

One day after questioning a group of fishers, I said: 'Supposing now you wished to tell your wives about this bird which you see every day, how would you describe it?' Said they: 'Why should we tell our wives? It is not eatable, and haven't they eyes to see for themselves?' After this I concluded that further inquiry was useless.

In a following article I trust to be able to give some idea as to methods and apparatus for natural-history photography in the hope that some may be induced to take up this fascinating method of nature study, and produce valuable records of the fauna and even flora of the land we live in.

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## MIMICRY IN EAST AFRICAN BUTTERFLIES

WITH SPECIAL REFERENCE TO DANAINÉ MODELS.

BY THE REV. K. ST. AUBYN ROGERS

The name Mimicry is used in a special sense in Entomology. It has been generally accepted as the term for certain interesting resemblances between different insects which cannot be accounted for on the grounds of affinity. Very shortly after the introduction of the natural system of classification by Linnaeus, it was found that very striking resemblances existed between butterflies especially belonging to genera by no means closely allied, and that in many cases these resemblances were confined to the female sex. These resemblances exist in most, if not all, classes of insects, and for many years received no adequate explanation.

In 1859 Darwin's 'Origin of Species' appeared, and one of the first results of the stimulus thus exerted upon all students of Natural History was a Paper by Bates in which these puzzling resemblances received a most ingenious explanation.

Bates collected for many years on the Amazon where the cases of Mimicry are the most numerous and the most remarkable in the world. On his return home he began to study his collection in the light of the new theory of descent by modification under the influence of Natural Selection discovered by Darwin and Wallace.

He soon found that in the case of these particular resemblances there was almost invariably one species which far outnumbered all the others, and, further, that this species was known, or at any rate suspected, to be distasteful to its enemies, and was characterised by conspicuous coloration and a slow flaunting flight, so that, instead of making any attempt to escape its enemies by its activity or by concealment, it seemed to invite attack. On thinking over these striking phenomena in the light of Natural Selection a brilliant flash of insight revealed to him the solution which has been largely accepted since that time. The abundant butterfly generally called the 'Model' was so conspicuous both in its habits and coloration because, so far from being an object of pursuit, it was rather an object to be avoided on account of its nauseous qualities, and its conspicuous colours and slow flaunting flight had been evolved so that it might be immediately recognised and not suffer from experimental tasting, to which it would be exposed if there were no easy means by which it might be recognised amongst the crowd of its palatable companions. The scarcer butterfly, which he called the 'Mimic,' on the other hand escaped recognition in the crowds of the Model and so was not regarded by its enemies as worth the trouble of capture, although were it to fall a victim it would be immediately devoured, whereas the Model would be infallibly rejected even if it were captured. There were, however, many cases of resemblance to which this theory could not apply because they occurred between different genera, both of which were known to be distasteful, or even between different sections of the same genus. These resemblances were attributed by Bates to the common action of the same local conditions, but some years later they received an explanation on the same lines as Bates' earlier work from another naturalist working in South America—Fritz Muller. He found that even amongst distasteful species there was an appreciable amount of experimental tasting by young enemies. These evidently have no instinctive knowledge as to what patterns are edible and what are not, but have to learn by actual experience, and it is evident that their education is assisted by the fact that the distasteful species have invariably a very conspicuous

pattern and are generally ornamented in the same way above and below.

Now if a species is very abundant it can well bear the losses caused by this experimental tasting, but if it is a species of considerable rarity it is obvious that the losses so caused would be a very serious matter to it, for they will be in proportion not to its own numbers but to those of the young enemies who have to be educated up to recognising its peculiar character. Now, if such a rare species should come to resemble another distasteful species of great abundance so that its enemies are unable to distinguish the two, the losses will be shared and will be in proportion to the numbers of the two species, so that the losses which will fall on the rarer species will be comparatively few. Professor Poulton has argued very forcibly for the view that mimicry amongst butterflies belongs mainly to this last which is known as Mullerian mimicry in distinction from that recognised earlier which is known as Batesian mimicry. It is unnecessary to repeat all these arguments here, but it may be said that the 'mimics' are frequently anything but the scarce and hard-pressed species assumed by Bates, and indeed are frequently very dominant species indeed; and one of the best-known African mimics—*Hypolimnas misippus*—in which the female alone is a mimic, not only accompanies its model throughout its immense range but has actually succeeded, in historic times, in invading South America and establishing itself in the most crowded area in the world without the presence of its model at all.

