

CONTRIBUTIONS TOWARDS THE COMPARATIVE MORPHOLOGY AND PHYLOGENY OF THE *MESOSTIGMATA* (ACARINA). VIII.

ON THE POSTEMBRYONAL DEVELOPMENT OF THE *CELAENOPSIDAE*

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As pointed out by author in several papers nothing is known about the postembryonal development of the *Celaenopsidae*; this is a very deplorable fact because it is to be expected that a knowledge of the larvae and the nymphae would throw light on the systematic position of this group which represents a quite distinct and isolated line of development amongst the *Mesostigmata* without any connecting links to such groups as the *Gamasides* or the *Uropodina* or the primitive *Liroaspina*.

This fact is the more deplorable as it would have been very easy and is still very easy for acarologists dwelling in countries where Passalids—which are the general carriers of the adult mites—must be found in great abundance in all stages in the same biotopes where the Passalids undergoe their development viz. in rotten logs and tree-stumps. An investigation of such biotopes at the proper season is sure to yield any amount of larvae and nymphs of the same species which in the adult stage are transported by the Passalids.

This being the case it is very fortunate that the nymphae of *Pleuronectocelaeno austriaca* Vitzthum (9) has been discovered both in my own material, collected by Mr. Bruce at Södertelje under the bark of a pine trunk and by Mrs. Helene Francke-Grossman in the galleries of the bark-beetle *Ips acuminatus*, a species which is very common in Northern Sweden.

SHORT SURVEY OF THE DORSAL SHIELDS OF THE *Mesostigmata*

Before giving a detailed description of the nymph of *Pleuronectocelaeno austriaca* it is necessary to give a short survey of our present conceptions regarding the number of dorsal shields in the *Mesostigmata*. As emphasized by the author (2, p. 2-6) the single dorsal shield present in so many genera must be looked upon as a secondary feature brought about by the coalescence of several shields. The presence of two dorsal shields in the nymphae of many genera which as adults have a single shield which was considered as an example of the biogenetic law which considers that a species during its development passes through stages representing stages in the phylogenetic development of the species. In this special instance it could of course be argued that the two dorsal shields of the nymphae were an adaptation for the purpose of allowing the nymphae the increase in size necessary for their development. But for this purpose it would only be necessary to have a strip of soft cuticle between the ventral and the dorsal shield.

In a later paper «Further contributions towards the comparative morphology and phylogeny of the *Mesostigmata*» (4, p. 92-98) the same problem was discussed and during the 30 years which have elapsed since my first paper was published many additional data have been brought to light which were discussed in the second paper. Vitzthum (10, p. 26-27) is of the opinion that the presence of several dorsal shields in the larvae and nymphae of several genera is probably not («ziemlich sicher nicht») a primitive feature. It is true that even if we do not know whether these shields are remnants a primitive segmentation or not there is every reason to describe them carefully and use them for the purpose of building up a natural system of the *Mesostigmata*.

In order to penetrate deeper into this intricate problem it is obviously necessary to study not only the exoskeleton but to investigate also the anatomy of all the developmental stages.

Let us now marshal the facts so far known about the correspondance between the number of dorsal shields and the sys-

tematic position of the different groups. It would of course be premature to assume that the presence of several dorsal shields is always a primitive feature. The comparative morphological researches on the *Mesostigmata* offer us numerous examples to the contrary. On one hand the investigations have elicited the fact that a shield may develop as a lobe from the mothershield, the lobe becoming finally quite independent save for the suture or articulation at the base of the secondary shield. In this way the so-called lateral shields have developed as anterior lobes, flanking the epigynial shield, as is the case in the *Diplogyniidae* (8).

On the other hand shields which were originally distinctly separated from other shields may become coalesced with other shields. Thus it has often happened the metasternal shield coalesces more or less with the sternal shields so that in the more pronounced cases only the metasternal hair bear witness of the fusion. This has happened f. i. in *Gamasellus* and in some *Diplogyniidae*, thus in two groups which are not at all related to one another.

It is true that these examples of progressive resp. retrogressive development of the shields are so far only known from the ventral side and are exhibited by the shields which have any direct relation with the formation of the genital aperture, and may therefore be considered as adaptations for some special purpose in connection with the copulation or the oviposition, and that it is not safe to draw any conclusions from the behavior of the ventral shields as regards the dorsal shields.

