

vermuthet, stehen auch bei *Pseudocotyle squatinae* die Pori dorsal. In allen den genannten Fällen finden wir die dorsal ausmündenden Pori weit vorn (so auch nach Wright⁵ bei *Sphyrnura*), meist in der Höhe der Geschlechtsöffnungen, selbst in der des Pharynx; doch kommt auch endständige Lage vor, z. B. bei *Onchocotyle appendiculata*, wo bekanntlich die beiden Öffnungen am Schwanzende ausmünden, während *Gyrodactylus* und *Tetraonchus* nur einen am hinteren Körperende, aber dorsal gelegenen Excretionsporus besitzen. Über viele andere Gattungen fehlen einschlägige Angaben.

Schließlich bitte ich in meiner: »Notiz über *Tristomum elongatum* N.« (p. 433 d. Zool. Anz.) in der Anmerkung zu lesen: »beschränken sich auf die Angabe, daß etc.«.

Nachschrift. Durch die Güte des Herrn Collegen Taschenberg bin ich in die Lage versetzt worden, *Tristomum papillosum* untersuchen zu können. Entgegen der Angabe Kölliker's habe ich anzuführen, daß auch bei dieser Art die Excretionspori dorsal und zwar ziemlich nahe der Mittellinie am vorderen Körperende ausmünden.

2. Studies in the Morphology of the Lepidoptera, I.

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eingeg. 10. October 1889.

The following observations relate to two points in the anatomy of the Macrolepidoptera: — to the external anatomical indications of sex in the chrysalis, and to the mode in which the azygos portion of the oviduct with its accessory organs develops in the female.

I. The fact that it is perfectly easy to determine the sex of a given chrysalis, seems so far as I can find, to have escaped the notice of all observers. The distinctive characters are to be found on the sternal region of the ninth abdominal somite in the male, and in the corresponding region of both the eighth and the ninth abdominal somites in the female.

The male shows a fine short line or linear depression corresponding to the aperture of the ductus ejaculatorius in the position indicated. This line has two small oval lips, one right, the other left, and is situated on a slightly raised surface in *Pieris* and *Pontia*: it lies in a cupshaped area with raised margins, sometimes thickened on the right and left, in the genus *Vanessa*: and in all the Heterocera I have examined, it has two tumid lips, one right, the other left, and is placed either in the centre of the sternal region or at its posterior border.

⁵ Journ. of morphol. Vol. I. Boston, 1887. p. 20.

The female has typically two fine linear depressions, one in the eighth sternal region, the other in the ninth. They correspond to the paired vesicles invaginated from the larval hypodermis (see *infra*) and to the apertures of the bursa copulatrix and oviduct respectively in the adult. In *Pieris* and *Pontia* they possess slightly raised oval margins. In *Vanessa* a continuous line interrupts the eighth and ninth sterna. This line indicates a shallow furrow at the bottom of which the two apertures lie: and it appears to be continuous because the intersegmental membrane between the two somites is completely folded inwards instead of being superficial and smooth as in *Pieris* and *Pontia*. In the Heterocera (*Sphingidae*, *Hepialidae*, *Arctiidae*, and *Noctuidae*) examined, the ninth sternum has a triangular extension forwards, invading the eighth sternal region and it is not clearly marked off from the tenth somite behind. There are either the two typical linear depressions, one in the eighth sternum, the other at the apex of the triangular plate of the ninth sternum as in many *Sphingidae*: or what is probably more common there is a single depression at or close to the apex of the triangular plate of the ninth sternum which appears to represent the two typical depressions confluent with one another. This is the case in all specimens of *Sphinx ligustri* that I have seen. But there may be variations in the same species. Specimens of *Cossus ligniperda* and *Zeuzera aesculi* may have two depressions or only one. Every example of *Cucullia verbasci* that I have seen has but one depression: a single example of *C. scrophulariae* which has come under my notice, has two.