It should be said there is a tendency amongst a considerable number of modern naturalists, particularly amongst those whose studies have been chiefly in connexion with the problems of heredity, to discredit the theories enunciated by Darwin and in particular the phenomena attributed to mimicry which yield them such powerful support. The phenomena which we have been considering are attributed to the uniform action of the same local conditions. These arguments have been met by Professor Poulton in the eighth chapter of his recent book 'Essays on Evolution.' It is not desirable to enter into the numerous arguments and lines of investigation by which he shows that the theory of

local conditions, or as he calls it 'External Causes,' is entirely inadequate to explain the vast array of interesting observations which he records, but it is, perhaps, permissible to quote one pregnant sentence:—'There is something attractive and plausible in the idea that the strong mutual resemblances within a group of butterflies of different genera and sub-families, inhabiting a single locality, are due to the direct action of peculiar local or chemical influences; but the suggestion loses all its attractiveness when it is applied to the resemblance between a spider and an ant, or a moth and a wasp.' That such cases do occur there can be no manner of doubt. Even in England it is well known that there are moths, such as the hornet clearwing, which are deceptively like stinging Hymenoptera, and Professor Poulton has himself figured examples of spiders which bear an extraordinary resemblance to abundant and well-protected ants.

This last is a very remarkable case on account of the profound modifications which are needed in order to produce the resemblance. A spider has eight legs and no antennæ, and in these particular instances two of the legs are held up in such a position as to give the appearance of the antennæ of the ant.

To come now to the more particular subject of the present paper, Mimicry in East African Butterflies. There are certain phenomena, which are indeed common to mimicry all the world over, which are a great help to its study. The models are not distributed indiscriminately in all the families of butterflies but are characteristic of certain genera and even families. The Danaidae and Acraeinae are the models for mimicry everywhere. And although the latter subfamily is peculiarly characteristic of Africa the Daniadae which are comparatively few are far more extensively mimicked.

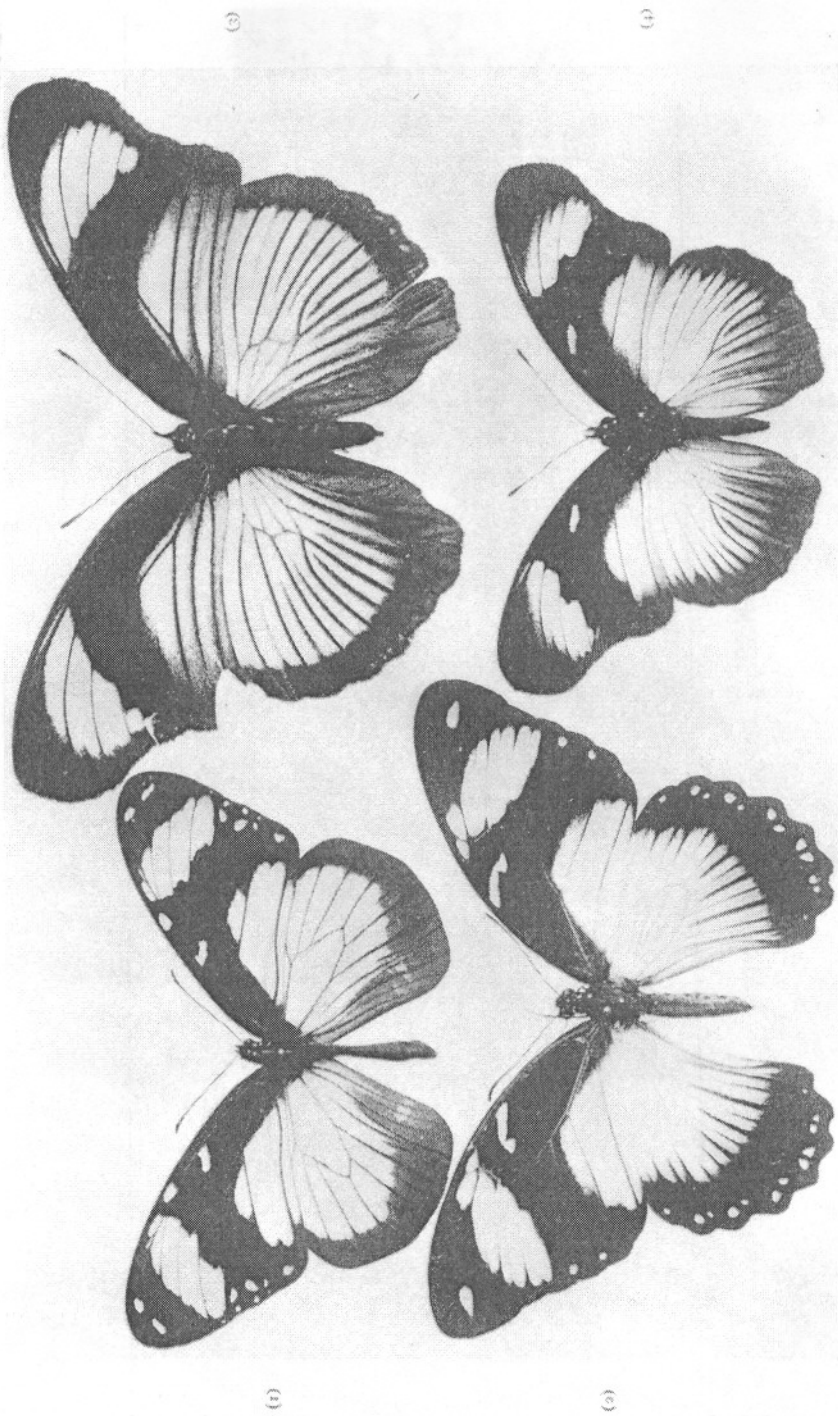
The most abundant and widely distributed of these is *Amnias chrysippus*. This species has been proved by actual experience to be excessively distasteful to many of the enemies of insects. It occurs under three forms, the most usual being a brown butterfly of considerable size with a broad black tip marked with a row of rather large white spots near its junction with the ground colour. The form prevalent in West Africa