But, on the other hand, there is every reason to believe that the marginal shields at least of the *Uropodina* have developed at the result of the coalescence of a great number of small shields (Comp. Trägårdh, 5). Nevertheless the great facility with which shields appear as isolated, detached portions of other shields or disappear, becoming coalesced with other shields, makes it necessary to thread varily when drawing any conclusions from the number of the dorsal shields.

It cannot be denied that there is a strong tendency to consolidate the exoskeleton by the fusion of the dorsal and ventral shields f. i. in many *Gamasides*. This applies in the genera *Pergamasus* and *Amblygamasus*. But it is very suggestive that this

consolidation is generally restricted to the males while in the females the dorsal shield is generally separated from the ventral shields by a streak of soft cuticle evidently because the volume of the body is subjected to variations in size at least when the eggs ripen and make an increase in volume necessary a feat which it would be impossible to perform save for the streaks of thin cuticle between the dorsal and ventral shields.

It is now universally accepted as a fact that the group *Liroaspina* Trägårdh is the most primitive amongst the *Mesostigmata* (comp. Trägårdh, 4) because the genera have no true epigynial shield, the genital opening being simply a transverse fissure between the sternal shield and the ventrianal shield, because the sternal shield shows distinct traces of a primitive segmentation, and because neither the legs nor the gnathosoma has any secondary sexual characters in the male. This being the case, it is extremely interesting that both in the *Liroaspidae* and the *Microgyniidae* the dorsal side has more than the usual number of shields. In *Liroaspis* (comp. Trägårdh, 3, 4) there are two pairs of shields between the anterior and the posterior dorsal shields, in *Microgynium* and *Microsejus* two shields between the anterior and posterior shield. Furthermore, in the tropical genus *Epicrosejus* there are either three shields as in *Microgynium* or four shields as in *Microsejus*. A comparison between the four genera elicits the fact that the median shields of some *Epicrosejus* and of *Microgynium* is formed by the coalescence of the one resp. the two pairs present in *Liroaspis*. Without entering into the question whether these shields represent traces of a primitive segmentation or not, we may conclude that in the most primitive genera of *Mesostigmata* hitherto known the dorsal side has two pairs of shields between the anterior and posterior one and that in other primitive genera the two pairs of median shields have coalesced into one shield making the total number of shields three.

In this connection it is worth mentioning that in *Microsejus* there are on the anterior shield three pairs of round areas, arranged in two longitudinal rows which have a special structure and have the appearance of being traces of earlier shields (comp. Trägårdh, l. c., fig. 14, p. 29). This feature is in itself extremely interesting because if the hypothesis of the triple origin of the

anterior shield be true and the median shields consists of two pairs of shields we arrive at the number of six shields, representing six segments which agrees with Reuters (view Reuter).

Also in the very isolated genus *Thinozercon* the great anterior dorsal shield has two longitudinal rows of three pairs of rounded areas with a special sculpture (comp. Trägårdh, 4, fig. I, A, page 95).

In many more highly developed genera as f. i. *Eugamasus* and *Liponyssus* many nymphae have one-three pairs of small shields between the anterior and posterior shields. I look upon these as remnants of an earlier segmentation (comp. Trägårdh, 1912, fig. 7, p. 4) in which the figure given by Oudemans of *Liponyssus chelophorus* is reproduced and Sellnick which delineates the deutonympha of *Eugamasus immanis* (1, p. 50).

After this review of the varying number of dorsal shields in the *Mesostigmata* we return to the deutonympha of *Pleuronectocelaeno austriaca*.

Pleuronectocelaeno austriaca (Vitzthum.)

Deutonympha.—Length 640 μ ; width 396 μ .

The dorsal side (fig. 1) is covered by three shields, an anterior, an median and one posterior which are separated from one another by broad bands of soft cuticle and do not reach the margin of the body but leave a strip of cuticle along the lateral sides unprotected. The anterior shield is semicircular, a little broader at the base than it is long; it has 14 pointed, slightly curved hairs, arranged as in fig. 1. The median shield is a little more than twice as broad as it is long, tapering gradually backwards with convex sides and bluntly rounded posterior angles; it has 11 pairs of hairs of the same size and shape as those of the anterior shield.

