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**FURTHER NOTES ON THE HOLOTHYRINA (ACARIDA)
I. SUPPLEMENTARY DESCRIPTION OF HOLOTHYRUS
COCCINELLA GERVAIS**

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With 9 text-figures

The present paper is the first part of a series of two studies dealing with the morphology of the suborder Holothyrim. Some years ago (Van der Hammen, 1961), I published already an extensive description of a species from New Guinea (*Holothyrus grandjeani* Van der Hammen), in which paper I pointed to a number of important characters generally neglected in the study of Anactinotrichida. Because my material of *H. grandjeani* contained only one adult specimen, a number of characters (e.g. details to be studied in transverse as well as in longitudinal sections) could, however, not be taken into consideration. As a result of my 1961 study, a reinvestigation of nearly all species of *Holothyrus*, and especially of the type-species (*H. coccinella*), became highly desirable.

In a paper on the morphology of *Glyptholaspis confusa* (Foà), a Gamasine mite (Van der Hammen, 1964), I continued my studies in Anactinotrichid morphology. Several views which I developed there necessitated a return to *Holothyrus*. A new investigation could be carried out by the discovery of additional material in our museum collection, and by the acquisition of further specimens. Because I have now two females of *H. coccinella* from Mauritius at my disposal, the first paper of the present series deals with the type-species of the genus. In a second part (to be published afterwards), material from New Guinea will be used to clear up some of the remaining problems.

The study of *H. coccinella* has been carried out in the same way as that of *Glyptholaspis confusa* (cf. Van der Hammen, 1964); this applies not

only to the description, but also to the ways of observation, the preparation of sections, and the orientation of figured structures. Some of the figures (notably those of paraxial surfaces) consequently have an orientation which is not the same as in the figures of *H. grandjeani*. Just as in my *Glyphtholaspis* paper, I have added some numbered remarks on subjects of general interest, an additional list of terms introduced in Anactinotrichid morphology, and an alphabetic list of abbreviations used in fig. 1-9.

I may still remark that, in order to study species of *Holothyryus* according to the method described in my *Glyphtholaspis* paper, cavity slides are required with depths ranging to 3 mm; these slides must be expressly grinded, which has the advantage that they are optically of superior quality.

***Holothyryus coccinella* Gervais, 1842**

Material. — Mauritius (no further data): 2 adult females which apparently have been in alcohol for a long time and consequently lost part of their colour; the gnathosoma was rather difficult to section.

Description. — The following description deals mainly with details not mentioned in previous descriptions (Gervais, 1842, 1844; Mégnin, 1897; Thon, 1906). It contains information about most of the characters listed by me in 1961, whilst special attention is paid again to the gnathosoma.

Measurements. — Length of one of the specimens 4.3 mm, breadth 3.1 mm, height (according to a section in the region of acetabulum III) 1.5 mm.

Habitus and colour. — The species has the typical appearance of a *Holothyryus*: relatively large, with highly arched, very shining, and nearly oval idiosoma; the habitus reminds in some respects of a very large Gamasine mite. The colour of my alcohol specimens is reddish brown; this appears from observations on a carbon block as well as by transmitted light. There are darker spots in the lateral and marginal regions, and darker lines in the median and anterior marginal part.

Cerotegument. — The idiosoma presents dorsally a very thin, whitish layer of cerotegument; when observed on a carbon block, it reminds of a thin layer of white frost. This cerotegument is also found on the ventral surface of the idiosoma, on the legs, and in larger masses under the extending border of the dorsal shield. The layer is much thicker and of a special structure in taenidium 1 (cf. fig. 1D, 2E, 9A). There is a brownish, more or less tube-shaped mass of secretion near stigma 2; this certainly is no cerotegument, but a matter originating from trachea 2.

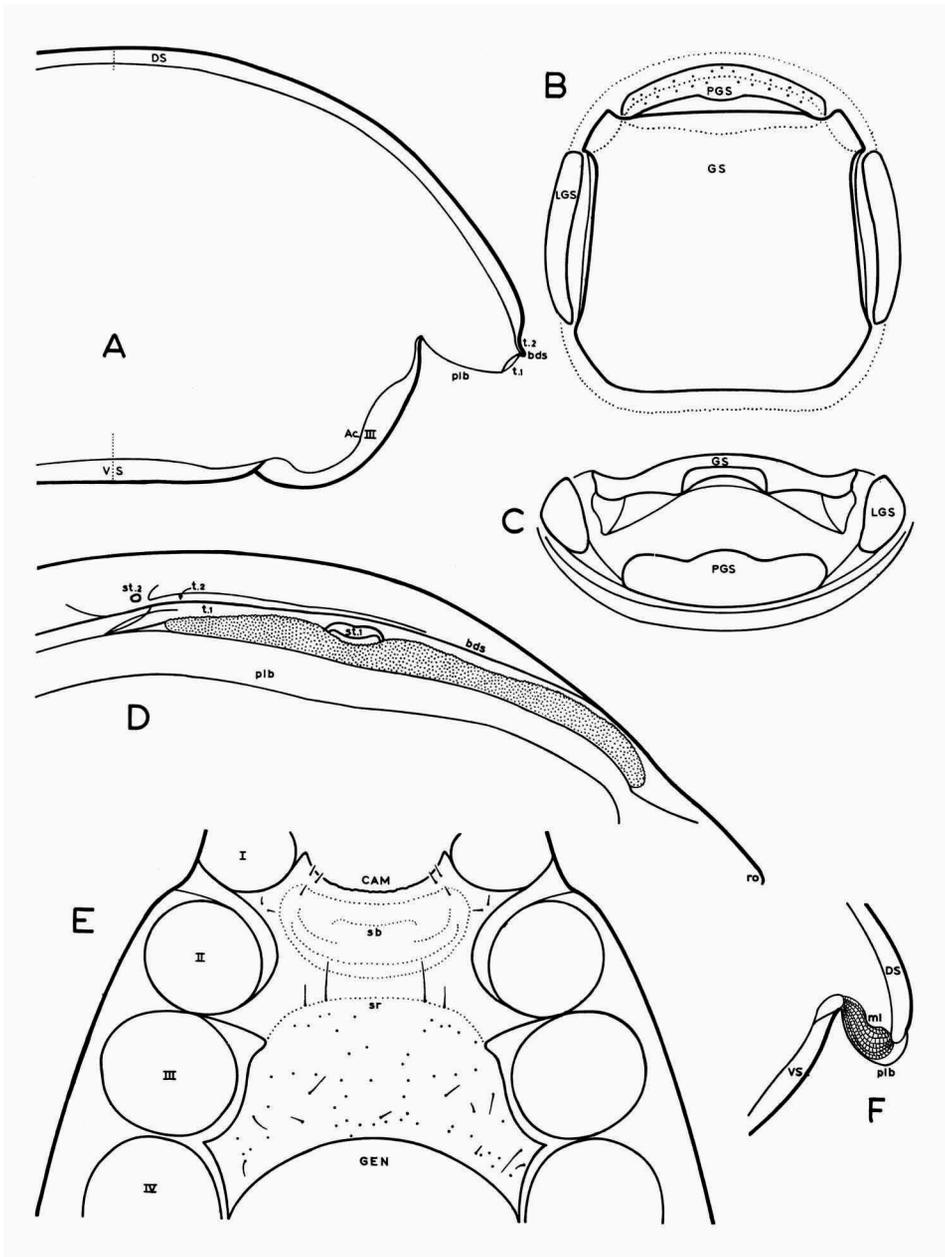


Fig. 1. *Holothyrus coccinella* Gervais, female; A, transverse section through idiosoma, between stigma I and genital area; B, ventral view of genital area; C, frontal view of genital area; D, lateral part of idiosoma with taenidia and stigmata, viewed obliquely from below; E, sternal region; F, transverse section through lateral part of idiosoma, posteriorly of genital area; A-F, $\times 36.5$.

Cuticle. — The cuticle is solid, just as in other species of *Holothyrus*; the surface is shining. The remarkable thickness is easily visible in fig 1A (a transverse section through the idiosoma). As a result of this solidity and thickness, the idiosoma is difficult to section.

There are two shields: a dorsal shield and a holoventral, connected by a chitinous plicature band. Consequently, the idiosoma is completely covered by an exoskeleton; the surface presents no soft skin. The rostral tectum (fig. 2A) is rather thin. Sections show that the reddish brown colour of the animal is indeed the colour of the cuticle, and not of pigment grains in the hypodermis.