has also a large white blotch in the middle of the hind wings, and that prevalent in our own area wants the black tip and white spots, though it sometimes has the white blotch in the hind wings. It is mimicked first of all by the female of *Hypolimnas misippus*, found like its model in India and South China as well as Africa, which has forms corresponding to those of the model. This only applies to the female, the male being a blue-black insect with two large white blotches in the fore wings and one in the hind wings. These forms, however, are not confined to special areas to the same extent as in the case of the model. The plain brown form, for instance, is common in countries where the corresponding form of the model is rarely, if ever, seen. Another mimic which also has three forms like those of the model is *Acraea encedon*, and, in this case, though the mimic belongs to a distasteful genus and is certainly a Mullerian mimic, it is remarkable that its forms in different areas correspond in their proportions to those of the model to a very large extent. In our own area we have one mimic at least which, so far as is known, only resembles the plain brown form and this is another *Acraea*, *A. johnstoni*, which also, as we shall see later, has forms resembling species which are very different from *L. chrysippus*. There is also a rare Lycaenid butterfly, *Mimacraea Dohertyi*, which resembles this brown form, but this may possibly be a variety of *M. Marshalli* which has not yet been recorded from British East Africa. Another very remarkable mimic is *Papilio dardanus*, which is so variable and has so many forms that it has received a whole host of names and is better known as *P. Merope*.

The form resembling *L. chrysippus* is always scarce, though even a form like the plain brown *L. chrysippus* has been recorded from Nairobi. The fact is that *L. chrysippus* is especially characteristic of the open country and is rarely found in forests, while the *Papilio* prefers forests or at least woodlands. Here again the male is a very different insect. It is creamy yellow in colour with a black border in the fore wings and a black submarginal band, often broken up into spots, in the hind wings, and it is an interesting fact that nearly allied species in Abyssinia and Madagascar have females with long tails resembling the five different mimics belonging to very different