The posterior shield is quadrangular, a little broader than it is long, with straight sides, converging towards the posterior end which is contiguous with the posterior side of the body; the anterior angles are obtuse... It has only two pairs of hairs, one pair in the anterior half and the other pair in the posterior angles pointing backwards and outwards in an even curve and almost

three times as long as the other hairs. In the space between the median and the posterior shield, near the anterior angles of the latter shield one pair of hairs, a little longer than the anterior hairs of the posterior shield.

At the anterior edge of the body five vertex hairs as in the

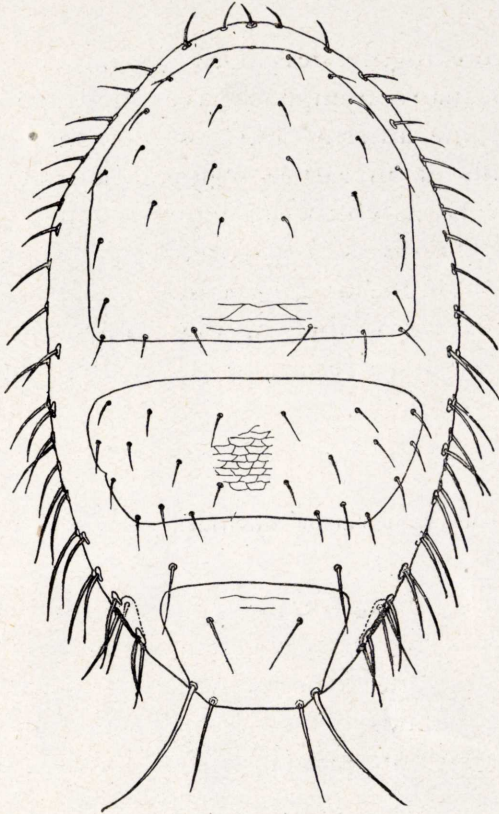


Fig. 1.—*Pleuronectocelaeno austrica* (Vitzthum). Nympha, dorsal side.

adults. Along the sides of the body, as far back as a little in front of the posterior angles of the anterior shield nine pairs of hairs, increasing in size backwards: further back a row of 18 pairs of hairs still larger, arranged two and two closely together, one of the pair being dorsal and submarginal while the other is marginal. The submarginal hairs are all inserted on very small but distinct, oval plates. In the space between the anterior shield and the body, on a level between the marginal hairs II and III one hair. The presence of submarginal hairs, inserted on small

shields is very interesting, recalling as it does similar structures in the nympha of *Trematurella stylifera* Trägårdh (comp. Trägårdh 7).

The ventral side (fig. 2).—The sternal shield has the shape of an urn, being constricted between coxae II, widening gradually

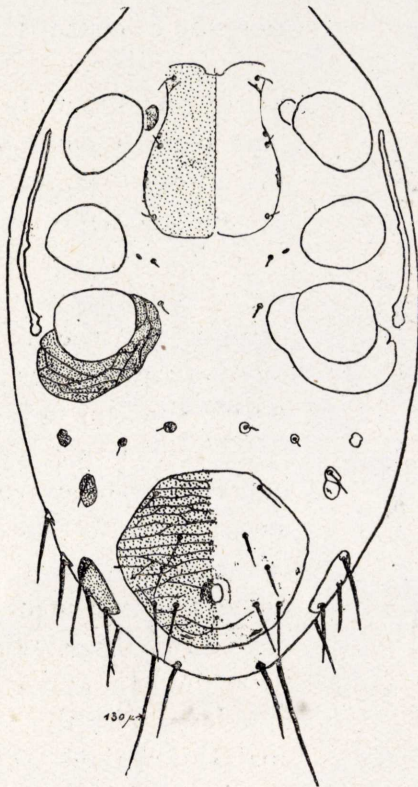


Fig. 2.—*Pleuronectocelaeno austriaca* (Vitzthum). Nympha, ventral side.

backwards with convex sides to a level with anterior sides of coxae III, then narrowing with transverse, straight posterior margin. In the middle of the anterior margin a shallow, blunt incision and a smaller one at the posterior margin in the middle. The sternal shield has only three pairs of hairs, one accompanied by a fissure-shaped pore at the anterior angles, hair II in the middle, near the sides and hair III near the posterior angles without any pore, this being found between hairs II and III and slit-shaped.

