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Notes on the Geographical Distribution and Dispersion of Insects ; chiefly in reference to a Paper by Mr. ANDREW MURRAY, F.L.S., "On the Geographical Relations of the Chief Coleopterous Faunæ" (Journ. Linn. Soc. vol. xi. (Zoology), No. 49.). By ROLAND TRIMEN, F.L.S., F.Z.S., M.E.S.

[Read April 20, 1871.]

HAVING attentively perused the above-mentioned treatise, I think that the following notes may perhaps be useful. I must

premise that they have nothing specially to do with the distribution of Beetles (a subject which Mr. Murray handles with his wonted care and skill), but refer only to some matters of more general import incidentally touched upon in the paper.

The drift of Mr. Murray's main argument (as summarized at p. 7) is to account for the greater part of the difficulties presented by the known existing distribution of animals and plants over the globe, by the simple explanation of "continuity of soil at some former period." While all will admit that very great changes have taken place in the relative extent and position of land and sea during various periods of the past, I think that I concur with many naturalists, when I venture to express the opinion that too frequent recourse has been had of late to that broad and general admission as a mode of solving the difficulties in question, and that a rather wholesale creation of ancient continents has been the result. The process of disposing of such problems by "calling up" connecting lands "from the vasty deep," in which it is assumed they have been submerged, has doubtless something attractive about it, and it possesses the manifest advantage of affording the fanciful geographer an inexhaustible field wherein to disport himself,—

"The world is all before him, where to choose."

In saying this, I have no wish to undervalue the importance of the influence on distribution necessarily exercised by changes in the level of the land, there being so many facts only explicable on the admission of those changes; but I think that great caution should be exercised in assuming the former existence of great connecting stretches of land in order to account for cases of generic or specific affinity at distant points of the earth's surface.

Mr. Murray's avowed inclination in favour of the "continuity" theory appears to me to make him attach too little importance to other means of dispersal, particularly in the case of oceanic islands\*. I do not propose here to recapitulate Mr.

\* The oceanic islands (at least those of the Atlantic) are regarded by Mr. Murray as the remains of submerged tracts of land; but those who have visited such islands will generally, I think, recognize the force of the following significant observation of Mr. Darwin (*Orig. of Spec.* 4th edit. p. 427), viz.:—"Nor does the almost universally volcanic composition of such islands favour the admission that they are the wrecks of sunken continents; if they had originally existed as mountain-ranges on the land, some at least of the islands would have

Darwin's masterly argument on this subject (Orig. of Spec. chaps. xi. and xii.), but will merely observe that it meets Mr. Murray's remarks, as if by anticipation, at every turn.

In reference to the Atlantic Islands, and particularly to Madeira, Mr. Murray (pp. 4 & 12) inquires with some emphasis how it is that the endemic insular forms have not "found their way to Europe" as easily as European species have found their way to the islands, and states that "not a single example of any of its [Madeira's] peculiar species" has ever so found its way, "except in an entomologist's box." Without inquiring too closely how it was possible to ascertain the truth of the latter statement, it should be observed that the question here is not so much one of travelling as of establishment of an organism in a country foreign to it; and the answer to the question in this view of it is really furnished by Mr. Murray himself (p. 62). Following in Mr. Darwin's wake, he clearly shows how easily and promptly unoccupied ground is seized upon by immigrants, and how extremely difficult, on the contrary, it is for a foreign form to effect an entrance, and still more to establish itself, on land already well occupied. Oceanic islands are notoriously poorly stocked, while Europe, for by far its greater portion, is rich in flourishing forms; so that, allowing the available means of transport to and from Madeira to be equally great, it was scarcely to be expected that Madeiran special forms should have the same force to accomplish a permanent settlement on European soil as continental species would possess to naturalize themselves on the island.

I regret that, on the two occasions on which I landed at Ascension, my time was too limited to make any but the most superficial exploration of a small portion of its area. I observed no terrestrial animals of any sort, with the exception of thousands of *Musca domestica* and its allies *M. vomitoria* and *M. Cæsar*, and a few of *Dermestes lardarius*, all four such devoted followers of mankind, that it is safe to regard them as introductions. I was, however, informed by a resident that butterflies were occa-

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been formed, like other mountain-summits, of granite, metamorphic schists, old fossiliferous or other such rocks, instead of consisting of mere piles of volcanic matter." I notice a remark recently published ('Nature,' Dec. 22, 1870, p. 148) by Dr. Hooker to the effect that the Seychelles group is formed of granite and quartz—a fact that widely distinguishes it from the Mascarene group of volcanic formation.