families, and though in the case of the two *Acraeas* and the *Mimacraea* the mimics are remarkably smaller than the models the mimetic connexion can hardly be doubted. But this is not all, for there are other butterflies of the genera *Euryphene* and *Euphaedra* in which the females at any rate are very like *L. chrysippus* as well as some day-flying moths, but here the interpretation is rather more doubtful, because these species differ somewhat widely from the model in habits and mode of flight. The fact is that it is characteristic of mimicry all the world over to occur in large associations composed of several different species and not simply in pairs, and it is probable that it is advantageous to all the members that the peculiar pattern should have a wide advertisement, so to speak, so that it may be the more readily recognised and more quickly learnt by young inexperienced foes. *Limnas chrysippus* is one of these species which is the model for mimicry wherever it occurs, and even in Africa there are well-known mimics which have never been recorded from this Protectorate. The most remarkable of these is *Pseudacraea poggei* in which the resemblance is almost closer than in the case of *Hypolimnas misippus*. It is probable that some of the day-flying moths are associated with *Euphaedra eleus*, which I took once at Rabai, in an association subsidiary to the main association, and that they gain advantage from their mutual resemblance as well as from their resemblance, which is palpable though not exact, to the better known and more widely distributed species. It should be remarked that most of the mimics of this group resemble the type form with the black and white tip only, and that these which have varieties corresponding to those of the model are not so numerous and have only been found in Africa.

The next great group which is very abundant in our country is even more complex than the *L. chrysippus* group. The original models, for there are two, are species of the African genus *Amauris*, another genus of the great family *Danaidae*, also known to be highly distasteful. These are *Amauris dominicanus*, the eastern form of *Amauris niavius*, and *Amauris ochlea*. In experimenting with spiders these *Danaidae* were the only species which were rejected, although I tried other well-known distasteful forms including several species of



Alfred Robinson, photo.

THE DANAINÉ.

*Am. danielae*, mimicked by a female *Papilio* and by two *Nymphalides*. (Coast District of British East Africa, 1906.)  
 (1) *Am. naxos dominicensis*. (2) *P. dardanus tibialis*, ♀ *J. hippocoon*. (3) *Eurulia nasuticornis*. (4) *Eurulia wallbergi*.  
 All figures are  $\frac{1}{2}$  of the natural size.  
 By kind permission of the Entomological Society and Prof. L. B. Poston, F.R.S.

*Acraea* and *Mylothris agathina* to which I shall have to refer again.

These two species of *Amauris* are both good-sized black and white insects, *A. dominicanus* being considerably the larger of the two. In this there is a white blotch across the wing from the costa to the hind margin and another large blotch on the inner margin. In *A. ochlea* in addition to the blotch across the wing near the tip there is a much larger band across the wings nearer the body.

Though they have somewhat the same appearance they can readily be distinguished even on the wing, and it will be more convenient to take the principal mimics separately. The closest mimics of *A. dominicanus* are three:—(1) *Euralia wahlbergi* belonging to a genus closely allied to *Hypolimnas*, and (2) *Euralia usambara*, a finer and rarer species, and (3) *Papilio dardanus f. hippocoön*. This form of *P. dardanus* is always more common than any other in tropical Africa, and shows perhaps slighter modification of the male pattern than any other except the primitive females which have been called *Trimeni*, which are the nearest of all. All these species are very like the model, having the two white blotches in the fore-wing and the white hind wings which are characteristic of it, and all are mimetic in both sexes. There is also another species which is a connecting link between these species and those which mimic *A. ochlea*. This is *Euxanthe wakefieldi* which is only mimetic in the female. This has a pattern more like that of *A. ochlea*, except that the large white band nearer the base of the fore wings is more broken up by streaks of the ground colour. On the wing, however, the resemblance to *A. dominicanus* is much closer owing to its being so much larger than *A. ochlea*, and before I was so well acquainted with the species as I am now, I have actually mistaken it for the model, whilst its resemblance to the *Papilio* mimic is even closer, owing to the great development of the submarginal spots in the hind wing, a feature which is altogether wanting in the model. *Amauris ochlea* has also three mimics, all of which belong to the *Nymphalidae*. These are *Euralia deceptor*, of which the male has had the name of *kirbyi* given to it, *Pseudacraea lucretia* in one of its forms, and *Euxanthe tiberius* which is only mimetic in the female.