Pores and lyrifissures. — The idiosoma presents a large number of small, simple pores which are distinctly different from the court-pores in *Glyptholaspis*. They have an apparently disorderly distribution, and the number probably has increased by plethotaxy. The idiosoma has only one pair of real lyrifissures (fig. 2A, E: i_1) which are certainly homologous with i_1 in *Glyptholaspis*. The position of i_1 dorsally of the camerostome is of considerable importance for the comparative morphology of the anterior part of the dorsal shield (cf. remark 1).

Lyrifissures are also present on the appendages (with the exception of the palp); these are dealt with in the paragraphs on chelicerae and legs.

Idiosoma. — The dorsal shield, the ventral face, and the lateral region of the idiosoma are described in separate sections. I recall that dorsal and holoventral shield are connected by a chitinous plicature band; the dorsal shield is distinctly protruding laterally. The greatest width of the idiosoma is just behind acetabulum IV.

Dorsal shield. — There are numerous very small, irregularly placed dorsal setae and pores. There is only one pair of lyrifissures (Fig. 2A, E: i_1). The thin, transparent rostral tectum has a pair of lateral lobes. The dorsal shield presents at each side the remarkable stigma 2; this stigma is situated in a small depression, from which a groove in the dorsal shield (a taenidium) runs closely parallel to the lateral border, as far as the rostrum (fig. 1D, 2A, E, 9A). In fig. 9B I have represented a sagittal section through trachea 2. A tube runs from the stigma through the cuticle and debouches into a system of saclets; these are situated partly inside the cuticle. According to Thon (1905) and Hughes (1959) the system would extend from the tracheal region to the rectum. In the present species it is, however, smaller and apparently more or less globular. Judging from the sagittal section, the trachea presents internal longitudinal ridges. As mentioned

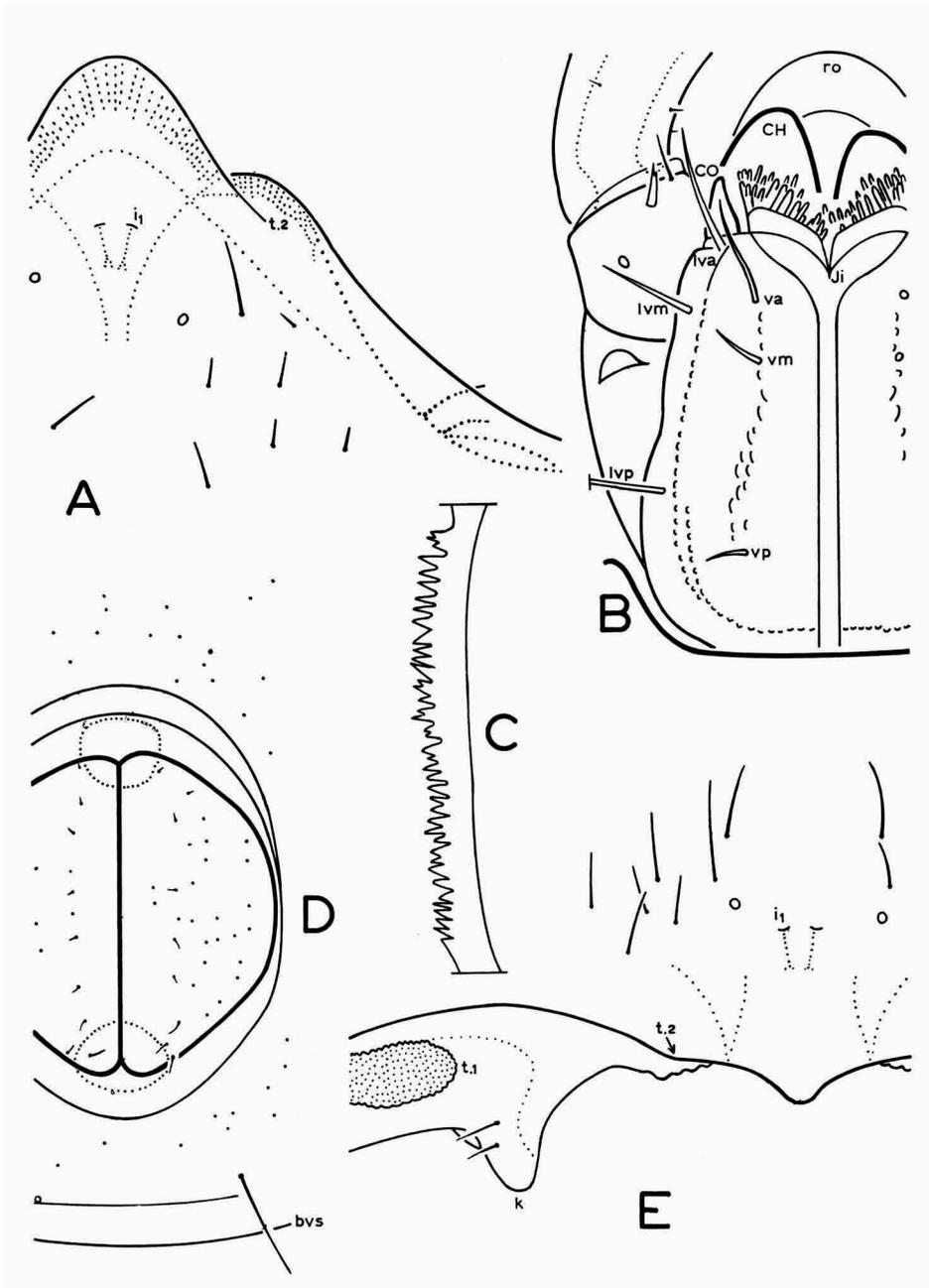


Fig. 2. *Holothyrys coccinella* Gervais, female; A, dorsal view of rostral region; B, ventral view of gnathosoma in retracted position in the camerostome; C, row of teeth on the left wall of the labial gutter, paraxial face; D, anal region; E, frontal view of rostral region; A, $\times 115$; B, $\times 110$; C, $\times 710$; D, $\times 55$; E, $\times 115$.

above, a mass of brownish secretion is usually found on the dorsal shield, near the entrance of the stigma.

Ventral face. — The ventral surface consists of a holoventral shield which encloses a genital and an anal region. The anterior part of the holoventral shield, between the acetabula of the legs, is the sternal region which presents numerous small setae and pores, but no lyrifissures and no specialized sternal setae. The sternal region consists of a posterior elevated part and an anterior depression (the sternal groove) mainly situated between the second pair of legs. In fig. 1E the line of greatest depth of the sternal groove is indicated by *sb*, the anterior border of the elevated part by *sr*. The anterior border of the sternal shield is the border of the camerostome.

The genital area has four shields: a large genital shield, a narrow anterior pre-genital, and a pair of narrow latero-genitals. They are represented in fig. 1B, C; these figures clearly show the way of closing of the four shields. Each anal valve presents a row of nine setae, and numerous pores. There is an anterior and a posterior anal locking-piece (fig. 2D).

Lateral region. — In lateral view stigma 1 and 2, and taenidia 1 and 2 are visible (fig. 1D). Stigma 1 is rather large and oval, and resembles the corresponding stigma of *Gamasina*; it is situated in the posterior part of taenidium 1 (syn. peritreme) which is relatively broad, and runs from below stigma 2 nearly as far as the rostrum. Taenidium 1 is situated in a special area ventrally of the border of the dorsal shield (this area takes the place of the so-called peritrematal shield of the *Gamasina*); consequently taenidia 1 and 2 run exactly parallel, only separated by a projecting border (cf. fig. 1A). A continuous, well defined strip of granular cerotegument covers the bottom of taenidium 1.

I recall that the complete lateral region of the idiosoma is projecting; it consists of the lateral part of the dorsal shield, the area of taenidium 1, and the plicature band (cf. fig. 1A). This plicature band consists of thin, flexible chitin; lateral muscles, attached to ventral and dorsal shield (fig. 1F: *ml*), regulate the state of contraction of the idiosoma.

Gnathosoma. — The present description of the gnathosoma is supplementary to that given by me in 1961. It deals successively with dorsal, ventral, lateral, anterior, and posterior faces; and with transverse as well as longitudinal sections.