sionally seen\*. Mr. Darwin has recorded (Nat. Voy. p. 587) that "a few grasshoppers occur a little inland at Ascension," and that "rats and land-crabs swarm in numbers." The island bears all the marks of having been the seat of volcanic action at a comparatively recent time; and the poverty of its fauna and flora may very probably be due to the shortness of the period during which it has been in a condition fit for the reception and support of organic life, as well as to its very restricted area. Sea-birds are very numerous, and some of them, I was told, nest on the island. The marine fauna, from the little that I could observe of it, struck me as one that would repay a systematic research. I believe that both the mollusks mentioned by Mr. Murray (p. 15), certainly the *Nerita*, were among those which I found crawling in abundance on the rough tufa-rocks near the turtle-ponds, and subsequently presented to the British Museum. A bivalve, which appeared to be a true oyster, was plentiful just about the water-line; and numerous shells of other mollusca, bleached to whiteness, lay in the rock crevices; while the general abundance of that class of animals was amply evidenced by the long beach of the well-known "Ascension sand," which appeared to consist solely of rolled and polished fragments of shells. Several splendidly coloured fish, resembling *Acanthurus*, were taken by the hook over the side of the steamer at her anchorage; and many others could be discerned in the clear water near the shore, as well as companies of gaily striped and spotted small species in the turtle-ponds. But the most striking and active animal I noticed was a species of crab (of the genus *Ocypoda*?) which swarmed on the hot rocks, close to the sea, in the full sunshine. These crabs possess an amazing agility, reminding one in their actions of the quickest hunting spiders, and evade with remarkable success any attempt to seize them; I even found it difficult to strike them with a stick. Their colouring is protective, being a dark reddish-purple, thickly spotted with white, and nearly resembling that of the rocks which they frequent, the spots representing the numerous orifices in the porous tufa.

In reference to St. Helena, Mr. Murray observes (p. 22):

\* I remember to have read, in an account of a visit to Green Mountain (upon which I cannot now lay my hand), that variegated reddish butterflies were observed on the ascent. In all probability these were *Pyrameis Cardui*. Green Mountain has on it a scanty native vegetation, as well as introduced vegetables and garden-flowers.

"The butterflies seem as badly represented as the birds; and I would recommended to the consideration of the advocates of introduction by chance dispersal the fact that the two classes of animals best provided with means of dispersal are precisely those which, along with the mammals, are least represented. I can find no published notice of any Lepidoptera in St. Helena. No specimens of any exist in the British Museum; and the solitary species that I can learn by inquiry to have been met with is the *Cynthia Cardui*." On this I wish to remark that, on the 1st August 1859, in a garden towards the higher part of the valley in which James Town is situated, I captured, during less than half an hour, five species of Lepidoptera, and secured the larva of a sixth species. Concerning these, I find in my journal that *Danais Chrysippus* and *Pyrameis Cardui* were abundant, *Lycæna bætica* common, *Hymenia recurvalis* not uncommon, and *Botys otreusalis* "in hosts." The larva was that of a Quadrifid Noctua, and resulted in *Achæa Melicerta*, Drury; it was resting on a grass (*Coix lachryma*) known as "Job's Tears." A fourth butterfly, *Diadema Misippus* (*D. Bolina*, auct.), I found among the relics of the Burchell Collection, so religiously preserved at Oxford by Professor Westwood. The three butterflies taken by myself have been recorded as inhabitants of St. Helena in my 'Rhopalocera Africæ Australis' (pt. i. pp. 90 & 121, and pt. ii. p. 237), and the *Diadema* in my paper "on Mimetic Analogies among African Butterflies," published in the 'Transactions of the Linnean Society' (vol. xxvi. pp. 504 & 513, note), where I show how curiously that butterfly's range corresponds with the distribution of its model, *Chrysippus*. In looking at this scanty list of species\*, which I cannot doubt could be considerably increased by any collector resident in the island, it is very noticeable that all seven are prolific and widely dispersed insects†, whose present distribution evinces their special aptitude for seizing upon and persistently occupying new stations, and that they are thus the very description of forms which one would

\* Godart states (Encyc. Méth. ix. p. 709) that *Urania Rhipheus*, "selon M. Bory de Saint-Vincent, se trouverait à Sainte-Hélène;" but some confirmation of this report must be received before we can make so magnificent an addition to the fauna of the island.

