

und gelb gestreifte Rutelide, mehrere Arten Chrysomeliden, Mordelliden und Curculioniden belebten die Blüten der Wasserpflanzen. Auf den riesigen Blättern der *Victoria cruciana* jagten lange, schmale, goldige Carabiden umher. Odonaten, bunt wie Schmetterlinge, brachten etwas Leben in die sonst unheimliche Ruhe. Nahe dem Ufer tummelten sich die Raupen einer *Palustra*-Spezies auf und unter dem Wasser. Diese Raupen werden, wohl ihrer dichten Behaarung wegen, von den vielen kleinen Fischen, die diese Lagunen beleben zwar geziemend angestaunt aber nicht gefressen. Unter diesen Fischen sieht man prachtvoll gefärbte und bizarr gestaltete Arten, die einem Aquarium zur hohen Zierde gereichen würden. Ich beobachtete eine etwa 6 cm lange Art mit veilchenblauem Rücken, violett gestreiften Seiten und rotgoldnen Flossen, die ich vergeblich mit dem Wasserketscher zu fangen versuchte. Zum Essen kann man sich an solchen Sammeltagen nicht viel Zeit nehmen, es wird während der Arbeit besorgt. Erst wenn die Sonne bereits zu sinken beginnt, sucht man wieder einen geeigneten Schlafplatz am Flußufer auf. Jeder Tag bringt neue Überraschungen. Wenn man alles sammelt, gibt es keine Arbeitspausen. Sind es keine Insekten, dann sind es Wirbeltiere, Mollusken oder Crustaceen, die uns unausgesetzt beschäftigen und würde dies alles fehlen, dann gibt es für den Botaniker so reichlich Arbeit, daß man sich wünscht, daß der Tag 48 Stunden hätte.

Die Bäume sind voll besetzt mit Epiphyten und Schmarotzern, mit Orchideen, Tillandsien, Bromelien und Kakteen, daß man mit den nur besseren und auffallenden Arten leicht einen Ochsenkarren füllen könnte. (Fortsetzung folgt.)

Mimikry.

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The report of the Fifth International Congress of Entomology which met at Paris in 1932, was published at the end of 1933. An article in it by Professor FRANZ HEIKERTINGER, of Wien, entitled »Kritisches zum Mimikryproblem: über Schmetterlingsmimikry«, is so strongly critical of the current theory of Mimicry as a result of Natural Selection that it calls for comment.

The article treats Mimicry among butterflies as if it were an isolated phenomenon of exaggerated frequency without any relation to the same kind of resemblances among other animals or to other types of coloration. Consequently conclusions are drawn as to the nature of the phenomenon and its causation which would not be considered applicable if there were a wider recognition of the real

extent of the phenomenon and its relation to other types of coloration in insects. The present writer, having been criticised in "Nature" for the paucity of his references in a recent publication ("Mimicry", Methuen's Biological Monographs), to continental critics turned to Professor HEIKERTINGER's spirited attack with great expectations. Here, at last, might perhaps be found some really new arguments to consider. But Professor HEIKERTINGER's arguments have all been urged before: some, indeed, were met by Bates himself, the founder in 1862 of the study of Mimicry. The first point made by Professor HEIKERTINGER is that there is no reason for considering the resemblance to each other of a few butterflies as something special and wonderful which requires an artificial explanation. No special explanation is demanded by Mimetists, who, since POULTON first showed that Mimicry falls into a natural scheme of classification of the colours of animals, have consistently urged that it should not be considered as anything but one of several types of coloration which protect the bearer sometimes from the attacks of enemies.

We do not claim that anything more than the ordinary processes of variation come into play, and that it is a broad rule that genera and species which furnish most examples of mimicry are very variable in appearance. The widespread occurrence of mimicry among butterflies can hardly be considered fairly summed up by Professor HEIKERTINGER's allusion to it as the resemblance between "a few" butterflies. Professor HEIKERTINGER takes as a special example the well known *Papilio dardanus* and demonstrates that the patterns of three forms of the female can be derived from that of the male quite simply by the ordinary processes of variation. TRIMEN demonstrated this in 1870, and POULTON has since gone into the question in detail and given a complete list of all known forms of *dardanus* and their relation to each other (1).

A point of considerable interest in this connection, which has apparently eluded Professor HEIKERTINGER, is that the likeness of the pattern of the female *dardanus* to that of its model has been produced by two different processes (2). In Abyssinia the black and white female form *niavoides* of the local race *d. hodsoni*, mimicking the local race of *Amauris niavius* has developed the mimetic pattern of the border of the hindwing by the appearance of a dark ground in which the separate black spots can be clearly distinguished.

