

*Hesperia Optata.*

Alis utrinque rufo-fuscis : anticis infra plaga atra plagisque duabus flavis : posticis plaga flava.

Upperside rufous-brown, paler at the middle of the anterior wing, the fringe rufous-yellow, the head and thorax tinted with lilac-blue.

Underside rufous. Anterior wing with a band of dark brown from the base to beyond the middle, bordered below with pale yellow. Posterior wing with the base rufous-brown, tinted with purple and bordered below with pale yellow.

Exp.  $1\frac{9}{20}$  inch.

Hab. Brazil.

In the collection of Dr. Staudinger.

Unlike any other species in the strange colouring of the underside.

*Hesperia Onasima.*

Alis utrinque rufo-fuscis: anticis punctis quatuor (duobus sub apicem minutissimis) hyalinis: posticis punctis duobus hyalinis: anticis infra plaga flava.

Upperside dark brown. Anterior wing with four transparent white spots—two between the branches of the median nervure and two (very minute) near the apex. Posterior wing with two central transparent spots.

Underside as above, except that it is red-brown, that the anterior wing has a small pale yellow spot in the cell, and a large yellow spot bordered with dark brown near the inner margin.

Exp.  $1\frac{4}{10}$  inch.

Hab. Brazil.

In the collection of Dr. Staudinger.

VI.—*Remarks on Observations by Captain Hutton, Director of the Otago Museum, on Peripatus novæ-zealandiæ\**, with *Notes on the Structure of the Species*. By H. N. MOSELEY, Fellow of Exeter College, Oxford, Naturalist to the 'Challenger' Expedition.

THE above-cited paper by Captain Hutton, which appeared in the November number of this Journal, contains so many

\* Ann. & Mag. Nat. Hist., Nov. 1876.

statements concerning the structure of *Peripatus* which are at variance with my own observations, and, indeed, with zoological probability, that it cannot be allowed to pass without comment.

I described various points in the structure of *Peripatus capensis*, in a paper in the Phil. Trans. Roy. Soc. vol. clxiv. 1874, p. 757, confining my remarks to those particulars which seemed to have been missed or erroneously described by former observers; and I further described the development of the species.

The points of chief interest which I determined, and which were new to science, were:—

1. That *Peripatus* was a tracheate.
2. That the tracheal openings were diffused over the body-surface, not confined to certain restricted regions only, as in all other tracheates.
3. That the animal was not hermaphrodite, but that the sexes were separate.
4. That the supposed testis of Grube was a slime-secreting gland, the mode of use of which was explained.
5. That *Peripatus* was viviparous, and that its horny jaws were foot-jaws, homologous with those of Arthropods and not with those of Annelids.

Captain Hutton, who unfortunately had access to the abstract of my paper only, as will be seen by reference to his paper, confirms some of my points by his investigations of *P. novæ-zealandiæ*, but comes to the extraordinary results that this closely related species is not unisexual but hermaphrodite, and that the horny jaws are not foot-jaws, but homologous with those of Annelids.

When H.M.S. 'Challenger' was at Wellington, Mr. W. T. L. Travers, who has done so much for science in New Zealand, and who first drew Captain Hutton's attention to the existence of *P. novæ-zealandiæ*, brought me off some specimens of the animal to the ship, and gave me such information about its whereabouts that collectors sent from the ship were able to procure me about fifty living specimens. I was unable to refer to special publications at the time; and I thought the *Peripatus* was certainly already named; but I examined some of the specimens at once, and made notes, which I should have published long ago had not press of work prevented me.

*P. novæ-zealandiæ* is not hermaphrodite, but has well-developed males, which, however, as is the case with the Cape species, are less numerous than the females. Captain Hutton has been unlucky, as was Grube; and his twenty specimens have all been females. The males have their generative organs in

essential structure exactly similar to those of *P. capensis*; but the organs differ in that the prostates are considerably larger in proportion to the testes in *P. novæ-zealandiæ*. The testes are placed one above the other in the body-cavity in both species.

The common termination of the male ducts is very muscular, and evidently acts as an intromittent organ. It is more developed in *P. novæ-zealandiæ* for this purpose than in *P. capensis*. It twists under the nerve-cord to reach the external generative aperture on the right side, as in most cases in *P. capensis*.

This enlarged terminal duct or penis was found in *P. novæ-zealandiæ* to be provided with a mass of unicellular accessory glands imbedded in its wall, in an enlargement near its outward termination. It contained in some cases a long spermatophore, forming a stiff rod distending the whole length of the enlarged duct, and composed of felted spermatozoa. The connexion of the vasa deferentia with the penis was not properly made out, nor the junction of the left duct with the right. The arrangement is possibly different from the peculiar one existing in *P. capensis*.