I may remark that there appears to be some difference between a

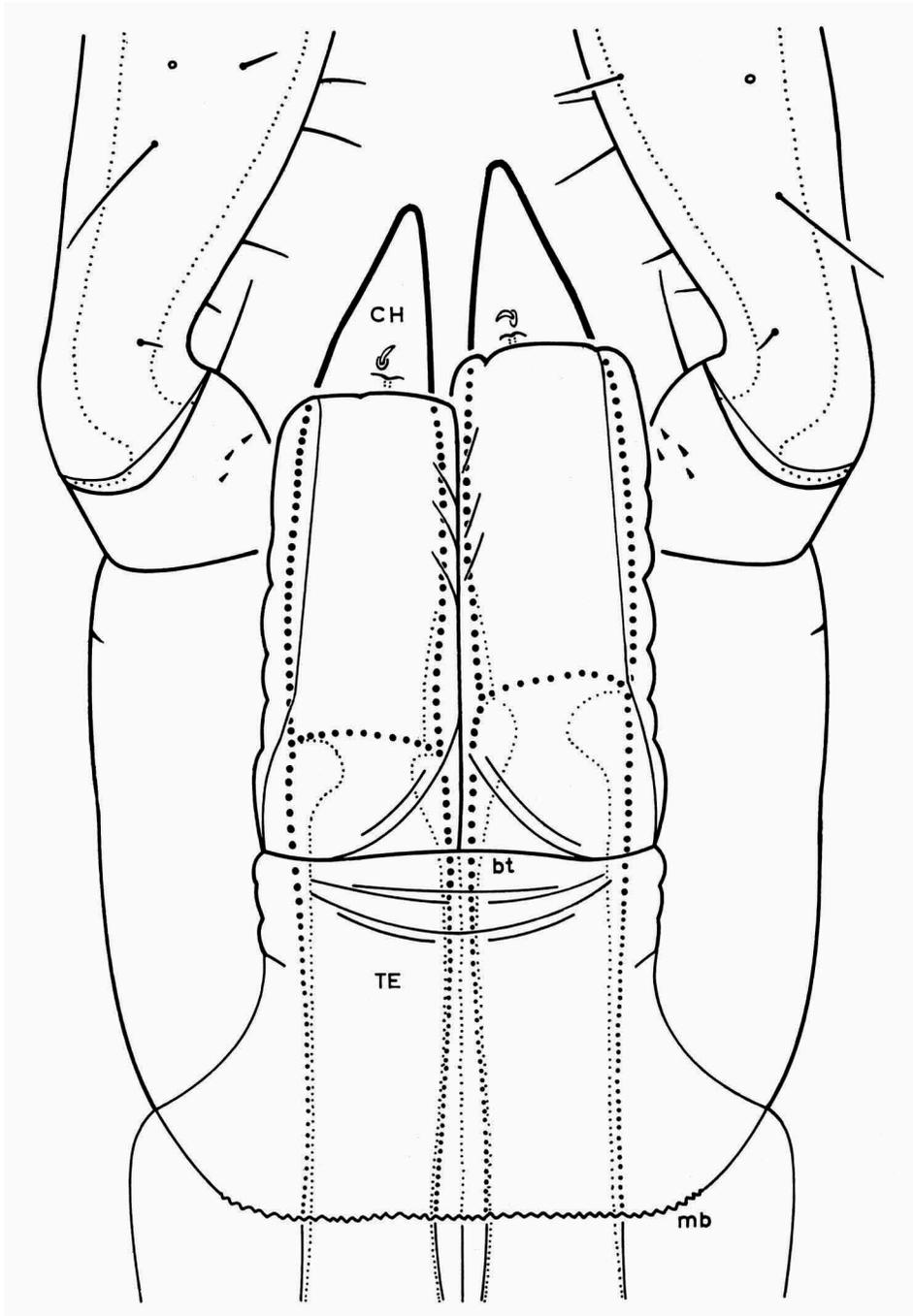


Fig. 3. *Holothyris coccinella* Gervais, female; dorsal view of gnathosoma; $\times 145$.

gnathosoma which is studied in retracted position in the camerostome (fig. 2B), and a gnathosoma that is separated from the idiosoma (cf. fig. 4). This is not only an apparent difference due to varying orientations of the strongly curved mentum, but also a real one due to the flexibility of the large lateral ridges (the coxal vaults) which are bent inwards when the gnathosoma is retracted; this is clearly demonstrated by a comparison of fig. 2B and 4.

The degree of sclerotization of the gnathosoma is different according to the various regions. The anterior and median parts, especially of the mentum, are heavily sclerotized. The posterior regions of cheliceral tectum, cervix, and mentum are, however, rather soft, pale in colour, and ill-defined. As a result of this, sectioning is difficult, and dissection must be carried out with the utmost care. The complete gnathosoma should preferably be separated from the idiosoma by cutting the cuticle surrounding the camerostome. Even after these precautions the posterior part, although undamaged, remains difficult to study because of the membranes attached to it.

The complete gnathosoma, which has more or less the shape of a cone, consists of a relatively large posterior part, and a smaller, narrower one in front of mouth and palpal acetabula. In Anactinotrichid mites, the anterior part is generally named rostrum. In this connection, rostrum is, however, misleading because the name relates also to the anterior part of the idiosoma; nevertheless, a term indicating the pre-oral portion appears to be very useful. For this reason I have replaced rostrum (of the gnathosoma) here by coniculus. This term is related to the name buccal cone, sometimes used when referring to the entire gnathosoma.

In 1961 I represented a dorsal view of the gnathosoma after removal of the chelicerae; in the present paper this is completed with a figure of a specimen in which the chelicerae are still in the original position (fig. 3). This figure not only clearly demonstrates the existence of a relatively small cheliceral tectum (already represented by me in 1961), but also the way in which the cheliceral sheaths are attached to its anterior border *bt*. In fact, at the line *bt* the simple tectum continues into two separate sheaths. I recall that this cheliceral tectum of *Holothyryus* has a considerable morphological importance, because it is the most primitive complete tectum we know. It demonstrates from which condition the strongly developed Gamasine tectum has probably originated in the course of evolution.

A ventral view of the gnathosoma (fig. 4) presents the same infra-capitular setae as in *Holothyryus grandjeani* (*va*, *vm*, *vp*, *lva*, *lvm*, *lvp*). The two species have also a great similarity in other details. I point to: (a) the

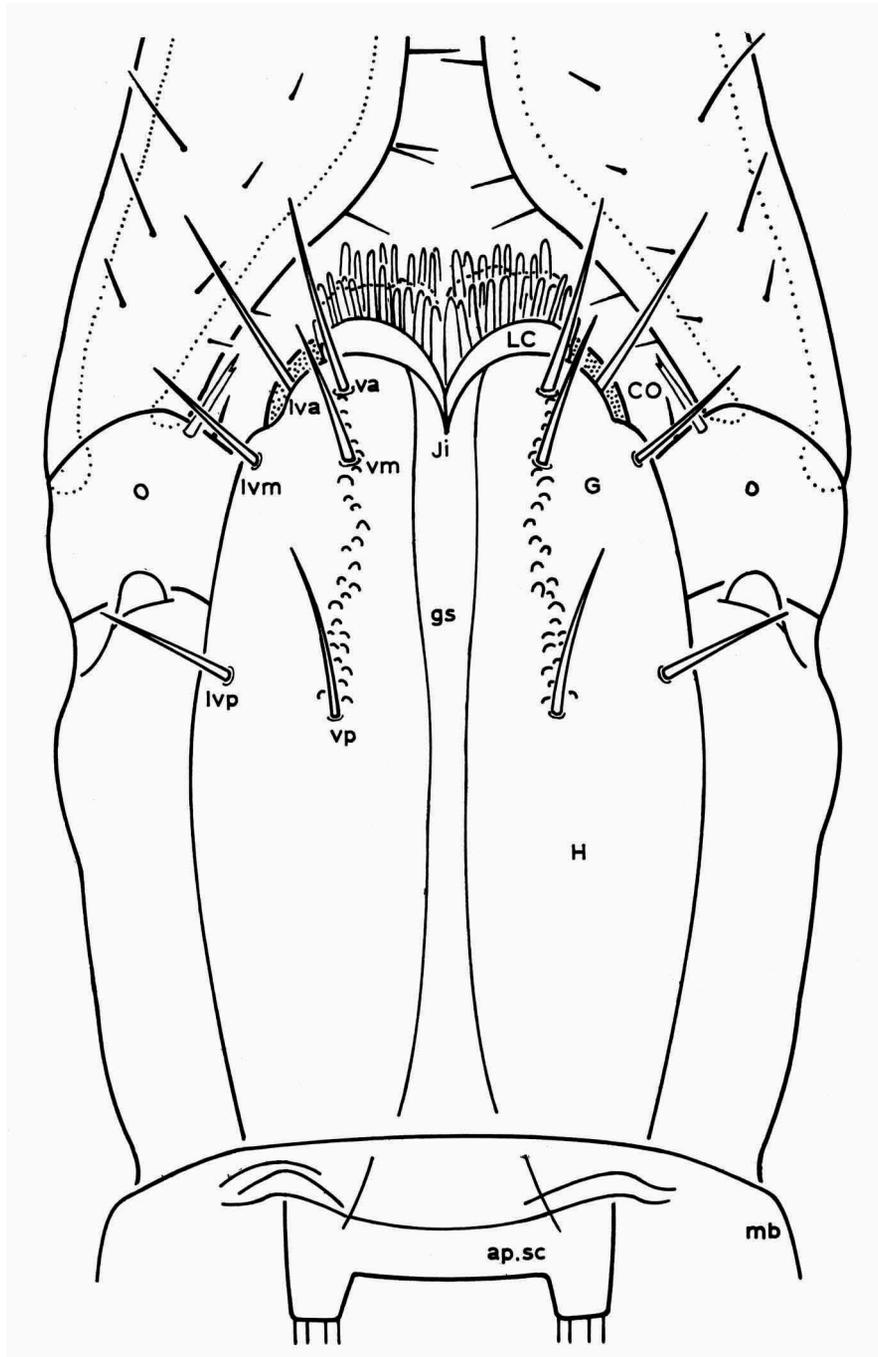


Fig. 4. *Holothyrys coccinella* Gervais, female; ventral view of gnathosoma; $\times 145$.