† *Pyrameis Cardui* and *Hymenia recurvalis* are found all over the world; a range only second to theirs characterizes *Danais Chrysippus*, *Diadema Misippus*, and *Lycæna bætica*; *Achæa Melicerta* is recorded from the Punjaub, Ceylon, Celebes, and Moreton Bay; and *Botys otreusalis* inhabits both Congo and the Cape.

expect to be amongst the first to reach and colonize so isolated a spot as St. Helena.

The few insects of other orders known to me as natives of St. Helena are quite of the same stamp as the Lepidoptera as to likelihood of their having been introduced. The brilliant Spheg, *Chlorion compressum*, which I noticed on the walls in James Town, is a well-known native of India and Ceylon, and doubtless "came over" with its particular favourites, the cockroaches. *Gryllus capensis*, again (a St.-Helena specimen of which, in the British Museum, is recorded in the official 'Catalogue of Dermaptera Saltatoria,' pt. i. p. 16), is a cricket of world-wide distribution, being known to occur in Southern Europe, Western and Eastern Asia, every quarter of Africa, North and South America, Australia, the Philippine Islands, Borneo, and Mauritius.

As regards the Coleoptera of the island, I am not in a position to speak from personal observation; but it is clear, from Mr. Murray's own remarks and those which he quotes from Mr. Wollaston (pp. 22-24), that a very considerable proportion of the species may safely be regarded as introductions from other countries.

While touching on the subject of dispersal, I wish to observe that the frequent occurrence of insects out at sea, very far from land, scarcely receives the attention which it deserves, and that my own slight experience assures me that a careful record of instances of the kind would prove very instructive and valuable. In the journal of a voyage, made in the year 1858, from England to the Cape, I noted the various insects that made their appearance on board the ship in which I sailed. They were as follows (I add the date and approximate distance from the nearest land\* in each case), viz. :—

1. *Pyrameis Cardui*. May 28th. About 90 miles west of Teneriffe.
2. A pale-yellow Moth, apparently a *Bombyx*, about the size of the Silkworm Moth (*B. Mori*). Same date and position.
3. *Botys* sp. *ignot.* June 5th. About 230 miles from the mouth of the river Gambia.
4. A small Longicorn Beetle (*gen. ignot.*). June 6th. About 230 miles from the mouth of the river Jeba.

\* The distance is roughly calculated from the recorded position of the ship at noon on each of the days mentioned.

5. A large Sphinx (perhaps *Sphinx Convolvuli*). June 7th. About 420 miles from Sierra Leone.
6. *Sphinx Convolvuli*. June 8th. About the same distance from Sierra Leone as on the preceding day.
7. *Clytus sp. ignot.* (smaller than *C. Arietis*). June 25th. About 150 miles from Bahia.

In addition to the above, I occasionally saw large insects which I could not determine, but which I usually thought to be Sphinges of some description, which whisk rapidly about the rigging, and was besides often told of "butterflies" and other insects noticed by the passengers and sailors. *Pyrameis Cardui* after settling for a few seconds on the binnacle, and *Sphinx Convolvuli* after hovering about some vegetables hanging in one of the boats amidships, alike sped away westward. On this voyage, it should be noted that the ship was a perfectly new one, and had never left England before.

A specimen of *Acridium peregrinum*, in the collection of the British Museum, is noted (Cat. Dermapt. Saltat. iii. p. 577) as having been taken "500 miles from land;" but the latitude and longitude are not mentioned.

The record of such occurrences of insects is much to be desired as an aid to better knowledge of the dispersal of species; and I would commend the subject to the attention of travellers across the ocean.

At p. 55, Mr. Murray notes what he considers "a very remarkable African affinity" in the Lepidoptera of Australia, in reference to the case of the larva of *Doratophora vulnerans*, Lewin. The instances which he cites as analogous, however, are very different in character; for he quotes the mention by Livingstone "of a caterpillar called *Rigura* producing fearful agony if a sore is touched *with its entrails*," and the statement made by Baynes and other travellers, that a caterpillar is used by the Bushmen to poison their arrows. It is evident that, if a caterpillar be used at all for poisoning arrows (concerning which report my inquiries have hitherto been attended by no satisfactory result), it must be the intestines or juices of the animal which are so employed. But the case of *Doratifera\* vulnerans* is the common one of (what appears to be mechanical) irritation by means of clusters of spines, a defence possessed by many caterpillars, not only in Australia and South

\* The name of the genus is thus given by Duncan and Walker.