II. One of the great peculiarities of the Lepidoptera is the existence in connection with the female reproductive organs of two separate external apertures — the aperture of the bursa copulatrix, and the aperture of the oviduct. The former is ventral, the latter terminal, posterior and immediately ventral to the anus on the same papilla. De Lacaze-Duthiers in his researches on the genital armature of the Insecta came to the conclusion 1) that the orifice of the bursa is in connection with the seventh sternal region and is altogether secondary, whilst 2) the oviducal aperture represents the genital opening of other female Insects and, 3) that the somites usually intervening between the oviducal opening and the anus are absent in the Lepidoptera. See the table on p. 230 of the *Annales des Sc. Nat.* (3) XIX, 1853. It is well known, however, that the caterpillar has ten abdominal somites, the first eight bearing spiracles, and the tenth the anal valve and two anal prolegs. The ninth somite varies in the degree to which it is pronounced externally. A chrysalis has the same number of abdominal somites,

but the spiracles of the eighth somite are abortive and the tenth somite bears the cremaster, the homologue of the anal valve Riley, Jackson. The sustentors which are present on this somite in some Lepidoptera are held by Riley to represent the »plantæ« of the anal prolegs, but it appears to me that they and the sustentoral ridges represent the body of the tenth somite and that the anal prolegs of the caterpillar are replaced by the two rounded elevations one on either side the anus. The abdomen of the imago is composed apparently of nine somites. The first seven have stigmata: the eighth which has the aperture of the bursa copulatrix on its ventral aspect has lost its stigmata or only shows a trace of them as slight scars. The terminal papilla or »ninth somite« of the abdomen is conical, and contains the anal and oviducal apertures. It is, I find, produced in *Vanessa Io* at a late period of pupal life by the ingrowth of a fold of hypodermis surrounding the anus and oviducal aperture: the latter shifts backwards in development. It must be regarded as a new formation, at least in the species named, in the tenth pupal somite, the rest of the tenth somite and the whole of the ninth being merged in the membrane between the base of the papilla and the eighth somite.

Herold in his »Entwicklungsgeschichte der Schmetterlinge« published in 1815, has given an account of the mode in which the female organs develop in *Pontia brassicae* from the close of larval life and during the pupal period. His results briefly summarised are as follows. The paired larval oviducts are attached in the full grown caterpillar to the posterior edge of the seventh abdominal somite near its centre — a fact confirmed by Bessels (Zeitschr. f. wiss. Zool. XVII, 1867, p. 561). Their ventral ends are connected by two striated bands crossing the eighth sternal region to a pair of oval pieces in the ninth sternal region. Subsequently the larval oviducts and two oval pieces approximate and fuse. The ventral ends of the larval oviducts unite and form the azygos portion of the oviduct whilst the oval pieces give origin to the bursa copulatrix, to the unpaired gland (= receptaculum seminis of von Siebold) and to the paired glands. He does not account for the presence of the two apertures to the female organs in the imago.

My own investigations have been conducted almost entirely on *Vanessa Io* because I was unable to command at the time a sufficient supply of *Pontia brassicae*. The results may be summarised to the following effect.

1) The larval oviducts are attached as stated by Herold and Bessels. The fully grown caterpillar has a pair of vesicles invaginated from the hypodermis in the eighth sternal region and a second pair in

the ninth sternal region. These invaginations are completely distinct from one another. Similar pairs of invaginations may be found in the fully grown larvae of *Pontia brassicae* and *Pygaera bucephala*.

2) During the quiescent period preceding pupation changes take place. The anterior vesicles enlarge, lose their paired character and become elongated antero-posteriorly. A tube invaginated from the hypodermis connects them to the ventral ends of the larval oviducts. They are afterwards connected by a furrow converted later on into a tube to the second pair of vesicles. This furrow and tube are also derived from the hypodermis. The posterior vesicles retain their paired character and each of them begins to develop a posterior tubular outgrowth. An aperture corresponds to the base of the first pair of vesicles, and another aperture to the base of the second pair.