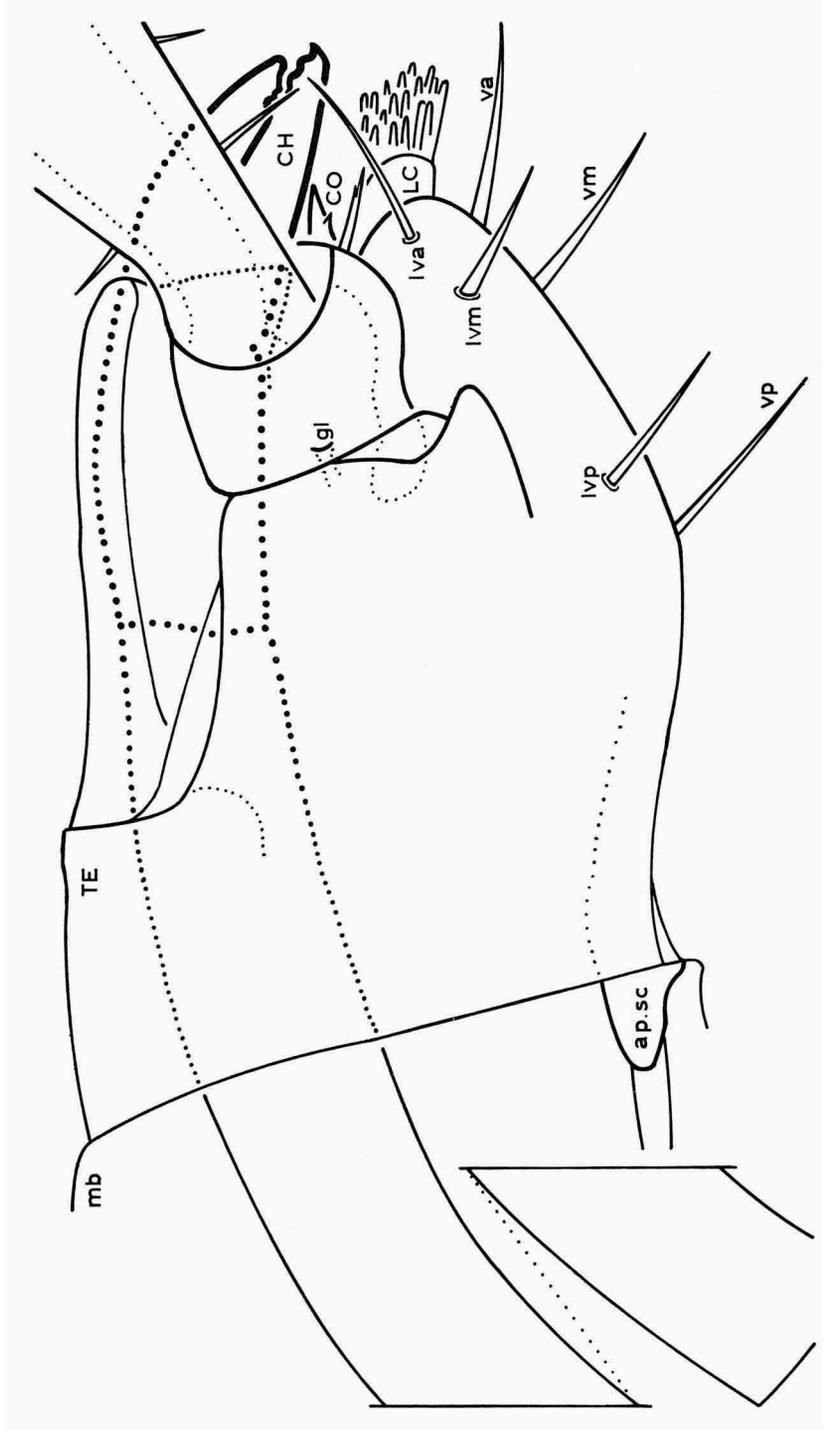


Fig. 5. *Holothyrus coccinella* Gervais, female; lateral view of gnathosoma; X 145.

absence of a separation between mentum and genae (just as in Gamasina); (b) the presence of a pair of flaps with papillose fringe anteriorly bordering the genae; and (c) the presence of an apodeme at the posterior border, which is more heavily sclerotized than the remaining posterior part of the gnathosoma, and consequently can be easily separated as a whole. The

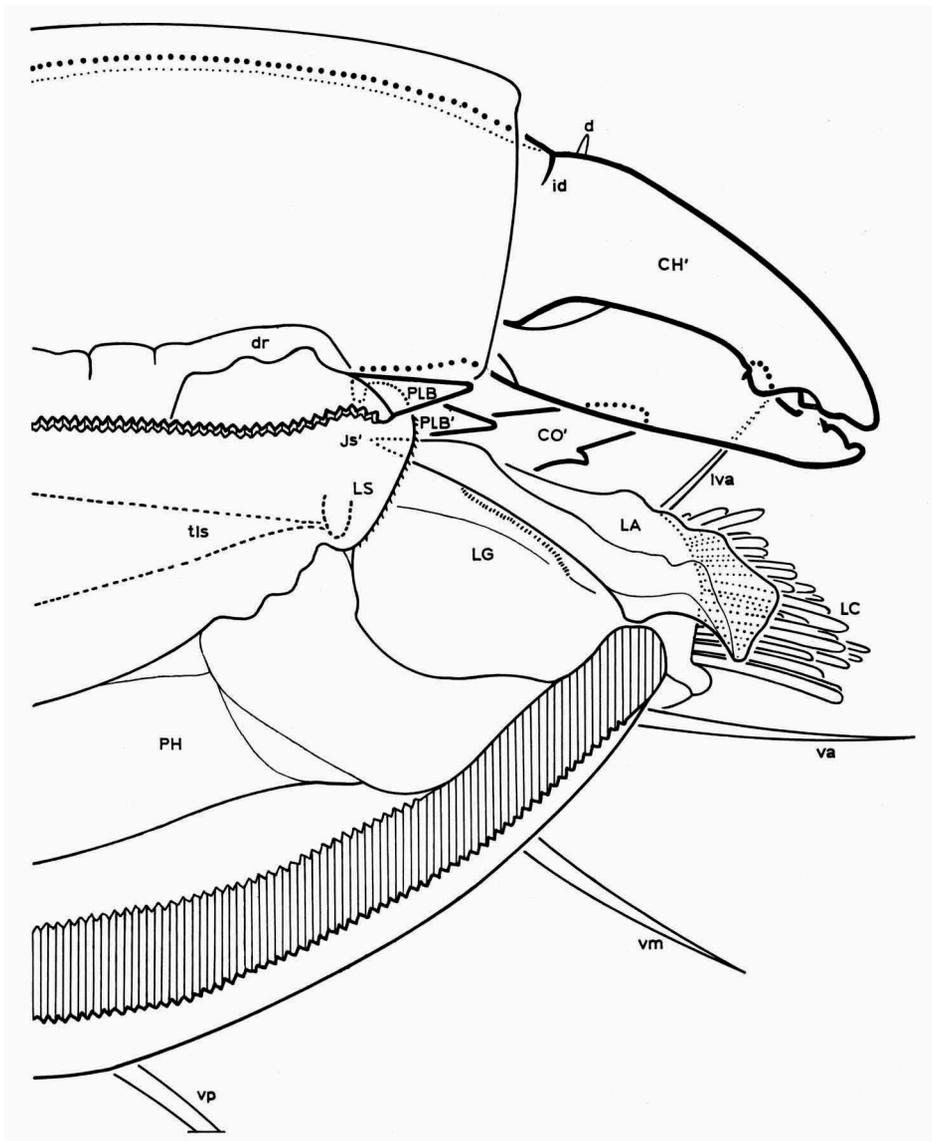


Fig. 6. *Holothyryx coccinella* Gervais, female; sagittal section through anterior part of gnathosoma (labrum schematized because of damage and retracted position); $\times 310$.

papillose flaps are certainly homologous with the laciniae of the Gamasina. The apodeme has an interesting position; it does not start from the border between segments I and II (i.e. from the posterior border of the cervix), but from the border between segments II and III (in this case the posterior border of the mentum, and the line of attachment *mb* of the membrane connecting mentum and idiosoma). Consequently there is no capitular apodeme, but a subcapitular. I regard this as a very important character, never mentioned before. In my opinion the subcapitular apodeme must be considered homologous with apodeme 1 of Oribatid mites, which is incorporated in the idiosoma (cf. remark 2).