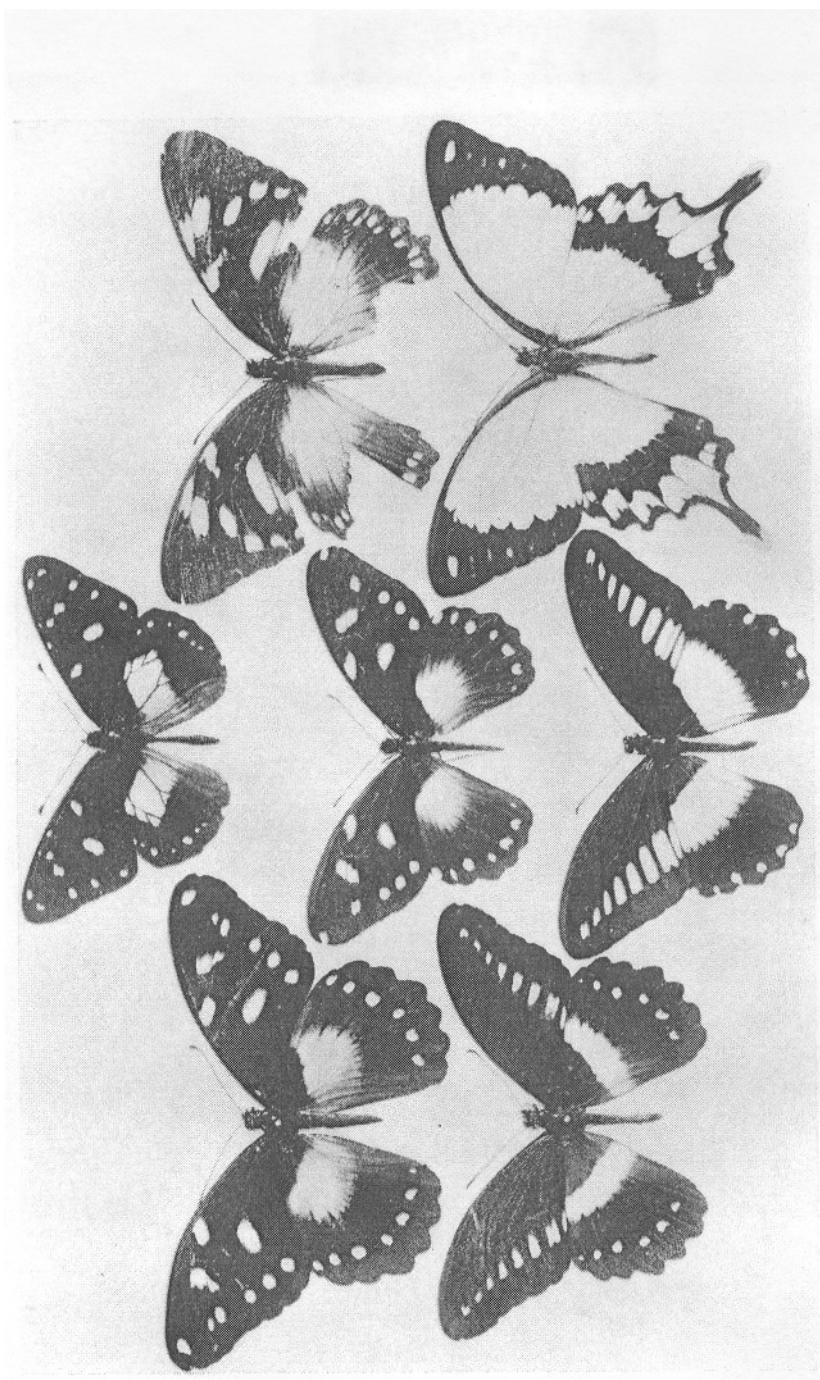


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The males of the two *Euxanthes* were figured in the first number of the Journal, and the females resemble them except that the fore wings are more produced, especially in *E. wakefieldi*, and all the pale markings become conspicuously larger and whiter and *E. tiberius* gains the large white patch in the hind wings. These comparatively simple changes are quite sufficient for the purpose, and there can be no doubt that both species can easily be mistaken in flight for their respective models, whereas their males can be recognised at a glance.

There are many other butterflies marked with white on a black or dark brown ground which, though they do not closely conform to the pattern of either of the two species of *Amauris*, yet bear a general resemblance to them. The butterflies which come nearest to them in appearance are *Acraea satis*, a rare species in which only the female is mimetic, the male having the paler markings, brick red, and *Papilio philonoe*. The former of these is undoubtedly distasteful but the *Papilio* is possibly palatable comparatively. Then comes a little group, consisting of *Planema montana*, *Acraea esebria* and *Pseudacraea rogersi*, which closely resemble each other in both sexes. The females of this group are larger than the males and are black and white, though the pattern differs somewhat from either of the *Amauris*.

