



SOUTH AMERICAN BUTTERFLIES,  
*Illustrating Mimetic Analogy.*

1. *Leptalis Nehemia*.  
 2. *Leptalis Theonoe*,  
     var. *Leuconoe*.  
 2a. *Ithomia Ilerdina*.

3. *Leptalis Orise*.  
 3a. *Methona Psidu*.  
 4. *Leptalis Theonoe*.  
 4a. *Ithomia Flora*.



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## MIMETIC ANALOGY.

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*(With a Coloured Plate.)*

THE theory of mimetic analogy is one that endeavours to account for a large and extensive series of phenomena that have long been known to observant naturalists. The phenomena themselves are indisputable, but hitherto no satisfactory explanation has been offered to account for their existence.

By mimetic analogy is meant the fact that one animal often possesses a very close resemblance to some other animal, which is most frequently of a very distinct group. Sometimes the object mimicked is an inanimate one—a stone, a bud, a leaf, or a broken twig. Instances of this latter kind of resemblance are so common as to strike even the most casual observer. The greater number of animals assume more or less closely the colour and appearance of the objects with which they are generally surrounded. Thus reptiles, such as frogs, snakes, etc., living on the ground, resemble the colour of objects on the earth's surface; whereas the tree-frogs are usually of a bright green colour, in accordance with the leaves amongst which they spend their lives. Even in birds of bright showy plumage, in which this assimilation of colours would hardly ever be suspected, it frequently prevails. Thus in the beautiful little Australian warbling parrakeets, known generally in this country by the aboriginal name of Betcherrygar, the resemblance of the colour to that of the leaves of the Eucalypti, or Gum trees, on which they repose during the mid-day heat, is so close, as Mr. Gould informs us, that though dozens may be perched on a branch, they are hardly to be observed when at rest. Among our own insects the imitation of inanimate objects is not unfrequent: the common buff-tip moth is a familiar example, as when at rest it closely resembles a piece

of broken lichen-covered twig, the end of which is simulated by the tips of its closed wings.

Nor is the imitation of natural objects confined to a few species: it has been noticed in entire groups, and even in the whole insect fauna of a country at particular seasons. In an interesting note on the autumnal and winter moths of England, published in the *Zoologist* for 1856, the Rev. Joseph Greene, one of our most accurate entomological observers, writes:—

“I am not aware whether any entomologist has ever been struck by the singular adaptation and similarity of colouring in the autumnal and winter Lepidoptera to the prevailing tints of nature during these seasons. Counting from the middle of September, when the leaves begin to turn, to the end of February, we find among the Bombyces, Noctuæ, and Geometræ, about fifty-eight species on the wing. Now in the autumn the hue of nature is golden—she passes through all the intermediate stages from pale yellow to a deep rich brown; while in winter she assumes a grey or silvery garb. Taking those fifty-eight species, we find in their prevailing colours a striking and remarkable similarity to those which nature assumes at the time of their appearance in a winged state. Three species are doubtful, seven militate against my theory, the remainder are decidedly in my favour.”

The writer then proceeds to enumerate the autumnal species, which are yellow or rich brown, and the winter species, which are grey or silvery, and concludes:—“It certainly strikes me as a very interesting fact, showing the hand of an Almighty and Allwise Being to be visible in this as in all the other works of the Creation.”

It must not be imagined that these imitations are confined to the invertebrate animals or the lower forms of life. Among the warm-blooded vertebrata the examples of mimetic analogy are not wanting. Thus the grey-banded cuckoos so closely resemble hawks, both in appearance and flight, that they are constantly mistaken for them in all parts of the world, and this not only by the natives, but by the smaller birds of the several countries.

One of the most amusing instances of this close similarity of birds of very different groups is related by Mr. G. S. Taylor in his account of the “Birds of Honduras,” published in the *Ibis*. Describing a large hawk, he writes:—

“I call it the ‘Curassow Hawk’ (*Ibycter americanus*), from its resemblance to the curassows, and to commemorate the following adventure:—While at Tauleri I was out one evening with my gun, and was returning home with a small trogon which I had shot, when I met Mr. Edwards, who pointed out to me some large birds sitting on a tree, which he said were

curassows. There were five of them; and they certainly did look like curassows in flight and general appearance. The plantain patch was thickly overgrown with long grass and weeds; but on I went, regardless of probable snakes and certain swarms of agarrapatas, although I had been particularly careful all day not to go where I was likely to carry any off. As for the trogon I threw it away in contempt, having much finer game in view. The curassows I thought would amply repay me for a sleepless night, endless scratching and consequent sores; so I stalked up to them and shot one, while the others flew off to a not very distant tree. From their flight, cries, and general appearance, I still thought they were curassows. The bird I killed fell into a dense thicket across a stream. Could I only have got it, I should have been spared additional agarrapatas and disappointment. However, not stopping to pick up the dead one, I followed the others across the plantain patch, then forced my way through an aloe fence, which presented a perfect *chevaux de frise* of spikes, and succeeded in shooting three out of the remaining four. I now felt proud of what I had done, and how well I had provided for our pot, which was in great want of supplies at the time. Edwards, who had been waiting for me, went to pick the birds up. As he took hold of the first, he said 'this is a hawk;' and hawks they all were, sure enough, to my great disgust and disappointment. When dead they still much resembled curassows, but were hawks nevertheless—nothing but great black, striking, red-legged hawks. However, I was not disappointed in agarrapatas, for I went home well stocked with them, and in no pleasant humour at having little or nothing to repay me for the discomfort I had to undergo."

