STRUCTURE AND ORGIN OF THE ENDOPLEURAL FORMATIONS IN THE METATHORAX OF THE AUCHENORRHYNCHA (HOMOPTERA)

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The internal pleural structures of the metathorax in Auchenorrhyncha have a number of significant characteristics, which in one form or another are manifested in all the present-day superfamilies (Cicadelloidea, Cercopoidea, Cicadoidea, and Fulgoroidea) or in most of them. At the same time, in each individual superfamily the structure of the metapleural region is distinguished not only by its own peculiarity, but also by its marked uniformity, though not strictly so among the Cicadelloidea only.

Among the particular endopleural formations of the metathorax are the episternal apodema, the complex secondarily superstructured pleural apodema and the sternepimeral carina, which extends from the pleurite over the postcoxal bridge. The internal structure of the posterolateral areas in Cercopoidea and Fulgoroidea is extremely complex, especially in the latter; in the Cicadelloidea and Cicadoidea it is simpler, being most probably the result of secondary simplification.

The characteristics of the metapleural structures in Auchenorrhyncha have not been elucidated or described in the literature. The author of the most consistent analysis of the morphology of all the Auchenorrhyncha, Kramer (1950), only speaks in general terms of the complexity of the metapleural apodema in the Fulgoroidea, but has nothing to say of the corresponding structures in the Cercopoidea and the remaining Auchenorrhyncha. The authors of earlier reviews and works on the individual families (Hansen, 1890; Taylor, 1919; Doering, 1922; Myers, 1928) in general have nothing to say about the metapleural apodema. Only in the later work of Sander (1956) is some information given on the metapleural apodema in the Fulgoroidea in the embryonic and larval stages, but these data reveal nothing of the composition and homology of the parts of the apodema.

The metapleura in all Auchenorrhyncha, except for the Cercopoidea and some of the Cicadelloidea, bear a special episternal apodema, located in the anterior-upper part of the episternum (Fig. 1-4, 5-31). In the Cicadelloidea and Cicadoidea, it has the appearance of a flat pocketlike invagination and is covered externally by an open fissure. In the Fulgoroidea, the apodema is more markedly developed and is reinforced by carinae. In the Cicadoidea, it serves for attachment of the muscles that extend to the trochantin and coxa, while in the Fulgoroidea it serves for attachment of the saltatorial muscles, extending to the trochanter. What muscles the episternal apodema supports in the Cicadelloidea remains unknown. In position and form, the episternal apodema may be compared with the corresponding apodema in the Psocoptera and with the invagination of the scent glands in the Heteroptera.

The sternepimeral carina is well developed in the Cicadelloidea and Cercopoidea (Fig. 1, 3, 5, 31). On the sternum, the carina in the median line terminates in the condyle of the secondary sternocoxal joint, resting on the medial margin of the base of the coxa. The carinae and condyles transmit a springing force from the

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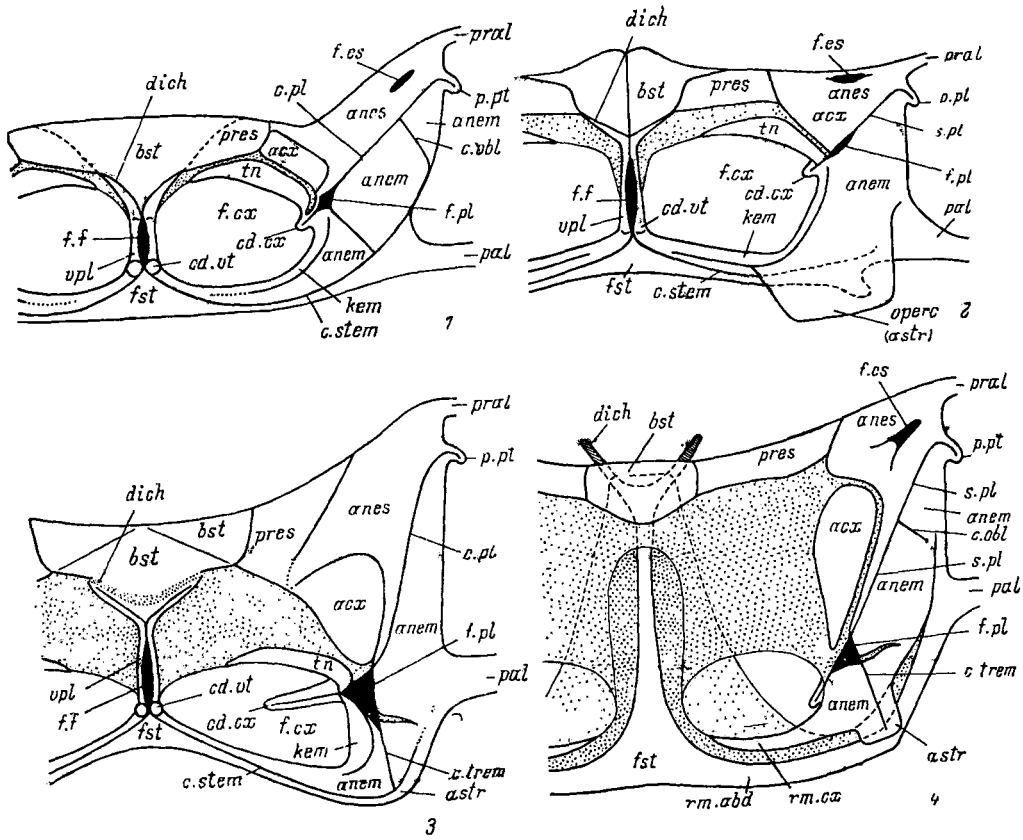