The ventral surface of the infracapitulum of *H. coccinella* mainly differs from that of *H. grandjeani* by the presence of a distinct apophysis in the coxal region of the palp.

Fig. 5, the lateral aspect, presents a number of characters already observed in dorsal and ventral views, such as the infracapitular setae, the subcapitular apodeme (of which the ventral position is distinctly visible), and the coxal apophysis. The figure clearly demonstrates the attachment of the cheliceral sheaths to the cheliceral tectum. The lateral mark *gl* in the trochanter of the palp probably is an orifice of a gland. I have represented also the border *mb* of the membrane connecting the gnathosoma with the idiosoma.

I have used my two specimens of *H. coccinella* also to prepare longitudinal and transverse sections. The longitudinal section, represented in fig. 6, is a sagittal one: the pharynx is just left untouched, but the pre-oral cavity is cut; the two paralabral teeth and the labrum are present, although the labrum is damaged and consequently had to be schematized. The figure shows a number of important details. The labrum is represented in retracted position. The tendon t_{18} is attached to a chitinous piece in the upper lip. The dorsal wall of the pharynx continues as the ventral wall of the labrum; the ventral wall of the pharynx reaches the ventral wall of the pre-oral cavity. One of the laciniae (with papillose fringe) is visible, dorsally partly covered by a thin flap which certainly is the labellum. The labial gutter has a longitudinal row of teeth; this row is represented separately in fig. 2C. One of the dorsal commissures of the mouth (*Js'*), figured already by me in 1961, is visible laterally of the paralabral tooth *PLB'*. A dorsal ridge (*dr*) separates the chelicerae.

In fig. 7A I have represented a frontal view of a gnathosoma in which the distal part of labella and laciniae is cut off. The pre-oral cavity is visible in the sectioned part as well as between the raised labella (cf. also my 1961 figure of a dorsal view of the gnathosoma in which the labella

are in resting position, so that the pre-oral cavity is closed). The dorsal position of the infracapitular seta *ldm*, posteriorly of the corniculus, is distinctly visible.

A posterior view of the gnathosoma (fig. 7E) shows that the posterior part of the cervix is very thin, and does not continue into a capitular apodeme. The distinctly sclerotized subcapitular apodeme is visible at the

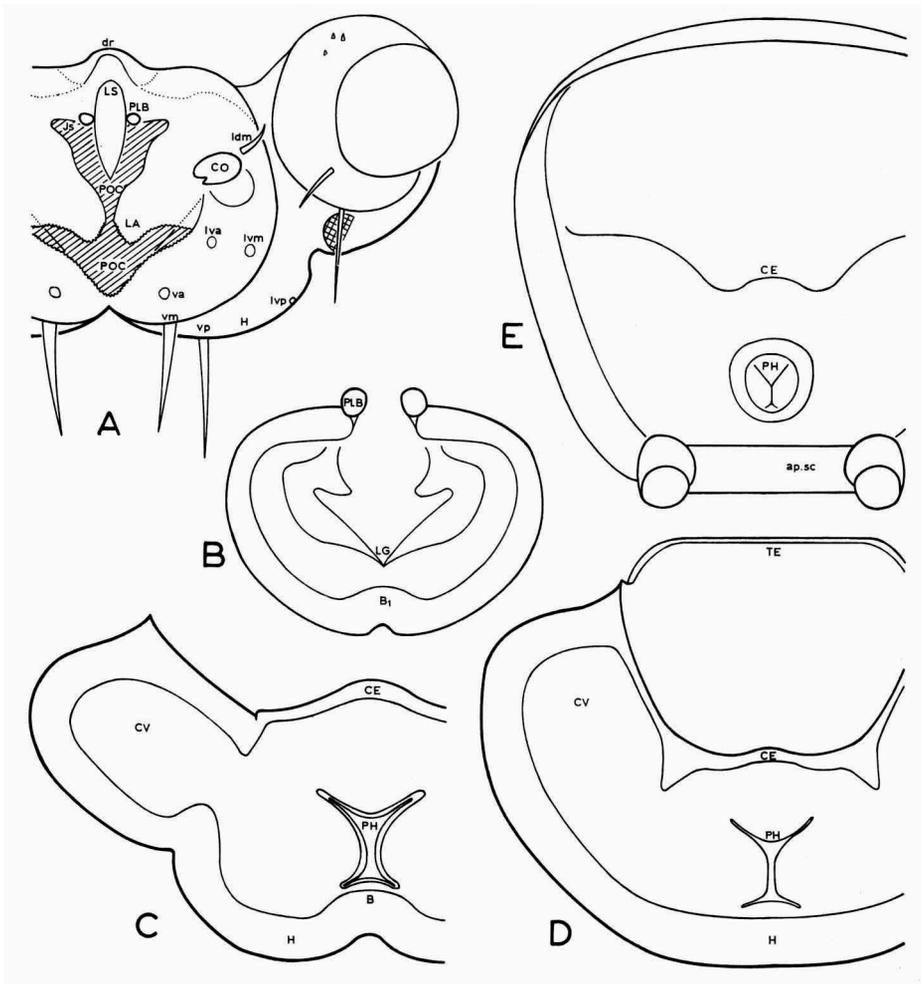


Fig. 7. *Holothyris coccinella* Gervais, female; A, frontal view of gnathosoma (distal part of labella and laciniae cut off); B, transverse section through coniculus, just in front of the base of the labrum (the section is viewed in distal direction); C, transverse section through gnathosoma, just behind the acetabulum of the palp; D, transverse section through gnathosoma, in the region of the cheliceral tectum; E, posterior view of gnathosoma; in all cases the chelicerae have been omitted for the sake of clearness; A-E, $\times 120$.

posterior border of the mentum. Coxal vaults are absent in the posterior part of the gnathosoma (this is in contradistinction to what I supposed in 1964). The posterior section of the pharynx is quadrangular, encircled by a strong muscular layer.

Transverse sections, respectively in front of the mouth, just behind the mouth, and in the region of the cheliceral tectum are represented in fig. 7B, C, E. I may remark that sectioning of the gnathosoma of *Holothyrus*, is very difficult because of the considerable differences in degree of sclerotization between dorsal and ventral parts. Consequently, fig. 7B-E must be regarded as more or less schematized.

Fig. 7B represents a transverse section through the coniculus (syn. rostrum of the gnathosoma). The paralabral teeth are visible; the labrum is removed. The lateral border of the labial gutter could be traced in the distal part of the section; the proximal part was too much damaged to be represented. A low boss (B_1) is visible at the bottom of the pre-oral cavity; an interpretation of this boss will be given below.

A transverse section behind the mouth (fig. 7C) shows that the coxal vault is not separated from the pharyngeal chamber: there is a paraxial connection. The pharynx is quadrangular. A distinct ventral boss (B) is present at the bottom of the infracapitular vault.

A transverse section in the region of the cheliceral tectum finally shows the cheliceral vault, the infracapitular vault (coxal vault and pharyngeal chamber have a large connection), and the quadrangular pharynx. A ventral boss at the bottom of the pharyngeal chamber is not present in this section.

The transverse sections, together with frontal and posterior views, teach us a number of important characters. We see that the coxal vault is lengthwise connected with the pharyngeal chamber and not closed laterally as in *Glyphtholaspis*. The pharynx appears to be quadrangular in the sectioned parts. The ventral bosses B and B_1 certainly are parts of a median ridge, starting posteriorly of the mouth and continuing in the pre-oral cavity. The ridge is not visible in fig. 6, because a sagittal section is represented there. In remark 3 I shall explain that this ridge probably is homologous with the unpaired under lip (labium), the presence of a labium being connected with a quadrangular section of the pharynx. It will be necessary to return to labium, mouth, and pharynx in the second part of the present series.