The males, which also resemble each other, are black and brown, but the depth of colour varies a little in different specimens. Then there are several species of *Neptis*, a genus of which there is some evidence of distasteful qualities, such as *N. agatha*, *N. saclava*, *N. melicerta* and *N. seeldrayersi*. These vary a good deal in size, the largest specimens of *N. seeldrayersi* being little if any smaller than *Amauris ochlea*, whilst the smallest specimens of *N. melicerta* do not reach half this size. In fact size seems of minor importance in these mimetic associations, and the last species which need be referred to is a little Lycaenid butterfly, *Alaena picata*, also belonging to a distasteful genus, which, in spite of its diminutive size, bears a considerable resemblance to the other members of the combination and is linked on to the larger species by the gradually descending series of the genus *Neptis*. The conclusions which were reached in discussing the mimics of *Limnias chry-*



Alfred Robinson, Photo.

(1) DANAINE MODEL  
*Am. althimaculata*, ♂

- (1) Mimic ♀
- (2) *Pap. jacksoni* ♂

- (3) Mimic ♀, *Croca form.*
- (4) *Pap. dardanus* ♂

(3) *Pap. echerioides* ♂

By kind permission of the Entomological Society and Prof. E. R. Peacock, F.R.S.

Mimicry of the Iovaine, *Am. althimaculata*, by the females of three *Papilio*s in British East Africa (Kikuyu Country, 1906-7.)

All figures are about 3/4 of the natural size.

*sippus* are seen to be fully supported by this great black and white association. The mimetic series is centred round the abundant and highly distasteful Daniadae, but there are a number of other species of more or less similar patterns, which have a tendency to fall into groups amongst themselves, and are united into a single large and highly complex association.

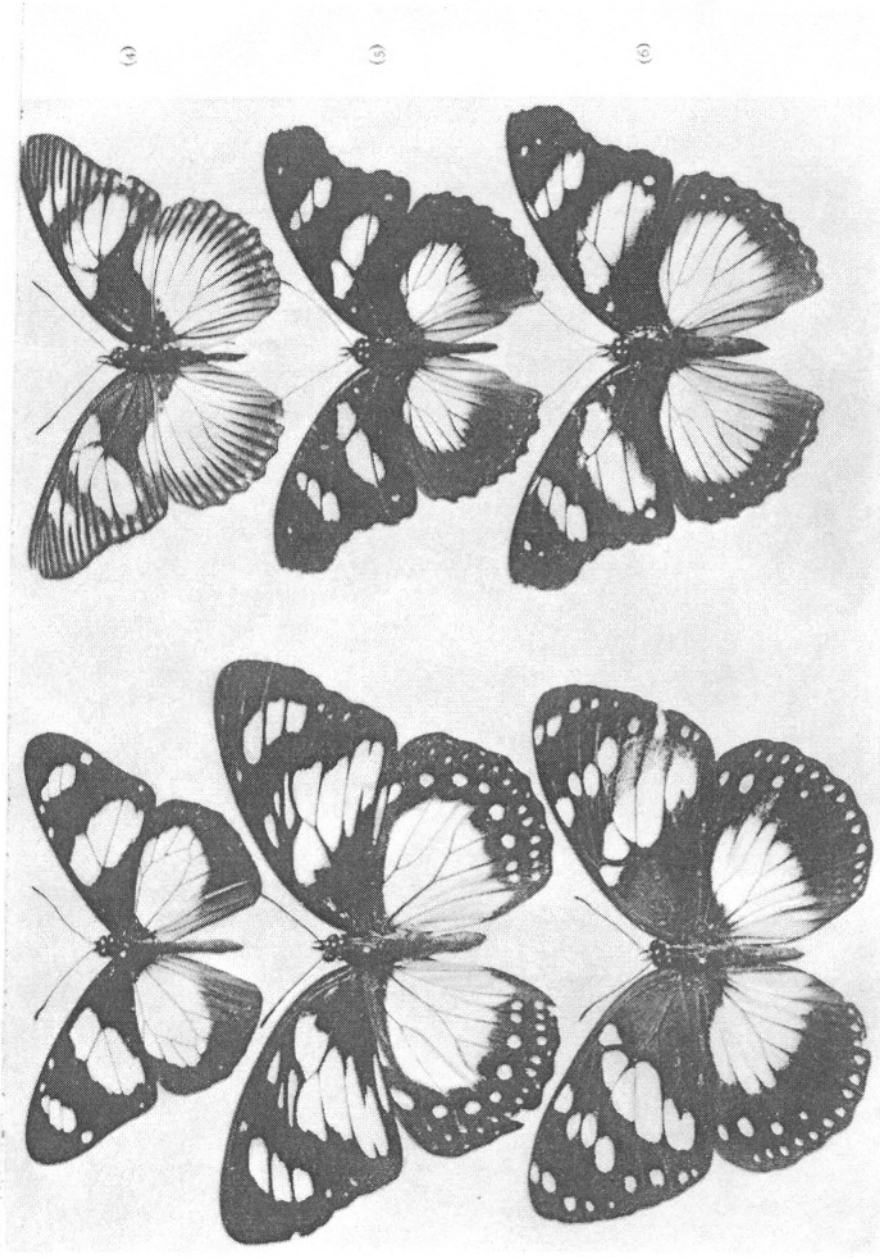
Besides the black and white species of *Amauris*, there are two other species which resemble each other so closely that they have only recently been properly differentiated by minute but definite structural differences. These are *Amauris echeria* and *A. albimaculata*. They are very abundant in many parts of the country, but do not occur in the coast district so far as is known at present. For our purpose these may be regarded as a single model. Here again we have a mimic of the genus *Euralia*, i.e. *E. mima*, which there is some reason to suspect may prove to be a dimorphic form of *E. wahlbergi*. This species I have never met with, but it is probably not uncommon in some places. The most interesting mimics, however, are those of the great genus *Papilio*. In the first place we have yet another form of *Papilio dardanus* known as the form *Cenea*, which is probably common at Nairobi.