Figs. 1-4. Plan of the structure (schematic diagram) of the ventropleural region of the metathorax in the superfamilies of the Auchenorrhyncha.

1 - Cicadelloidea; 2 - Cicadoidea; 3 - Cercopoidea; 4 - Fulgoroidea.

acx - antecoxal; anem - anepimeron; anes - anepisternum; astr - heel of the epimeron (astragalus) - special process for linking the thorax to the abdomen; bst - basisternum; cd. cx - coxal condyle of the metathorax; cd. vt - secondary ventral condyle of the metathorax; c. obl - oblique condyle; c. stem - sternepimeral carina; dich - furcate suture, running by the base from the furcal fossa and delimiting the basisternum posteriorly by its branches; f. cx - coxal foramen; f. es - foramen of the episternal apodema; f.f. - furcal fossa (fissure); f. pl - fossa of the pleural apophysis; fst - furcasternum; kem - katepimeron; mb. st - sternal membrane - desclerotized part of the sternal surface; operc - operculum of the sound apparatus in the Cicadoidea, homologous to the heel of the epimeron in the Fulgoroidea; pal - postalar bridge; p. pt - pleural wing process; pral - prealar bridge; pres - pre-episternum; rm. cx - coxal branch of the coxal bridge in the Fulgoroidea; rm. ad - abdominal branch of the postcoxal bridge in the Fulgoroidea; s. pl - pleural suture; tn - trochantin; vpl - ventropleurite.

coxae to the corpus. In the Cicadelloidea, the pleural part of the epimeral carina in front of the abdominal margin of the epimeron runs across the apodema and passes into the pleural carina. In the Cercopoidea, the transverse part of the sternepimeral carina (oblique carina) is not manifested and the carina passes into the postphragma of the metathorax along the posterior margin of the epimeron.

In the Fulgoroidea, in connection with the adherence of the hind coxae to the thorax, only the anterior transverse section of the sternepimeral carina remains,

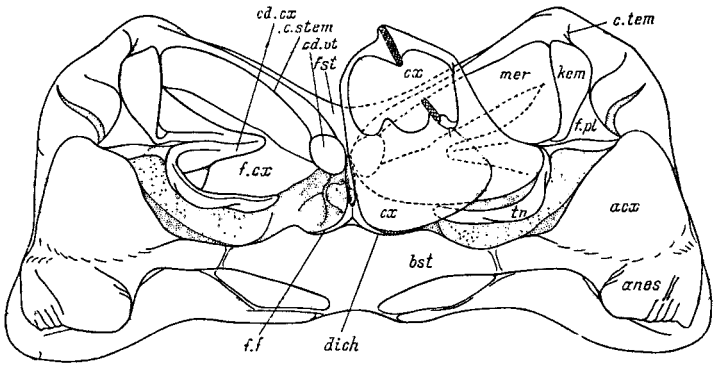


Fig. 5. Metathorax and right coxa in the Cercopoidea (*Aphrophora* sp.). viewed from the rear and somewhat from below.