Captain Hutton has evidently mistaken portions of spermatophores present in the upper part of the oviduct for the testes. Large masses of spermatozoa penetrate the oviduct and pass right into the ovary in a similar manner in *P. capensis* (see my paper, pl. lxxiv. fig. 1 a). Captain Hutton must have been entirely deceived in imagining he saw vasa deferentia. Had he established his position, *P. novæ-zealandiæ* would have been not only an hermaphrodite, but one of the most extraordinary in existence, considering its affinities. The testes are, according to him, mere appendages of the oviduct, with very short ducts opening into the oviducts close to the ovary; and he avers that the ova are fertilized in the oviduct immediately on their leaving the ovary, on their reaching these openings of the male ducts. These are his words (*l. c.* p. 367):—"On passing the vesiculæ seminales it (the ovum) becomes fecundated, and total segmentation ensues." *P. novæ-zealandiæ* would thus be a self-impregnating hermaphrodite according to our author, in which cross-fertilization would never occur.

With regard to the development of the jaws, Captain Hutton's description runs (*l. c.* p. 367), "Two large oval or pyriform swellings arise from the lower surface of the cephalic lobes, just in front of the opening of the gullet; a longitudinal depression is formed in each of these by invagination; and in these depressions the teeth are subsequently

formed." The whole of Captain Hutton's figures are most crude and imperfect. I believe that he has missed the turning-in of the first pair of limbs, of the claws of which the jaws are the homologues, and that in (*l. c.* pl. xvii.) fig. 13 the pair of appendages marked *a* correspond with those marked *f* in fig. 15 (*i. e.* with the jaws), and not with those marked *a* in that figure (which become the oral papillæ).

I have no doubt at all that he has been here misled by imperfect observation, as in the case of the generative organs. I examined the embryos of *P. novæ-zealandiæ*, and observed some nearly 7 millims. in length, in which the first pair of appendages was not yet turned inwards. Hence I saw the same condition to exist as that which occurs in the Cape species.

In some minor points I think Captain Hutton must be further misled. He fails to see the dorsal heart in *Peripatus*, and describes as the blood-vascular system the two well-known linear lateral bodies which are of doubtful function and homology, and which have before been supposed to be possibly connected with the vascular system (Claus, 'Zoologie,' p. 387), but which I considered to be mere fat-bodies.

He further describes salivary glands. I have not seen such structures in *Peripatus capensis*, and do not see how I could have missed them in the other species, since I dissected *P. novæ-zealandiæ* with considerable care. In regard to Captain Hutton's general remarks, it may be noted that he does not seem to see the importance of the determination of foot-jaws as existing in *Peripatus*, though it is the presence of these structures which forms the real distinction between Arthropods and Annelids. The real points of interest which Captain Hutton has determined appear to me to be:—

1st. The observation of the offensive use of the viscid fluid of *Peripatus* for catching prey and obtaining food. Were the ducts otherwise placed as to their opening, we might here almost find a step towards the development of the spider's web; for the ejected slime forms a web (Phil. Trans. *l. c.* p. 760); and I believe *Peripatus* to be ancestral to spiders together with other tracheates.

2nd. The probable shedding of the skin by *Peripatus*. What points most certainly to this is the presence of the reserve horny jaws and claws within the active ones. I observed, however, in the case of both jaws and claws in both *P. capensis* and *P. novæ-zealandiæ*, three sets one within the other; and Captain Hutton's figure (*l. c.* fig. 2) seems to indicate such a condition, although he mentions only two.

3rd. That the animal breeds all the year round. I was astonished to find it breeding in mid-winter (July).

4th. The observation of the mode of birth.

Captain Hutton's reference to the geographical distribution of *Peripatus* is extremely apposite. He might have added Australia to the list of regions in which *Peripatus* occurs. Its occurrence in Australia, the West Indies, Chili, New Zealand, and the Cape is additional evidence to its structure of its great antiquity. I am not without hope that its horny jaws may some day turn up in the fossil condition in strata older than the Carboniferous; for of such age must *Peripatus* be if it be a representative of the Protracheata.

The fact that two pairs of jaws are formed from the modification of one ambulatory member, being simply the slightly specialized pairs of foot-claws, would seem to point to the possibility that in Myriopoda and other tracheates the two pairs of maxillæ may possibly be derivable from one segment only.

My friend Prof. E. Ray Lankester has drawn my attention to a late paper by Mr. J. F. Bullar \*, of Trinity College, Cambridge, in which the conclusion is arrived at that five species of parasitic Isopoda are hermaphrodite and probably self-impregnating. And Mr. Lankester suggested to me that possibly an error in observation has here occurred similar to that fallen into by Captain Hutton in the case of *Peripatus*, viz. that spermatophores or portions of them have been mistaken for testes. A result so remarkable and apparently improbable as the determination of the existence of hermaphroditism amongst the Arthropoda should certainly not be admitted without the very strongest evidence. No description whatever of the finer structure of the supposed testes in the Isopoda examined by Mr. Bullar is given in the paper in question; and the figures do not give evidence of any testicular tissue. Apparently only spermatozoa have been observed in the supposed testes and what seem to be spermatophores (pl. iv. fig. 6). Of testis-cells and vesicles of evolution no mention at all is made; yet if such had been observed it is very unfortunate that in a case of such importance they should not have been described, since it is they and not spermatozoa which constitute a testis. For evidence that large masses of spermatozoa may occur in a female Arthropod in the closest relation with the ovary, I would refer to my figure of the ovary of *Peripatus capensis* (Phil. Trans. *l. c.* pl. lxxiv. fig. 1). It is possible that an external opening to the oviduct may exist in earlier stages