The resulting black border to the wing is thus of different origin from that of the southern *dardanus* form *hippocoon* in which it has arisen by fusion of the black spots present in the male wing.

The evolutionary history of the two forms is different and it would appear to be in support of DARWIN's argument that the path of evolution is not repeated, nor are identical species produced twice over along independent lines. The forms *niavoides* and *hippocoon*, though superficially alike owing to resemblance to a com-

mon model, are fundamentally different in origin, owing to the forms having varied in different directions in different localities.

The pattern selected by Professor HEIKERTINGER to show that there is no need to invoke the aid of mimicry to explain what is probably the result of descent from a common stock is not quite the simple matter to be easily accounted for that it would seem to be from his argument. It appears in other widely separated groups of insects such as Hymenoptera, Diptera and Odonata. Moreover, in certain butterflies it can be seen to be derived in a quite different manner from that in *dardanus*, for it can be formed by fusion of a series of spots across the wing. It seems to be a pattern for the increase of conspicuousness, and confined on the whole to day-flying insects. If it is due to inheritance it is curious that it should not manifest itself to any great extent in butterflies which frequent dark shady places, or in night flying moths, whereas on the other hand it commonly occurs in day-flying moths.

Professor HEIKERTINGER seems to imply that mimetists claim to have discovered a special riddle in the case of *dardanus*, whereas it is only an example of a general law among Lepidoptera that the female is more variable than the male: he quotes FISHER and FORD in support of this. Curiously enough, the same reference was quoted by the writer in his recent book on Mimicry in support of the same conclusion, but with the object of aiding understanding of the greater frequency of mimicry in the female sex.

HEIKERTINGER's argument seems to be that because the mimetic *dardanus* shows variations from yellow to brown, which are shown by other butterflies, there is no special significance to be attached to the curious resemblance to other species which also show similar variations in colour.

Mimetists do not claim for colour any more than for pattern that it is something which follows different laws in mimetic and in non-mimetic species. The beautiful transitions which can be found, in a long series of a variable species, between a non-mimetic form and a mimetic one are evidence that there is no such difference. For instance, the case of *Euphaedra eleus* of which one form resembles the day flying moth *Aletis helcita* and others show transition from the mimetic red-brown to a non-mimetic blue-green. But the point of importance is that the variations in a mimic so wonderfully follow the variations in the model; and on the other hand (see later. *P. cynorta* in Abyssinia) it sometimes happens that a change in appearance of the usual model cannot be followed by the mimic which then resembles another model whose appearance is not beyond its capacity for variation.

The next point is Professor HEIKERTINGER's "Reductio ad absurdum", the more difficult to deal with because of the basal correctness of his argument. It is absurd to hail resemblances occurring in the same area as Mimicry, and resemblances occurring

in separated areas as Coincidence or, to use Professor HEIKERTINGER's term, as "Pseudo-mimicry". But, again, the argument is not quite so simple as that, for the two classes of facts are on a different footing. There is no comparison between resemblances in the same area and in different areas as regards their number, or the minuteness of detail which makes resemblance. This point was examined at some length by DIXEY and reference should be made to his results (4). The argument that mimic resembles model merely because their development has been along parallel lines provides an example of the difficulties which arise when conclusions are applied to a very large group of phenomena from study of a small section only. Mimicry is not a peculiarity of butterflies, nor is mimetic resemblance of one animal to another a peculiar and isolated phenomenon. The following series should be considered.

1. A sand-like grasshopper.
2. A stick-like Geometrid larva.
3. A thorn-like Membracid (Hemiptera) on a twig.
4. A beetle resembling a pellet of droppings of a caterpillar, or a moth resembling a bird-dropping.
5. A spider, frequenting the rubbish heap outside an ant's nest and resembling the head-capsule of a dead ant thrown out from the nest (3).
6. A spider resembling a whole, living ant.
7. A caterpillar resembling, or suggesting, a snake.

The theory of resemblance having been produced by parallel development could only be made to apply to one of these cases; to the mimetist all are alike attributable to the operation of Natural Selection and are merely different aspects of one phenomenon, as indeed BATES himself pointed out.