Summarizing some of the special characters of the gnathosoma of *Holothyrus*, I point to the presence of six pairs of ventral infracapitular setae and one pair of latero-dorsals. This number is unknown in other groups of Anactinotrichida. A large number of infracapitular setae (including latero-dorsals) is also found in Opilioacarida. I may remark that there is

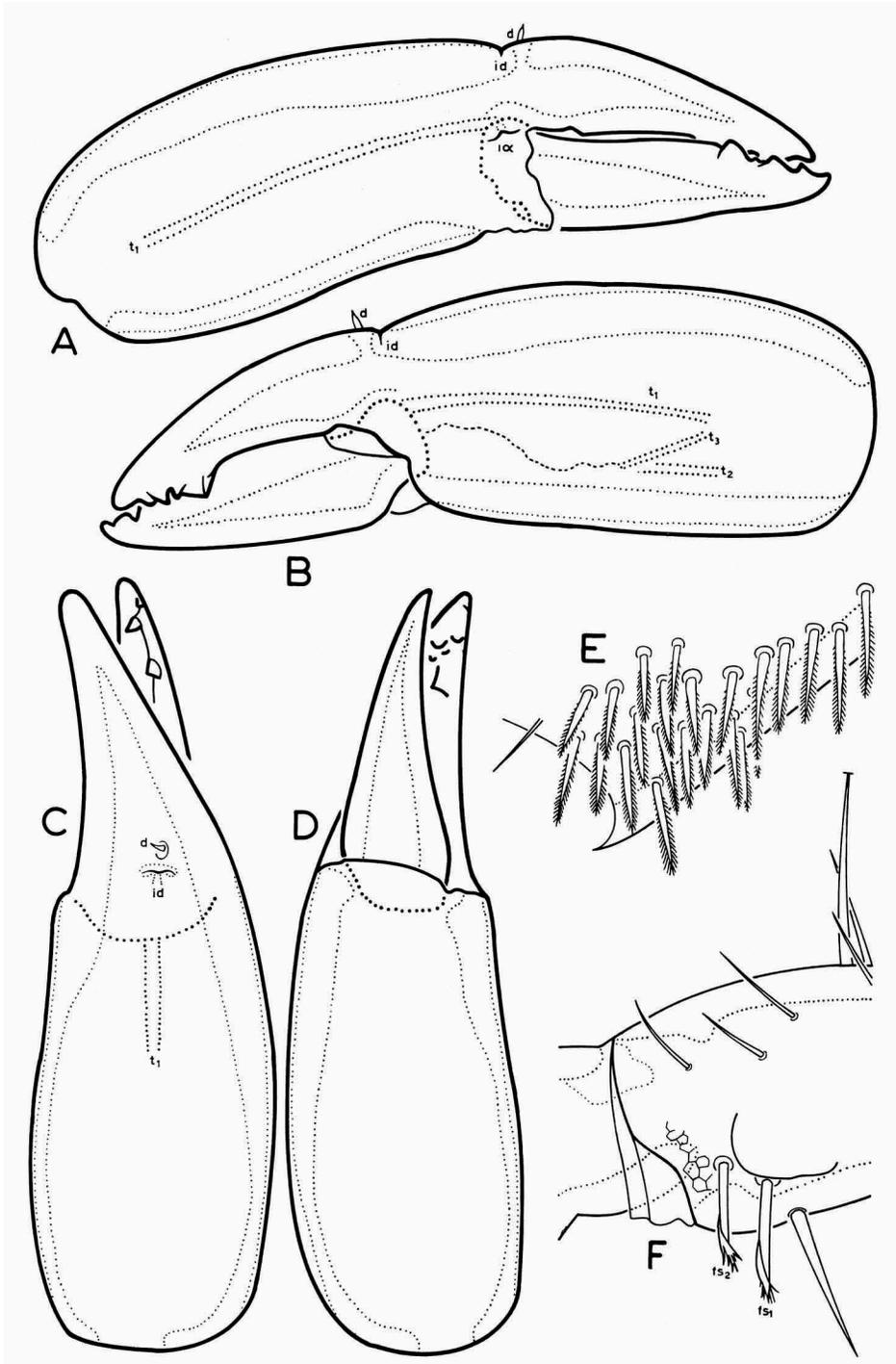


Fig. 8. *Holothyrys coccinella* Gervais, female; A-D, distal part of right chelicera; A, lateral (antiaxial) face; B, lateral (paraxial) face; C, dorsal face; D, ventral face; E-F, lateral (paraxial) faces of right palp; E, group of stiff setae on the paraxial surface of the tibia; F, distal part of the genu, showing two fringed setae; A-F, $\times 185$.

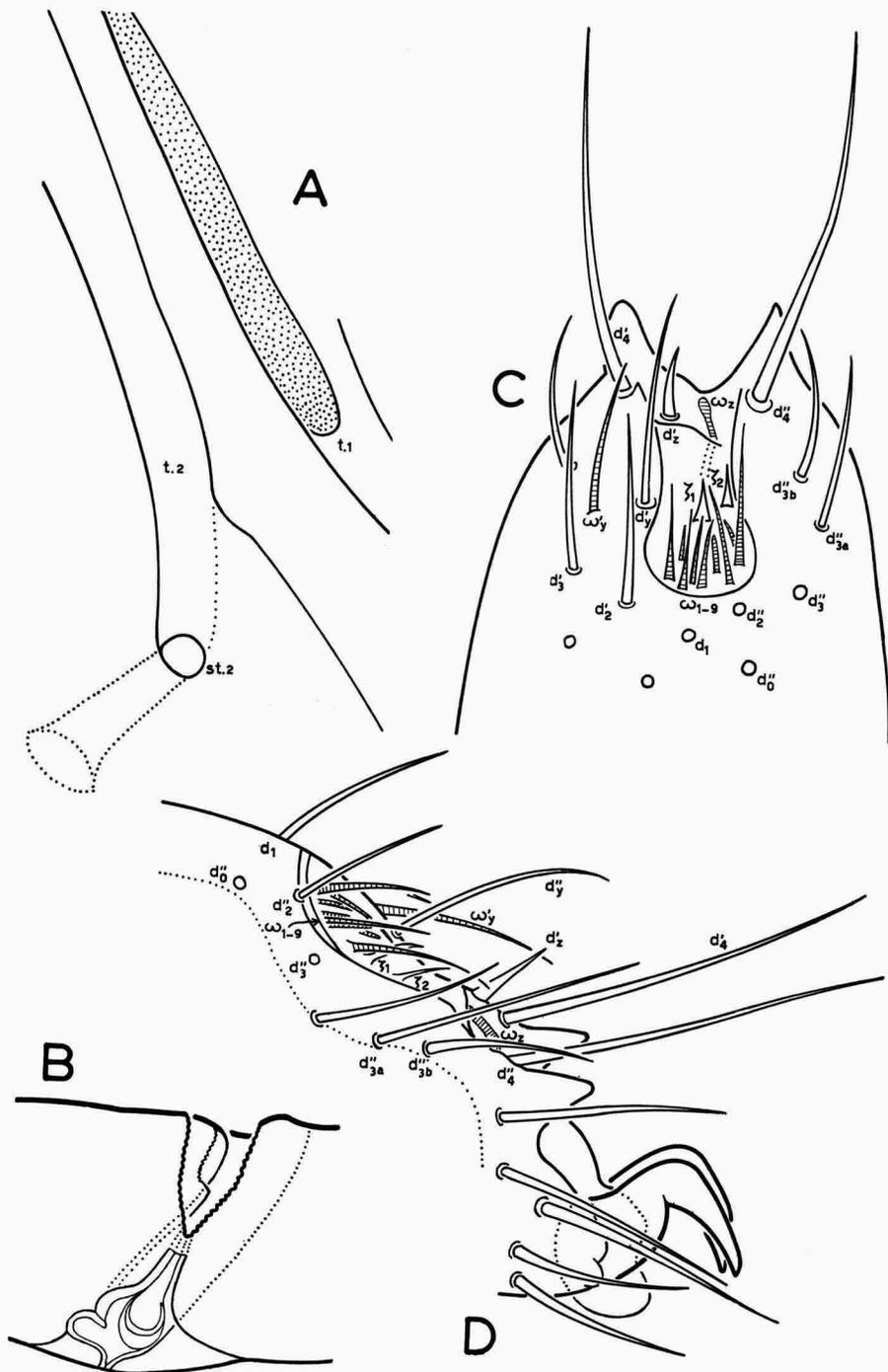


Fig. 9. *Holothyrys coccinella* Gervais, female; A, stigma 2 and taenidia 1 and 2, obliquely from above; B, transverse section through trachea 2; C-D, distal part of right tarsus I with Haller's organ; C, dorsal face; D, lateral (antiaxial) face; A, $\times 230$; B, $\times 370$; C-D, $\times 230$.

no proof at all that this concerns neotrichy. The conditions in *Holothyryus* and Opilioacarida are apparently isolated cases which, at least in *Holothyryus*, do not show any evolutionary trend.