It may perhaps be asserted that these imitations are rather general, and, as it were, accidental, than particular and designed; I will, therefore, quote from the *Transactions* of the Zoological Society, a much closer and more remarkable example of mimicry, described by Mr. Wallace, who, when speaking of the birds newly discovered by himself in the Mollucca Islands, observes, "that two species of the Oriolidæ, natives of Bouru and Ceram, departed altogether from the natural appearance of the group, and mimicked two species of Honey-suckers so closely as to deceive ordinary observers." Speaking of the birds inhabiting Bouru, he writes, "the oriole has departed from the usual gay colouring of its allies, and is actually the dullest coloured of its family, while the honey-sucker that it imitates very much resembles in its colouration other species of the group to which it belongs. The imitation is carried to the minutest particulars; the black orbits of the honey-sucker are copied by a patch of dusky feathers around the



eyes of the oriole, and even the very peculiar ruff of recurved feathers on the nape of the former, has its general effect imitated by a collar of pale colour in the latter. The under and upper surfaces of the two birds are as near as possible of the same tint respectively, and, stranger still, the oriole has closely copied the mode of flight and voice of its model, so that in a state of nature the two birds are practically undistinguishable."

"This curious instance," states Mr. Wallace, "does not stand alone, for in the adjacent island of Ceram, two allied but very distinct species resemble each other with equal accuracy."

With regard to the object of this imitation, Mr. Wallace proceeds:—"In the case of insects it seems probable that it is the odour or the taste of the imitated species which is unpalatable to insect-eating birds; or, in other cases, like the clear-winged moths, which mimic Hymenoptera, the species mimicked are armed with a sting. In birds, it is evidently the bravest, strongest, and best armed groups should be the subjects of mimicry, and the weakest and most defenceless which should obtain some advantage by imitating them.

"Returning to the oriole and the honeysucker, we have to observe that the former is a smaller, weaker, less active, less noisy, and less pugnacious bird. The feet have a less powerful grasp, and the bill is less acute. The latter has a great variety of loud and piercing notes, which bring its companions to the rescue in time of danger. And I have observed them drive away crows, and even hawks, which had ventured to perch on a tree where two or three of them were feeding.

"The honeysucker knows how to take care of himself, and make himself both respected and feared. It would, therefore, evidently be to the advantage of the more defenceless oriole to be mistaken for him.

"In this instance, as in most others, the imitation is far closer in the living bird than in the dead specimens. This is a far more satisfactory case of mimicry than any of those which I have before alluded to as occurring among birds. We have here two species, each confined to single islands, and each accurately imitated by a bird of a distinct family, with which it has no direct affinities. I therefore cannot doubt that this is a true case of mimicking exactly analogous to that so common among insects."

The most remarkable cases of mimetic analogy with which we are acquainted are those found amongst the butterflies of the valley of the Amazon. These cases have been investigated with great care by Mr. H. W. Bates, and the results published in the twenty-third volume of the *Transactions* of the Linnean Society.

Among the most numerous butterflies of this South American region are various genera and species belonging to the family of *Heliconidæ*. The species, wherever they occur, are described by Mr. Bates as being exceedingly abundant in individuals; they show signs of flourishing existence, although of slow flight and feeble structure, and apparently unfurnished with any means of defence, although living in districts abounding with insect-eating birds. So numerous are they that the pathways in the forests are rendered gay with the multitudes that fly about among the trees in their bright dresses of orange, blue, yellow, red, and black. Some species of these fine showy butterflies are described by him as assembling together in small parties like our gnats, or by twos and threes, to sport together and perform a kind of mazy dance. The sport generally begins with a single pair; they advance, retire, glide right and left in face of each other, wheel round to a considerable distance, again approach, and so on; then a third joins in, and then a fourth, and so on, until a large party is assembled. They never touch; but when too many are congregated a general flutter takes place, and they all fly off to fall in again by pairs shortly afterwards.

It is noticed that wherever large numbers of any of these *Heliconidæ* abound, they are always accompanied by species which closely mimic them in size, form, colour, and marking; and these resemblances are so close that it is often impossible to distinguish one species from the other when they are on the wing, as the imitators fly in the same part of the forest, and go usually in company with the species they imitate. To so wonderful an extent is this imitation carried, that, in cases where there is a local variety of a species of the family *Heliconidæ*, the butterfly imitating that particular species changes so as to follow the variations of its model.