Africa, but throughout the globe, and of which the larva of the European *Cnethocampa processionea* presents a familiar example. Duncan (Nat. Libr., Ent. vol. vii. Exotic Moths, pp. 181-2, pl. xxii. f. 5) represents the larva of *D. vulnerans* as possessing four fascicles of rufous spines, exsertile at will, on both the anterior and posterior portions of the body, and quotes Lewin to the effect that the wound *inflicted by the fascicles* is very painful. According to Mr. Murray's account it would appear that the African larvæ, from the handling of which Dr. Welwitsch experienced such suffering, were near allies (if not actually species) of *Doratifera*; and the conclusion is obvious that it was by fascicles of spines that the pain was occasioned—not an uncommon case in the warmer parts of the world, and one by no means indicative of any special relation between the Lepidopterous faunas of South-Africa and Australia.

In explaining the presence of a "Brazilian type" or "element" in the Coleopterous fauna of Western Africa, Mr. Murray (p. 63) states that this South-American relation "has also now been recognized in the Lepidoptera;" but he points out neither on what grounds, nor by whom, the recognition has been made. Among the *Rhopalocera*, I am not aware of any genus characteristic of Brazil that occurs in Western Africa\*; unless, with Hopffer, we refer the species of Boisduval's genus *Crenis* to the genus *Eunica*, Hübner.

Referring to *Urania Rhipheus* of Madagascar, Mr. Murray observes (p. 68) that "it is an unusual thing at any time to meet with a gay-coloured Moth; but one with metallic brilliancy is still rarer." The former part of this remark certainly does not hold good, even with regard to Europe, when one recalls the *Deilephila* and other Sphinges, the "Burnets," the "Tiger Moths," the *Catocalæ*, the brightly tinted *Geometræ* of many genera, and various diurnal *Pyralidæ*; while, for metallic adornment, the *Plusiæ* and very many *Tineina* can be cited. But when we turn to tropical and subtropical regions, the proportion of brightly coloured moths is in nearly all groups greatly increased; and

\* The Nymphalidæ genus *Eurema*, Doubl. (which is scarcely separable from *Pyrameis*), is common to both regions, and also inhabits the West Indies; but as there are three known African species to five American, it is difficult to assign the genus to either fauna. The genus *Acraea*, which has representatives in South-eastern Asia and in Australia; is specially African, and the South-American species belong to a very distinct section, which Mr. Butler (Cat. Fab. D. Lep. B. M. p. 128) separates as *Actinote*, Hübner.



most of these are diurnal in flight, and more than rival the majority of butterflies in their gorgeous hues; while whole families (*e. g.* the *Glaucopidæ*) glitter with metallic hues vying with those of humming-birds. I am at the same time disposed to indorse the judgment of Dr. Boisduval, M. Guenée, and Mr. Murray, that the preeminence for surpassing beauty of right belongs to *Urania Rhipheus*.

Looking, however, to Mr. Murray's argument of the evidence of a Brazilian element in the fauna of Madagascar afforded by the presence of *Urania*, it is well to bear in mind that such considerable differences (chiefly shown in the stages of larva and pupa) exist between *U. Rhipheus* and the allied Uranides in South America and the West Indies, that the eminent lepidopterist M. Guenée has not only separated it from them generically, but as the representative of the distinct family Uranidæ (Sp. Gen. Lep. t. ix. p. 10). Nor should it be lost sight of that, if the independent testimony of Drury\* and Cramer is of any value, either *U. Rhipheus* or some very close ally inhabits South-eastern Asia. These statements of Indian and Chinese localities for the insect, considered in connexion with the well-known eastern stations of the allied genera *Alcidis* and *Nyctalemon* (of both which the earlier states are as yet unknown), seem to afford considerable ground for the opinion that the presence of *Urania* in Madagascar may eventually be proved to indicate an Asiatic rather than an American element in the island fauna.

Cape Town, Feb. 14, 1871.

\* It is not necessary here to enter upon the moot question whether Drury's insect is to be regarded as a manufactured specimen, combining the head and body of *Papilio* with the wings of *U. Rhipheus*, or (as Mr. Butler suggests in Cat. Fab. D. Lep. B. M. p. 288) as a butterfly mimicker of the *Urania*, because in either case the presence of *Urania* in China or India, according to the ostensible *habitat*, has to be assumed.

*Additional information.*—Mr. J. C. Melliss, who has been at St. Helena for some time, informs me that Honey-Bees (*Apis*, s. l. *icheronia* *Atropos* were long known in that island for two or three years after his first arrival, but have since disappeared almost simultaneously. The same gentleman has shown me specimens of a Quadrifid Noctua, *Ophiodes Hottentota*, Guen., reared from larvæ in St. Helena: this moth is widely distributed in Southern Africa, and is nearly allied to the South-European *O. Tirrhæa*, Cram.—R. T., 5th September, 1871.