Other interesting characters of the gnathosoma of *Holothyryus* are the primitive cheliceral tectum, the lengthwise open coxal vault and the apparent absence of latero-coxal setae.

Chelicera. — The chelicerae are 3-segmented; the so-called 5-segmented condition in *H. grandjeani* and other species is due to an erroneous interpretation of constrictions. A homologization of the segments is difficult; the movable bit is apparently the apotele. The proximal segment is relatively very long. The length of the entire chelicera can be derived from fig. 5. The distal segments are represented in various views in fig. 8A-D. Just as in *Glyphtholaspis* there is a dorsal lyrifissure *id*, a dorsal seta *d*, and an antiaxial lyrifissure *ia* (more difficult to recognize). The antiaxial surface of the fixed bit presents proximally a vestige *x*, possibly homologous with the orifice *gc* of *Glyphtholaspis*. Ventral setae and a specialized cheliseta are absent. In my specimen the muscles are difficult to observe, possibly because it concerns old material; I believed to recognize again three tendons. The figures, especially fig. 8C, D demonstrate that the fixed and the movable bit do not fit into each other. Probably, the latter is capable of movements in the vertical as well as in the horizontal plane; in this case, the horizontal movements are certainly controlled by *t*₃. The fixed bit is distinctly shorter than the movable. Teeth occur in the distal part of both.

Palp. — The palp consists of six segments. Details of genu and tibia are represented in fig. 8E, F. Tarsus and tibia together have the shape of one large segment. Lyrifissures are not present. There is a strong resemblance to the palp of *H. grandjeani*: apotele, dorsal paraxial group of hollow setae, and paraxial and terminal setae are nearly similar. In most segments the number of setae has increased by plethotaxy. The palp mainly differs from that of *H. grandjeani* by the presence on the genu of a ventral paraxial group of 23 stiff ciliate setae (one observation: fig. 8E) instead of a comb, and by the presence on the tibia of two paraxial fringed setae of moderate length (fig. 8F) instead of one large.

Legs. — It is impossible to prepare formulae representing the chaetotaxy of the legs, because the number of setae has considerably increased by plethotaxy. In the case of the setae surrounding Haller's organ (dorsally, in the distal part of tarsus I) a notation of comparative value appears,

however, still possible. This condition can be characterized by the term idionymic neotrichy (cf. remark 4).

The legs present synarthrodial joints at femora I to IV and at tarsi II to IV. The term synarthrosis is introduced here to replace the misleading term false articulation; I refer to the glossary at the end of the present paper. Lyrifissures are only present in the basifemoral and basitarsal rings; one of the lyrifissures of the femur is composite.

Coxa I has no latero-coxal spine and no coxal "sacculus". The femora especially present numerous small pores. Tibiae and tarsi have no distal or ventral teeth. Tarsi II to IV bear a pair of bifurcate terminal setae as in *H. grandjeani*; in II and III the outer branch of the fork is the largest. Leg I has no pretarsus; the other legs present a pretarsus bearing a pair of ciliate setae. Pulvilli II to IV have nearly the same shape as in *H. grandjeani*; pulvillus I is strongly reduced (fig. 9D). The claws of leg I are rather short and thick. Haller's organ closely resembles that of *H. grandjeani*. In fig. 9C, D I have used nearly the same notation as in my 1961 paper. I observed the following differences: at the foot of the paraxial lobe a clavate sensory seta (ω_z) with an appressed position (certainly a solenidion) is inserted; ω_y'' is apparently absent, and replaced by an ordinary seta d_{3a}'' ; the two sensory setae in the groove (ξ_1, ξ_2) resemble eupathidia. The dorsal seta d_1 has a median position; d_0'' is strongly developed.

REMARKS

REMARK I. THE ANTERIOR LYRIFISSURE OF THE IDIOSOMA

The presence of an anterior lyrifissure i_1 in *Holothyryus* at nearly the same place as the anterior lyrifissure in *Gamasini*, is an important character that points to a homology of the anterior region of the dorsal shield in both groups. It is interesting to find that in one of these two groups (*Holothyrina*) the gnathosoma is situated in a camerostome, whilst in the other it has an advanced position in front of the idiosoma. These conditions can be interpreted in various ways. Most authors (cf. Hughes, 1959: 135) still believe that the cheliceral tectum represents the dorsal part of the anterior segments; consequently, the advanced position of the gnathosoma would be the primitive condition. In my opinion the situation in a camerostome is more primitive. In the course of evolution the chelicerae migrated posteriorly under the prodorsal shield; the beginning of this process is still visible in other groups of Arachnida. As a consequence of the migration, the cervix (originally a ventral component) developed its dorsal position, and the cheliceral tectum developed from the cheliceral sheaths as a secondary

roof. The tergites of segments I and II, and the precheliceral segment(s) remained incorporated in the (pro)dorsal shield. The posterior border of the precheliceral segment(s) is still visible as the line of attachment of the membrane of the cheliceral frame to the rostrum. From this condition the advanced position of the gnathosoma in Gamasina has developed. It is evident that, also in this case, the precheliceral segment(s) and the tergites I and II remained incorporated in the dorsal shield. This is apparently again confirmed by the presence of the lyrifissure i_1 in Holothyrina as well as in Gamasini.

REMARK 2. CAPITULAR AND SUBCAPITULAR APODEME

As a rule the gnathosoma of mites presents posteriorly a capitular apodeme, starting from the posterior border of the cervix, and the line of attachment of the ventral membrane of the cheliceral frame, i.e. from the border of segments I and II. I may recall that apodemes are by definition the internal extensions of the chitinous skeleton, arising from the border of segments.

An apodeme starting from the border of segments II and III is known in Oribatid mites as apodeme 1; it is attached to the idiosoma. It is now extremely surprising to find a homologous apodeme in *Holothyrus*, although attached to the gnathosoma. As mentioned above, the subcapitular apodeme of *Holothyrus* starts from the posterior border of the mentum and the line of attachment of the membrane connecting mentum and idiosoma. The apodeme is more heavily sclerotized than the rather soft posterior part of the gnathosoma, so that it can be easily separated as a whole; it has the shape of a transverse lamella with a pair of apophyses. The presence of a subcapitular apodeme is recorded here for the first time. Possibly it is a special character of the Holothyrina, but it will be important to definitely prove its absence in other groups of mites.

REMARK 3. THE RELATION BETWEEN THE SHAPE OF THE PHARYNX AND THE NUMBER OF FUNCTIONAL OR VESTIGIAL LIPS

In Arachnida there appears to be a close relation between the shape of the pharynx and the number of lips. According to our present knowledge, the following general rules can be applied in this connection. (a) A quadrangular pharynx points to the presence of two or four lips: an upper lip (labrum), an under lip (labium), and (if present) a pair of lateral lips. (b) A triangular pharynx points to the presence of an upper lip and a pair of lateral lips, the under lip probably being lost in the course of evolution. (c) A hexagonal pharynx points to the presence of six functional lips of

different origin (Opiliona; the partly hexagonal pharynx of Opilioacarida will be studied in a later paper).

Two lips and a quadrangular pharynx are present in most orders of Arachnida; this is apparently the primitive condition from which the condition with four lips evolved by the origin of lateral lips. A further development of the lateral lips appears to result in a disappearance of the under lip. The occurrence of four lips is apparently rare, but they are still present in some primitive Actinotrichid mites (several Palaeacaroida and Endeostigmata). I may remark that the occurrence of lateral lips is not restricted to mites; they are also found in Solpugida.

In the case of *Holothyryus* we observe a quadrangular pharynx, an upper lip, and a pair of lateral lips. This seems to be in contradistinction to the general rules. It is, however, rather probable that the ventral median ridge ($B-B_1$), starting just posteriorly of the mouth, and continuing in the pre-oral cavity, must be considered a vestige of the unpaired under lip; it has exactly the same position. In the course of the advanced fusion of mouth-parts, the under lip must have been incorporated in the ventral wall of the pre-oral cavity. I recall that in 1961 I discovered already the quadrangular pharynx in *Holothyryus* without, however, realizing its special importance. Because a quadrangular pharynx apparently occurs in several Gamasina, it will be interesting to pay more attention to this problem.