Why is it necessary to have one explanation for the resemblance to a tree trunk of beetles sitting upon it, and another for other beetles on the same tree which resemble, not the tree trunk, but one the other? No student of mimicry can ignore accidental resemblances but the essential features of mimicry are not shown. Until, for instance, the alteration of habit and instincts often shown in mimics by which a greater resemblance to the habits of the model is produced, can be found to occur in areas apart from that inhabited by the models the two classes of cases are not parallel. It is an axiom that mimicry deceives the artist, not the anatomist. If the resemblances are merely fortuitous why should they be confined to reproducing the appearance only? In the case of a Longicorn beetle which mimics a species of another group of which the antennae are knobbed or clubbed, resemblance is effected by an apparent thickening of antennae, at the right distance from the base, by a tuft of hairs; beyond this the normally long antennae are so attenuated as to be almost invisible. Why has not coincidence reduced the length and thickened the tip as in the model? The production of the same result

by different means is so typical of the operation of Natural Selection that its illustration by mimicry strengthens the argument of the mimetist.

POULTON figures a beautiful example of resemblance of *Papilio laglaizei* to the Uraniid moth *Alcidis agathysus*, in which the mimicry is remarkably well shown on the under surface.

The abdomen of the moth is bright orange beneath and is visible when the wings are closed. That of the *Papilio* is not so coloured, but an orange patch on the inner margin of the hindwing meets its fellow when the wings are closed, so that on the apposed surfaces of the two wings which hide the abdomen an orange patch appears which reproduces the orange body of the moth. The arguments of co-incidence and parallel development cannot explain this case.

The question of Geographical Distribution of models and mimics is has been raised by Professor HEIKERTINGER, and rightly, for it is of the very greatest importance as has long been recognized by Lord ROTHSCHILD and Dr. KARL JORDAN at Tring, and by all workers under POULTON at Oxford. But Professor HEIKERTINGER does not carry his studies nearly far enough, and in reply to his arguments the following cases are, not for the first time, brought forward. (to be continued.)

Literarische Neuerscheinungen.

Entomologisches Jahrbuch 1935 OSKAR KRANCHER (Verlag von Franckenstein & Wagner, Leipzig). — Kaum jemals seit nunmehr fast zwei Jahrzehnten dürfte dieses kleine Unterhaltungs- und Belehrungsbuch für Naturfreunde willkommener sein, als eben jetzt, wo nach einer fast 20jährigen, für die Entomologie so wenig erbaulichen Zeitspanne die Naturfreude wieder mehr Allgemeingut des deutschen Volkes zu werden verspricht. Der Ruf nach innigerer Naturverbundenheit und nach Vertiefung des Studiums der Heimatkunde, den die neuen Führer so eindringlich ertönen lassen, kann nur die erhofften Früchte tragen, wenn das Volk auch mitarbeitet; wenn an Universitäten und höheren Schulen die Naturwissenschaften, die Pflanzen- und Tierkunde, und der letzteren beliebtester Zweig, die Entomologie, wieder zur Geltung gelangen. Wer sein Vaterland kennen will, der muß auch wenigstens über das Größte in der Insektenkunde unterrichtet sein. Dem trägt der neue KRANCHER in vollkommenster Weise Rechnung: fünf Sechstel vom Inhalt des diesjährigen Jahrgangs beschäftigen sich mit der Faunistik Deutschlands und der angrenzenden Länder, und was von Exoten dazwischen eingestreut ist, wie die allgemeinen Betrachtungen über Vogelschutz, Bienenfeinde, Raupenzucht usw., ist auch seinerseits geeignet, Vergleiche mit dem Vaterland anzuregen. Die Faunistik des »Hausgärtchens« ist ein meisterlich werbender Bericht über die Art, wie mit minimalen Mitteln erfolgreich Entomologie getrieben werden und die Kenntnisse eines jeden erweitert werden können. Sie machen jedem fühlenden und denkenden Leser Lust, den Versuch selbst zu wiederholen, ebenso wie die fachlich musterhafte Führung des Minenforschers jeden ernstesten Entomologen veranlassen wird, dem Schreiber und Spezialisten durch die 12 Monate des Jahres hindurch zu folgen. Die Gedanken über den Einfluß von Land-Urbarmachung und Vogelschutz enthalten, wenn auch im fernen Urwald entstanden, eine Fülle köstlicher Beobachtungen. — Der KRANCHER braucht nicht mehr empfohlen zu werden. Durch das, was er in 44 Bändchen uns gegeben hat, empfiehlt er sich selbst!

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