The presence of only three pairs of hairs on the sternal shield shows that the metasternal shields have not coalesced with the sternal shield. As a matter of fact the metasternal shields are either missing or too weakly chitinized to be visible. The meta-

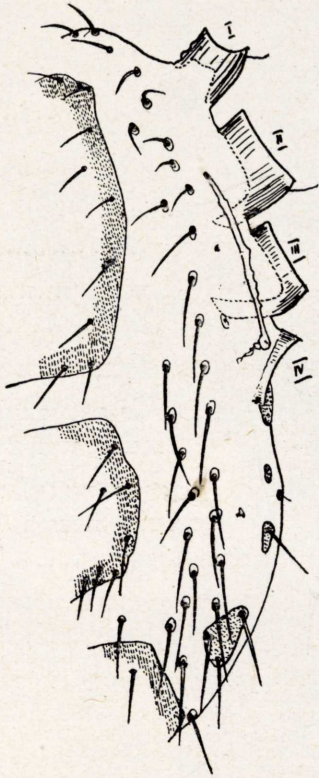


Fig. 3.—*Pleuronectocelaeno austriaca* (Vitzthum). Nympha, lateral view.

sternal hairs are, however present and are inserted on a level with the posterior side of coxae III and accompanied by a small pore. The fifth pairs of hairs, corresponding to the epigynal hairs of the *Gamasides*, are placed near the anterior side of coxae IV, close to the metapodial shields. The presence of only three pairs of hairs on the sternal shield is very remarkable there, being f. i. in the nymphae of the *Gamasides* always four pairs of hairs. The sternal shield is very finely punctured.

There is no ventral shield but halfway between coxae IV and the anterior side of the anal shield there is a transverse row of very small, round plates the two median pairs of which carry single hairs while the lateral ones have no hair and further backwards, on a level with the anterior side of the anal shield there are two pairs or similar, contiguous plates each with its hair.

The anal shield is almost pentagonal, with truncate anterior side and semicircular posterior side. It has a scaly texture, consisting of transverse lines, connected by oblique anastomosing lines; it has five pairs of hairs which the two posterior ones are longer than the others.

At the posterior side of the body, behind the middle of the anal shield a pair of elongate, submarginal shields carrying three pairs of hairs (fig. 3). At the posterior side of the body a pair of marginal bristles, about half as long as the posterior bristles of the posterior dorsal shield.

The metapodial shields have a polygonal texture and surround coxae IV from the middle as far as to their anterior side and the posterior and lateral side as far as to the middle. The stigmata on a level with the middle of coxae IV, the peritremata reaching as far as to middle of coxae II.

REVIEW OF THE CHARACTERS OF THE NYMPHA OF *Pleuronecto-
celaeno austriaca*

It is of course too early to draw any sweeping conclusions from the facts brought to light by the discovery of this nympha because, for one thing, we know nothing about the development of the closely related families, the *Diplogyniidae* and the *Schizogyniidae*. Nevertheless the presence of three dorsal shields in the nymphae is very interesting because this is a feature which as far as we know only occurs in the primitive groups such as the *Liroaspidae* and the *Microgyniidae*. It is therefore possible that the remote ancestors of the *Celaenopsidae* may be looked for in the vicinity of the *Liroaspina*. Perhaps new discoveries amongst the teeming masses of as yet unknown mites of the tropics will yield forms which may bridge the present very great gap between these groups.

The next feature which characterizes the nympha is the three pairs of hairs on the sternal shield. This has, however, no systematic value, as we know other genera in which the sternal shield is still shorter and carries only two pairs of hairs, as f. i. in *Aspidilaelaps* Trägårdh from Samoa (comp. Trägårdh, 7).

The next remarkable feature is the row of dorsal, submarginal hairs in the posterior half of the body, each hair being surrounded by a small plate. This feature has, as far as I know, only been found in the nymphae of some *Uropodina* f. i. *Trematurella*.

The last feature is the most interesting one because it is quite unique: the presence of a pair of ventral, submarginal shields on each side of the anal shield. All that can be said about it is that since it can hardly be an adaptation it is probably a primitive feature.

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