There can be no question that these very distinct females of *Papilio dardanus* are all one species, for they have all been bred from the same female by Mr. G. F. Leigh at Durban, and it would be a most fascinating study to breed them through at Nairobi, where other mimetic forms are known to be present and where some very interesting and primitive females have been taken from time to time. The food plant in South Africa is *Vepris lanceolata*, and there is probably a nearly allied plant in British East Africa, even if this species does not prove to be found. The result of such an experiment would well repay the labour involved, and all the offspring should be kept. I may say that Professor Poulton is very anxious to get this done, and he would be more than pleased to receive whole bred families and would give them a place in the Museum at Oxford where they would always be kept together.

In addition to *Papilio dardanus* there are two other species of this genus which mimic *Amauris albimaculata*. These are *P. echerioides* and *P. jacksoni*. They are closely allied but

belong to a different section of the genus from *P. dardanus*. Here again the males are non-mimetic and are dark brown insects with a continuous pale stripe across all the wings, broadest in the hind wings and becoming macular in the fore wings. The females are very close mimics of *A. albimaculata*, as may be seen in the plate. Unfortunately the specimen of the *Cenea* form of *P. dardanus* here figured is not only much shattered but is also distinctly intermediate towards the black and white form. Generally it is also an excellent mimic, and there can be no doubt that the three mimics resemble each other more closely than they do the model. Associated with these there is the ordinary form of *Acraea johnstoni*, of which we have seen that there is a form mimicking the *Dorippus* form of *Limnas chrysippus*. This is a smaller butterfly than any of the *Papilio*s and the resemblance is rather in general coloration than in exact pattern ; but as this species has many different forms, all of which bear a considerable resemblance to distasteful species, and itself belongs to a genus well known to be distasteful, there can be no doubt that the mimetic interpretation of these resemblances is correct. It is certainly remarkable that, in spite of its wonderful powers of adaptation, it as a rule does not attain to the exact and wonderful resemblance which we have seen to exist in other species—but it is possible that the adaptation is still proceeding.

Moreover *Acraea johnstoni* itself is mimicked by a species of *Neptis*, *N. woodwardi*, in a very convincing manner, and Professor Poulton has shown that the resemblance is much closer east of the Rift valley, where this combination is most dominant, than it is further to the west. It is at least possible that *N. woodwardi* should be regarded as a Batesian mimic, but it should be borne in mind that mimicry is very characteristic of this genus and numerous other examples are known from India and elsewhere, whilst we have seen that several species of *Neptis* are probably to be included in the large black and white association, and I have myself suggested that *Neptis incongrua* may be a mimic of *Eurytela hiarbas*. At any rate there can be no doubt that the whole genus participates to a marked degree in the slow leisurely flight so characteristic of distasteful butterflies, though I must confess that they are not



Alfred Robinson, photo.