3) During pupal life the structures assume by degrees the form of the organs of the imago. The anterior end of the first vesicle becomes the bursa copulatrix, the posterior end the receptaculum seminis. These two structures are at first perched on the dorsal aspect of the azygos oviduct, and are closely connected at their point of origin. At a later period the bursa copulatrix is placed laterally to the azygos oviduct, and finally the connection between the two is converted into a tube — the seminal canal: but the bursa, and not the oviduct, retains a connection with the original external aperture of the first pair of vesicles. The receptaculum seminis maintains its position. The two posterior vesicles are converted into the paired »sebaceous« glands. They open into the azygos oviduct by a common duct, and their tubular processes grow to an immense length. The azygos oviduct or vagina which is derived from the tube connecting the first pair of vesicles to the larval oviducts, and from the tube connecting them to the posterior pair of vesicles grows in length. Its posterior aperture shifts backwards until it lies immediately ventral to the anus and some distance behind the second pair of vesicles. It acquires a very distinct chitinous lining at an early period. A pair of glands — odoriferous glands of von Siebold — absent in *Pontia brassicae* develop as invaginations from the hypodermis immediately beneath i. e. in front of the oviducal aperture. Finally a circular fold of hypodermis grows inwards and surrounds the anus, the oviducal aperture, and the aperture of the odoriferous glands. The area inclosed by the fold corresponds to a portion only of the tenth somite and constitutes the terminal papilla of the abdomen. The epithelium of the azygos oviduct and the accessory organs is derived solely from the hypodermis.

Two results follow from the above-given description. First, that the aperture of the bursa copulatrix belongs to the eighth somite and

is strictly speaking the homologue of the single genital aperture of other Insecta, that the Lepidoptera have really two postgenital somites intervening between it and the anus, and that the oviducal aperture is an acquired peculiarity. These statements are true of the majority of Lepidoptera, but variations may occur as may be seen from Chodkowski's account of *Nematois metallicus* in Zeitschr. f. wiss. Zool. XLII, 1885.

The second result is that there are three distinct stages indicated in the phylogenetic history of the female reproductive organs. In the first stage paired larval oviducts opened at the posterior border of the seventh abdominal somite as in existing *Ephemeridae*. If accessory organs were present they opened independently on the two succeeding somites. In the second stage a short vagina or azygos oviduct derived from the hypodermis of the eighth somite made its appearance. The bursa copulatrix and receptaculum seminis opened close behind its aperture or into it on its dorsal aspect, whilst the sebaceous glands retained a separate aperture. Very similar arrangements obtain in many living Orthoptera. Finally in the third stage the sebaceous glands open into a continuation of the vagina which possesses a second terminal aperture: a disposition of parts specialised in the Lepidoptera.

A full account of this investigation with figures, will I trust be shortly published.

Museum, Oxford, Oct. 7. 1889.

3. Sur le *Monotus setosus* sp. nov.

Communication préliminaire par le docteur G. du Plessis à Nice.

eingeg. 14. October 1889.

Nous avons publié dans le numéro 310 de ce Journal une nouvelle Planaire marine du groupe des Tricladés, fort remarquable par la transition, presque complète, qu'elle établit entre les Dendrocèles et les Rhabdocèles. Nous avons nommé l'animal *Otoplana intermedia* en mémoire de ce fait. Or, précisément au même endroit sous les mêmes cailloux de la rive dans les mêmes conditions se rencontre aussi très rarement et à la même saison un autre Turbellaire nouveau qui achève parfaitement la transition si bien commencée par l'*Otoplana* susdite. Celle-ci comme nous l'avons fait voir à l'évidence se rapproche surtout des Monotidés parmi les Rhabdocèles. Or c'est précisément d'un *Monotus* qu'ils agit ici, mais d'un *Monotus* court, plat et large qui a tout l'air d'une petite Planaire et en particulier de l'*Otoplana* elle-même, à la quelle il ressemble tant qu'au début de nos observations nous prenions souvent l'un pour l'autre.

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