Fidonia atomaria* occasionally being black in South-West Yorkshire.

¹ *Naturalist*, February 1906, pp. 48-9.

Enough has probably been said as to the indisputable fact of melanism, and it is time to get on to our discussion as to the 'Why' and the Cause or Causes of the phenomenon. As we all know, the generally accepted theory as to the 'Why' is that it is a means of protection. But is it really a protection? And from what? We have been told over and over again that birds are the natural enemies of our moths, and that the pale forms, being so much more conspicuous on our darkened tree trunks, the birds pick them off, and the darker specimens, being less conspicuous, are more likely to escape detection, and so escape in proportionately greater numbers, and are left to perpetuate still darker forms. But *do* birds feed to any extent on moths? My own experience certainly does not warrant any such conclusion. Many lepidopterists here will bear me out when I say that if, in an early morning's walk in the woods, one espies any moth, however pale and conspicuous on a tree trunk, and does not happen to have a box in his pocket, it may safely be left there until towards evening, when one has time to fetch it. In ninety-nine cases out of the hundred the moth will be there just as when left in the morning, notwithstanding that the wood may be alive with insectivorous birds. Birds, as we all know, feed largely, many species almost exclusively, on caterpillars, and I have always maintained that the chief use of the Lepidoptera in the economy of Nature is to provide food for birds as larvæ; but if the birds fed on the moths themselves, would it not be a case of 'killing the goose that lays the golden eggs?' You may go on to one of our heaths on a fine late afternoon or early evening, and see the place absolutely alive with Micro-lepidoptera on the wing, and at the same time the swallows feeding on the Diptera high up; but they are not taking the moths, which are flying in myriads a few inches above the heather. The only bird I remember which seems to live upon moths is the goatsucker, and he undoubtedly does get rid of an enormous quantity. But the goat-sucker only feeds at night, and always catches his meal on the wing, so the colour assimilation to tree trunks cannot apply to it. The same remark applies to bats, which also account for the slaughter of myriads of moths; but it is only at night, and we can scarcely conceive that a dark moth would have any better chance of escape than a pale one from the eyes of either a goatsucker or a bat. Dragon-flies certainly take moths in the daytime, but they hawk for them and take them on the wing, never, I should say, from a tree trunk. Besides, we have comparatively few dragon flies in Yorkshire, and certainly far less in the melanic area than in any other part of the county. The big green grasshopper (*Locusta viridissima*) is a deadly enemy to moths, but it does not occur in Yorkshire at all. On the Deal sandhills, and on the South Devon coast, I have often seen them perched on the tops of sugared posts, waiting for the moths to come up, and have seen one seize and devour immediately a large *Xylophasia polyodon*. Only last August, on a marshy part of the Deal sandhills, I saw these grasshoppers in profusion perched after dark on the tops of the thistles, deliberately waiting to pounce on the moths as they visited, as they do in large numbers, the thistle flowers. There was no melanism in the moths there, but if there had been it would not have protected them one atom. Hence I cannot see my way to assent to the theory that the primary reason of melanism is for protection against such enemies.

Melanism is with us, strongly, and is still increasing; but what *do* we know as to its cause?

It has been noticed that the areas of melanism are generally in those large manufacturing districts which have a humid atmosphere or heavy rainfall, and hence it has been assumed that smoke and moisture, aided by natural selection, have produced the phenomenon. Mr. Tutt has argued the case from this standpoint at great length in his pamphlet *Melanism and Melanochroism in British Lepidoptera*. No doubt it is true that melanism is almost confined to the western side of Britain—that is, the side most strongly influenced by the Gulf Stream; and also that it is most prevalent in the manufacturing, and consequently smoky, districts of our island. But if smoke is an essential, how are we to account for the numerous and marked examples of melanism in the Hebrides and the Shetlands and Orkneys, where there is no smoke? As we have already seen, extreme melanism occurs there in many species which in the melanic area of South-west Yorkshire are not at all affected by it, and *vice versa*. And if in these districts it is caused by humidity only, why do we find that in the fen and marshy districts of Norfolk and Cambridgeshire, where species absolutely live in fog and damp, and a humid atmosphere as well, there is practically no melanism? I know Mr. Tutt maintains that in the fen districts there is plenty of melanism, but I can only say that, with a large experience of fen collecting, I have never seen it. That there are plenty of dark specimens of such species as *Chilo phragmitellus* among the pale ones I admit, but such are not at all on 'all fours' with true melanism as we understand it in Yorkshire. Again, if smoke and humidity cause melanism in Yorkshire, how is it that in the melanic area some species which we know have a latent tendency to melanism are not there affected by it? That the latent tendency to melanism in *Acronycta menyanthidis* is strong we are sure from the fact that it is developed in extreme form at Selby and York, independent of smoke; but although it occurs right on the spot where numerous other species, including one in the same genus, have succumbed, it remains there absolutely untouched, though its habits in both areas are the same.

An almost analogous case is that of *Noctua glareosa* in the Shetland Isles. There is no smoke there, and still, in apparently similar localities, and with the same habits, melanism occurs strongly in the species. Yet in South Yorkshire, although occurring in plenty with many of our most melanic moths, it retains practically untouched its pale character.

Then, supposing that smoke and humidity *do* cause melanism, we have to face the question as to *how* they cause it. The obvious answer is, of course, that it is natural selection in the first place, followed up by heredity. But surely, if natural selection operated on the few chance specimens which were a little darker than the type, we should have seen a *gradual* darkening in all melanic species; whereas we are pretty certain that in many no such thing has occurred. And it is just here, I think, where our great difficulty lies. After the first dark specimens, if in sufficient numbers, heredity is quite sufficient to account for a rapid increase, if we allow that the darkening is in any way a distinct advantage to the species; for we have proved over and over again by breeding that the progeny of melanic parents have an inherent tendency to become still darker with each successive generation.

I have not alluded to a theory I have seen argued, to the effect that melanism may be a reversion to the original forms of the various species,

because I am convinced we have no reason to believe that at any former time our melanic species were dark ; and if they were, there is still less probability, nay, possibility, that they should revert to such forms, unless the atmospheric and all other conditions of their former existence were again to become the same.

As I stated at the beginning of my remarks, I only undertook to introduce the subject, with a view to eliciting possible theories from others, and if, from the facts I have given, any satisfactory deduction can be drawn, our time this morning will not have been wasted.