\* "The Generative Organs of Parasitic Isopoda," Journal of Anat. and Physiol. vol. xi. part 1, Oct. 1876, p. 118.

than that described by Mr. Bullar as the third, but be difficult of detection. It is difficult to see why what appear to be spermatophores, or portions of such, should be formed in a self-impregnating animal; and the immobility of the spermatozoa observed is a fact quite as much in favour of these having been introduced for some time and tired out, as freshly developed and functionally active. Surely it is quite possible that in such a case as that of *Cymothoa æstroides*, which Mr. Bullar cites as unable to swim, active males may exist, which have not yet been detected. The rudiments of both external and internal male organs may well exist in a female Isopod; and it is significant that the double penis is present only in the earlier stage in development of the Isopod in question. It is quite possible that Mr. Bullar has observed testis-cells and the actual development of spermatozoa in his Isopods, but has not described their occurrence. If so, it is to be hoped that he will not omit to do so in some further account of his most interesting researches, and thus set all doubt as to his conclusions at rest.

With regard to my own observations on *P. novæ-zealandiæ*, I may mention some further facts. *P. novæ-zealandiæ* differs from *P. capensis* in that it has 15 pairs of ambulatory members and no anal papillæ. There is further in the New-Zealand species a distinctly prolonged but short conical tail, with a slight knob-like enlargement at its extremity, which does not exist in *P. capensis*; further, the anus being terminal, the vulva is separated from it, and situate at a considerable interval further forward and between the last pair of members. The two orifices are close together in the Cape species. In *P. novæ-zealandiæ*, and probably also in *P. capensis*, there is present, in addition to the jaws, a single mesially placed row of very small simply conical chitinous teeth on the roof of the mouth, running from before backwards. The antennæ are in *P. novæ-zealandiæ* provided at the tips with tactile hairs. The place of commencement of the rectum appears better-defined in *P. novæ-zealandiæ* than in *P. capensis*; and the viscus is longitudinally plicated.

The ovarian ova of *P. novæ-zealandiæ*, apparently ripe, were ovoid in form, 1 millim. in length, filled with oily particles, and with a germinal vesicle and spot. When pressure was made on the covering-glass the egg-membrane was seen to be tough and elastic, and only gave way after the egg had been distorted into various forms. When the contents finally escaped by rupture, the germinal vesicle made its way out, becoming elongated and altering its form in order to pass the aperture in the membrane; but it resumed its shape again when

free, giving evidence of its toughness and definite walling. It contained a single germinal spot.

The New-Zealand *Peripatus* is much smaller than the Cape species; and yet the embryos are much larger. In all the specimens examined by me the embryos were far fewer in number than ordinarily in *P. capensis*; yet Captain Hutton in one instance found 26 embryos in one female. The embryos, as observed by Captain Hutton, occur in successive stages of development in the oviduct, and are not all nearly equally mature as in *P. capensis*. The embryos have the contents of the developing intestine coloured red in *P. capensis*; in *P. novæ-zealandiæ* the contents are white. The embryos appear in the New-Zealand species not to go through the preliminary worm-like stage, with the body spirally coiled (Phil. Trans. *l.c.* pl. lxxv. fig. 1), which is present in *P. capensis*; they seem to have lost this earlier stage, and to skip at once to the further stage of *P. capensis* (Phil. Trans. *l.c.* pl. lxxv. fig. 4), the first indication of form being the appearance of a hilum near one pole of the ovoid egg, which hilum marks the spot where the tail and head meet in the doubled-up condition of the embryo.

VII.—On Rhopalocera from Japan and Shanghai, with Descriptions of new Species. By ARTHUR G. BUTLER, F.L.S. &c.

MR. MONTAGUE FENTON (of Tosengi, Takanawa, Tokei, Japan) has recently forwarded to the British Museum a small box of Diurnal Lepidoptera, comprising the following species.

*Cænonympha annulifer*, n. sp.

Nearly allied to *C. geticus*, but larger, longer in the wing, much darker; on the underside with the plumbagineous streak, which bounds the ocelli of secondaries internally, straight on its inner edge instead of undulated. Expanse of wings ♂ 1 inch 7 lines, ♀ 1 inch 10 lines.

About 370 miles from Tokei (Yedo).

This species is probably the same as that noted by the Rev. R. P. Murray as *Cænonympha œdipus*, Fabricius.

*Neope Fentoni*, n. sp.

*Lasiommata epimenides* ♀, Ménétrés, Reisen und Forschungen im Amur-Lande, ii. 1, Lepid. tab. iii. fig. 9 (1859).

In the heart of the mountains, about 370 miles from Tokei.



Moseley, H. N. 1877. "VI.—Remarks on observations by Captain Hutton, director of the Otago Museum, on *Peripatus novæ-zealandiæ*, with notes on the structure of the species." *The Annals and magazine of natural history; zoology, botany, and geology* 19, 85–91.

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