REMARK 4. THE VARIOUS DEGREES OF MULTIPLICATION OF ORGANS AND THE POSSIBILITY OF A NOTATION

Pores and setae in Anactinotrichida have often been subject to various degrees of multiplication. In many cases the number has increased by plethotaxy, resulting in an obscuration of the personal homology of each organ, and the final impossibility of a notation. There are, however, transitions between orthotaxy and plethotaxy. A development of further distinctions in terminology appeared necessary. Grandjean (in litt.) informed me that he created two new terms that will probably be dealt with in the fifth series of his "Nouvelles observations sur les Oribates", to be published in "Acarologia". These new terms are: oligotaxy (referring to a feeble increase in number) and idiotaxy (referring to the possibility of a personal notation). In combination with suitable adjectives, a terminology is attained that will cover all possible cases. In the present paper, in the case of the setae of Haller's organ, I have used the term idionymic neotrichy, in this way referring to a probable multiplication of setae as well as to the possibility of a notation.

ADDITIONAL GLOSSARY OF TERMS INTRODUCED HERE IN ANACTINOTRICHID
MORPHOLOGY

The present list is a supplement to the glossary recently published in my *Glypholaspis* study (Van der Hammen, 1964). It contains new terms, additions, and a correction. All terms are again arranged according to the first catchword.

ANAL LOCKING-PIECES. — The anterior and posterior chitinous pieces which serve opening and closing of the anal valves.

BUCCAL CONE. — Exceptionally used for the gnathosoma; the name points to the general cone-shape.

CONICULUS (new). — The anterior part of the gnathosoma, in front of the mouth and the acetabula of the palps; it contains the pre-oral cavity. Syn. rostrum.

CUTICLE. — The chitinous tegument, consisting of epiostracum and ectostracum; the non-chitinous layers of the tegument (i.e. cerotegument and hypodermis) are not considered to be parts of the cuticle.

GENITAL SHIELD. — In Holothyryna one of the four shields, viz., the large unpaired posterior one, closing the female genital opening. Syn. "Hauptplatte der Epigyne" (Thon, 1906).

HOLOVENTRAL SHIELD (new). — This shield must be regarded as a fusion of sternal, ventral, and holopodal shields. Syn. "Plastron" (Thon). I may remark that Thon's "Carapax" is a synonym of our dorsal shield.

LABELLUM (Van der Hammen, 1964). — The plural of this term is labella, and not labelli as was erroneously mentioned by me in 1964.

LABIUM. — The unpaired (functional) under lip of Arachnida. In mites it is rarely met with (some primitive Actinotrichida); in Anactinotrichida a vestige is possibly present in species with quadrangular pharynx.

LATERO-GENITAL SHIELDS. — In Holothyryna the narrow lateral shields which form part of the closing mechanism of the female genital opening. Syn. "Lateralplatte der Epigyne" (Thon, 1906).

PARALABRAL TEETH (Van der Hammen, 1961). — The relatively large, spear-shaped teeth on the anterior border of the cervix, laterally of the labrum.

PLICATURE BAND. — The thin, chitinous band which forms a flexible connection between two shields.

PRE-GENITAL SHIELD. — In Holothyryna the narrow anterior shield which forms part of the closing mechanism of the female genital opening. Syn. "obere Platte der Epigyne" (Thon, 1906).

PRE-ORAL CAVITY. — The cavity in the coniculus, i.e. the room in front of the mouth, enclosed by labrum, labella and genae.

ROSTRAL TECTUM. — The tectum which is an anterior prolongation of the rostrum (i.e. the anterior part of the idiosoma).

SUBCAPITULAR APODEME (new). — The apodeme starting from the posterior border of the mentum, at the place of attachment of the membrane connecting gnatho- and idiosoma; it consequently starts from the border of segments II and III.

SYNARTHROSIS, SYNARTHRODIAL JOINT (new). — Syn. false articulation. Because joints of this type permit of slight articulating movements, the characterization as false must be considered erroneous.

TAENIDIUM 1. — Syn. peritrema.

TAENIDIUM 2 (new). — The groove starting from a small depression near stigma 2, and running parallel to taenidium 1 as far as the rostrum.

ALPHABETIC LIST OF ABBREVIATIONS USED IN FIG. 1-9

- Ac.* III, acetabulum III.
ap. sc. subcapitular apodeme.
B, B₁, proximal, resp. distal section of a median ridge on the innerside of the ventral infracapitular wall.
bds, border of the dorsal shield.
bt, anterior border of the cheliceral tectum.
bvs, border of the holovenral shield.
CAM, camerostome.
CE, cervix.
CH, chelicera.
CO, corniculus.
CV, coxal vault.
d, dorsal seta of the chelicerae.
d₀₋₄, d₂, setae in the area of Haller's organ.
dr, dorsal ridge of the cervix.
DS, dorsal shield.
fs₁₋₂, fringed setae of the palpal genu.
G, gena.
GEN, genital area.
gl, supposed orifice of gland in the palpal trochanter.
gs, subcapitular groove.
GS, genital shield.
H, mentum.
id, dorsal lyrifissure of the chelicerae.
ia, antiaxial lyrifissure of the chelicerae.
i₁, anterior lyrifissure of the dorsal shield.
Ji, ventral commissure of the mouth.
Js, Js', dorsal commissures of the mouth.
k, condyle of the camerostome.
LA, labellum.
LC, lacinia.
ldm, latero-dorsal infracapitular seta.
LG, labial gutter.
LGS, latero-genital shield.
lva, lvm, lvp, latero-ventral infracapitular setae.
LS, labrum.
mb, membrane connecting gnathosoma and idiosoma.
ml, lateral muscle of the idiosoma.
PGS, pregenital shield.
PH, pharynx.
pl.b. plicature-band.
PLB, paralabral tooth.
POC, pre-oral cavity.
ro, rostrum.
sb, line of greatest depth of sternal groove.
sr, anterior border of the flat, elevated sternal area.
st. 1, stigma 1.
st. 2, stigma 2.
TE, cheliceral tectum.
t_{1s}, muscle (retractor) of the labrum.
t. 1, taenidium 1.
t. 2, taenidium 2.

t_{1-3} , muscles (tendons) of the chelicera.
 va , vm , vp , ventral infracapitular setae.
 VS , holoverstral shield.
 x , supposed vestige of orifice of gland in the fixed bit of the chelicerae.

ζ_{1-2} , hollow sensory setae (possibly eupathidia) of Haller's organ.
 ω_{1-2} , ω'_1 , ω_2 , hollow sensory setae (probably solenidions) of Haller's organ.
 I-IV, acetabula of legs I-IV.

SUMMARY

In the present paper a supplementary description is given of the type-species of the genus *Holothyrus*. Special attention is paid to characters which up to now generally have been neglected, and which are important for the classification of the Acarida. In the following summary the most interesting of these characters are listed.

1. The exoskeleton is highly developed because of the presence of two large shields, a dorsal and a holoverstral, laterally and posteriorly connected by a chitinous plicature band.

2. The idiosoma presents only one pair of lyrifissures; it is situated in the anterior part of the dorsal shield, and probably is homologous with the anterior pair of lyrifissures in Gamasina.

There are no sternal lyrifissures, and no specialized sternal setae.

3. Beside a taenidium 1 connected with stigma 1, there is also a taenidium 2 which runs from stigma 2, parallel to taenidium 1, as far as the rostrum; taenidium 2 had not been recorded before.

4. There are about nine pairs of anal setae, whilst in Gamasina this number appears to be maximally one.

5. The mentum is heavily sclerotized in the anterior and median part; the posterior regions of the gnathosoma are, however, soft, pale in colour, and ill-defined. The anterior part of the capitulum in front of the mouth, which up to now in Anactinotrichida was generally indicated by the misleading term rostrum, is named here coniculus.

The existence of a relatively small cheliceral tectum is again demonstrated. It must be regarded as the most primitive complete tectum we know.

The number of infracapitular setae appears to be constant in the genus *Holothyrus*: there are six pairs of ventrals and one pair of latero-dorsals. The labrum is retractable by means of a tendon attached to a chitinous piece inside the upper lip. There is a pair of labella and a labial gutter which bears on each side one row of teeth. The flaps with papillose fringe, anteriorly bordering the genae, are homologized here with the laciniae of the Gamasina.

A capitular apodeme is absent, but a subcapitular starts from the posterior border of the mentum and the line of attachment of the membrane connecting mentum and idiosoma, i.e. from the border between segments II and III. The presence of a subcapitular apodeme appears to be a very important and unique character never mentioned before.

The pharynx is quadrangular, which condition is connected with the presence of a ridge starting behind the mouth and continuing in the pre-oral cavity; this ridge probably is a vestige of the unpaired under lip (labium).

The coxal vault is lengthwise connected with the pharyngeal chamber. Latero-coxal setae are apparently not present.

6. The palp differs from *H. grandjeani* in the presence on the tibia of a ventral paraxial group of stiff setae instead of a comb, and by the presence on the genu of two paraxial fringed setae instead of one.

7. Haller's organ is present, just as in *H. grandjeani*; it differs from the last-mentioned species by the number and position of the sensory setae.

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