It may be asked if two butterflies, of totally distinct groups, and having different structures, thus closely resemble one another, how can it be known which is the imitator and which the imitated? The answer to this question is sufficiently easy. The objects imitated preserve the form and likeness peculiar to the family to which they belong; but the imitators are of a different aspect to their nearest allies. Thus when a clear-winged moth is found, having a close resemblance to any species of bee, we have no hesitation in saying that the moth, having departed from the usual aspect of its group, has imitated the bee, which remains like its congeners, and not that the bee has imitated the moth. Or, to take the examples shown in our coloured plate, we are justified in assuming that the different species of *Leptalis*, shown in the Figures 2, 3, and 4 in our coloured plate, are the imitators, because they have



departed from the proper normal form of the genus *Leptalis*, which is shown at Figure 1, representing *L. Nehemia*; whilst the Heliconidæ figured, belonging to the genera *Ithomia* and *Methona*, are the imitated, because they resemble their nearest allies. Hence we regard *Leptalis Theonoë*, var. *Leuconoë*, Fig. 2, as imitating *Ithomia Ilerdina*, Fig. 2A; *Leptalis Orise*, Fig. 3, as imitating *Methona Psidii*, Fig. 3A; and *Leptalis Theonoë*, Fig. 4, as imitating *Ithomia Flora*, Fig. 4A.

These resemblances are sufficiently striking when seen in the cabinet, or even as represented in the accurate plate which illustrates this article. But it is only when the animals are seen in the natural state that the palpable intentional imitation is seen in its full force; for those features of the portrait, says Mr. Bates, are most attended to by nature which produce the most effective deception when the insects are seen alive.

The next point to be considered is the useful end served by this mimetic analogy. In the majority of cases the motive is evident—it is protection against natural enemies, either by concealment or disguise. Those animals that resemble the objects with which they are surrounded are protected from the observation of others that prey upon them. The ground feeding birds, such as the partridge and snipe, the hare amidst the dried leaves, the ptarmigan in the snow, are all well known instances of the advantage of the assimilation of colour to that of surrounding objects. In the case of the South American butterflies the imitation is obviously for the purpose of disguise rather than of concealment. The Heliconidæ are a numerous and flourishing group: although slow flying, they are never persecuted by birds or dragon-flies, to which it might be supposed they would be an easy prey; nor when at rest on the leaves are they molested by lizards or predaceous flies, which constantly devour butterflies of other families. They appear to owe this immunity from persecution to their offensive odour, which renders them unpalatable to the enemies of insects. Even when set out to dry in the cabinet of the collector, they are less liable to be attacked by vermin than other specimens.

Now it is obvious that the more closely an inodorous butterfly of another species, resembles one of the bad-smelling and offensive Heliconidæ, the less likely will it be to be preyed upon by its natural enemies. Hence the imitation of the genera *Ithomia* and *Methona* by the persecuted insects of the genus *Leptalis*.

The mode in which this remarkable imitation is brought about has now to be considered. Some naturalists maintain that the resemblances existed from the Creation; but the difficulties in this view of the case are numerous. One of the strongest arises from the fact, that in those cases where a local

variation of the imitated animal exists, the imitator also varies to keep up the resemblance. Others say that as imitator and imitated both inhabit the same district, they are necessarily exposed to the same external conditions, producing the same amount of form and colour. This also is a perfectly untenable argument. It cannot be imagined that an insect resembles a green leaf or the bark of a tree, because both are exposed to the same physical conditions.

By the Darwinian Theory of Natural Selection, the explanation of these remarkable analogies is sufficiently easy. All animals, without exception, are liable to variation in form, colour, and in size. Among insects in particular, variations of marking and form are most frequent. Let us now imagine a race of insects, like those of the genus *Leptalis*, that have no special means of defence, and are consequently liable to be devoured by predaceous animals. When a variety of *Leptalis* arose which happened to resemble in any slight degree the offensive *Heliconidæ*, it would be much less liable to be pursued by predaceous animals than the unchanged original to which they were accustomed, hence that variety would have a greater chance of being propagated.

Similar variations would occur in subsequent generations, those imitations that most closely resemble the model always being left, until at last, as in the cases that we have illustrated, this remarkable result would follow, that two insects, belonging to distinct families, would so closely resemble one another as only to be distinguished by a close inspection of their structural peculiarities.

The use of the terms mimetic analogy and mimicry, as descriptive of these undeniable phenomena, has been strongly objected to by certain writers, who imagine that the words imply that the animals have power to change or alter their own condition. No supposition can be possibly more absurd. The change is not effected by the will of the individual animal, but occurs in the species; variations are involuntary, and at present even their very cause is unknown; all that is known is that they do occur both in wild and domestic animals, and that they are capable of hereditary transmission. And it is evident that those varieties that are protected in the most complete manner from their natural enemies, are the most likely to survive and perpetuate their race.

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