DANAINE MODEL.

- (1) *Am. ecklon*.
- (2) *Euxanthie wockelfeldti* ♀.
- (3) *Eux. tibetis* ♀.

- (4) *Pseudaer. lucerna expansa*.
- (5) *Euralia birys*.
- (6) *Euralia decolor*.

The pattern of the Danaines, *Am. ecklon*, mimicked by Nymphalines. Secondary resemblances between the mimics. (Coast District of British East Africa, 1906.)

All figures are 3/6th of the natural size.

By kind permission of the Entomological Society and Prof. E. B. Poulton, F.R.S.

nearly so easy to catch as one would be led to expect from their appearance.

This brings me to the end of the large combinations centred round the different species of *Danaidae* found in the country, but there are yet two species of this subfamily to be found in our area, and both of these are objects of mimicry. The first of these is the beautiful *Melinda formosa*, which is a somewhat local species of a limited range. It may be described as a black insect with nearly half the fore wings near the base orange brown, and with numerous rather large pale blue-green spots over the rest of the wings, the basal area of the hind wings being occupied by a large blotch of the same colour divided into three parts by the black nervures. This is very accurately imitated by the rare and fine *Papilio rex*, though it may be separated from it immediately by the important structural differences. (The *Papilios* have six perfect legs whilst all the *Danaines* have the first pair aborted.) The other *Danaine* is *Tirumala linniae*. This species does not differ sufficiently from the Indian representative to be considered as a distinct species and is almost certainly a comparatively recent immigrant from some part of the Oriental region. It is a very abundant and distasteful species, but it appears to have done little in the way of drawing other forms into resemblance to itself, and is the only abundant and wide-ranging *Danaine* in the country which has not become the centre of an association.

It is true that there is one species which does bear a considerable resemblance to it, but the mimicry is not nearly so close as in the other cases we have been considering. This species is *Papilio leonidas* which, I may remark, has a form in South Africa which resembles *Amauris echeria* and another form which is not mimetic at all. We seem to have here an interesting case of incipient mimicry, and it is worthy of note that the model is in all probability a recent invader whilst the mimic is, so far as we know, an old inhabitant. Such cases as these, and they are known to occur in other regions, are an insuperable difficulty in the way of interpreting these resemblances as due to the influence of local causes, whilst they afford the strongest possible support to the theory of mimicry, since the invader which is able to draw after itself original

inhabitants is always a species which is well known to be very distasteful and is invariably a dominant species found in immense numbers. I do not wish to be understood as putting forward these considerations in any dogmatic spirit, but I must own that the evidence which has been accumulated for many years in favour of these theories seems to be conclusive.

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### ON THE SMALLER FAUNA OF MOUNT ELGON

By R. KEMP.

Having recently spent five months on Mount Elgon and in its vicinity, a few notes on my experience there and remarks on the smaller animals and birds which were met with may perhaps be of some interest to those who read these pages.

It was on the 20th August 1909 that I left Kisumu, northward bound, and on the 21st January 1910 I reached the railway again at Kibigori, having collected during that time four hundred and sixty nine small mammals and two hundred and fifty small birds, for Mr. C. D. Rudd of South Africa.

Of the birds which I obtained and noted I do not propose to write much, partly because birds have already been so thoroughly studied and collected that little new can be expected, and partly because the specimens have not yet been worked out, so that a detailed examination of them yet remains to be gone through.

However, I was pleased to find fan-tailed grass-warblers (*Cisticola*) and their near relations much in evidence, from the grass plains at the foot of the escarpment right up to the great cave at about 10,000 feet on the south face of the mountain.

Engabuni or the Elgon escarpment, where there are such a great number of caves, is distant from the Kirui's villages only some five or six miles, and yet the bird lists of these two places is almost entirely different. Apart from the forms which sleep on the escarpment, but which feed on the plains below, such as most of the pigeons and doves, the hawks, the pied raven and a few others, my records show only one species which really lives in both places, and that is the Bulbul with a