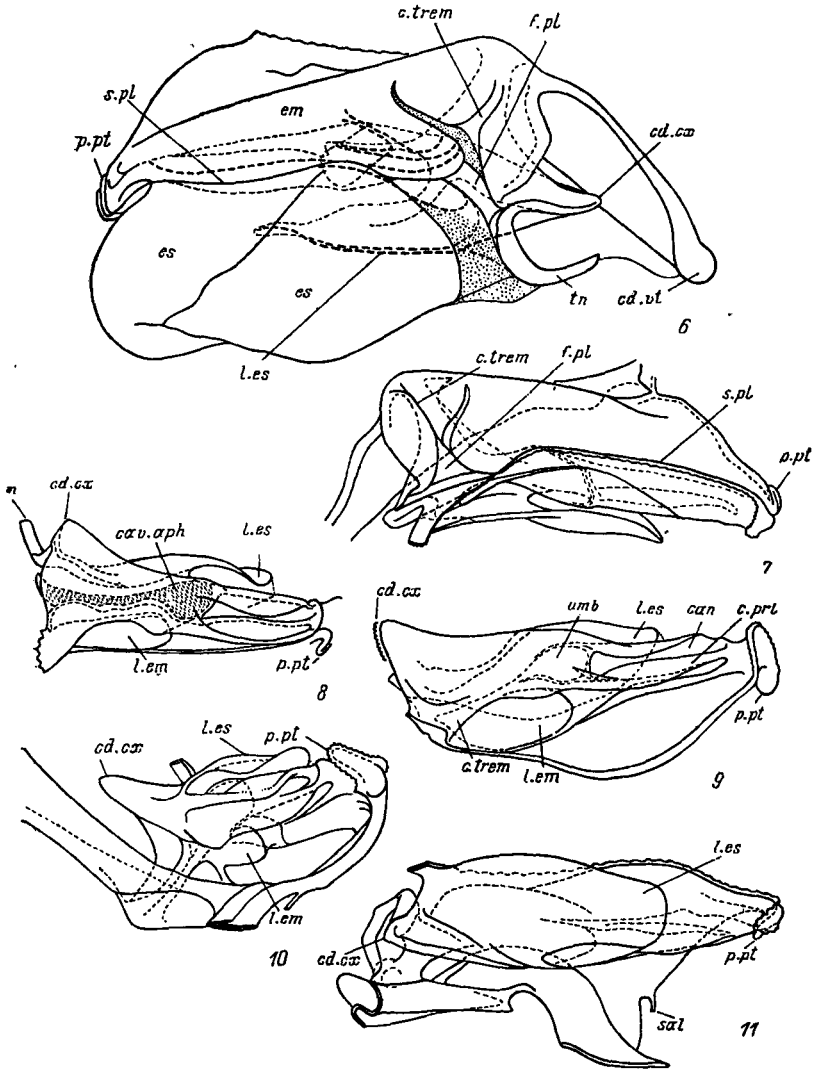
Conventional symbols as in Figs. 1-4.

attached to the metapleural apodema - oblique carina (Fig. 4, 20-23, 27). In the Cicadoidea, the sternepimeral carina is not developed, though there are traces of it and well developed secondary coxal condyles, which evidently bear out the fact that the ancestors of the Cicadidae were capable of jumping.

The structures of the pleural apodema are most fully manifested in the Cercopoidea (Figs. 6-11). The structure of the metapleural apodema in the other superfamilies of the Auchenorrhyncha is to a great extent to be explained as the result of further evolution of the structures developed in the Cercopoidea. At the same time, the transformation of the metapleural apodema in the ontogenesis of the Cercopoidea helps us to understand the history of the formation and structure of this apodema in all the Auchenorrhyncha.

In the Cercopoidea, the powerful and elevated carina of the pleural apodema extends almost horizontally in front of the coxal articulation to the wing process. In front of the wing process, the carina diminishes by reason of a flexure of its base and, consequently, of the outer wall. The most forward - low - sector of the carina in the region of the wing process curves upwards in a steep arch and rearwards, while the process inclines markedly to the rear. The episternum lies lower than the pleural carina while the epimeron does so higher. The posterior margin of the apodema throughout its whole breadth is terminated by the linear condyle of the pleurocoxal articulation. The body of the apodema is divided into a katapleural and anapleural part by the cavity of the apophysis, the apex of which is inclined forwards, while a broad osculum is convergent with the coxal condyle. The actual body of the apophysis is not manifested, while the apex of its cavity is located under the flat crest of the pleural apodema. The walls of the apodema along the sides of the cavity of the apophysis are not sclerotized, while the anapleural and katapleural parts of the apodema are firmly joined with one another, apart from the outer wall of the pleurite, only by a sclerotized bridge (umb), through the apex of the cavity of the apophysis following the epimeral wall of the carina of the apodema, along the crest.

The crest of the pleural apodema passes along the episternal margin of the apophyseal bridge. The crest of the transepimeral carina along the cavity of the apophysis passes behind it into the epimeral margin of the apophyseal bridge. In front of the apex of the apophyseal cavity, i.e., in front of the apophyseal bridge, the epimeral margin passes into a sharp carina, running parallel to the crest of the apodema as far as the base of the wing process; here the crest of the apodema and



Figs. 6-11. Pleural apodema of the metathorax in the adult of the Cercopoidea (*Aphrophora* sp.).

6 - metathorax from the rear and side, parts of the apodema (left) adhering to the body wall indicated by a heavier broken line; 7 - fragment of the pleurite and apodema (right) viewed from the rear and from the side, episternum removed; 8 - idem, viewed medially and from the rear; 9 - idem, viewed from above; 10 - idem, viewed from the front-above-inside (medially); 11 - idem, viewed from below.

aph. pl - pleural apophysis; can - canaliculus of the pleural apophysis; cav. aph - cavity of the pleural apophysis; cx - coxal condyle of the metathorax; cnv - line of junction of the sacs of the pleural apodema; c. prl - parallel carina; cr. pl - pleural crest; c. trem - transepimeral carina; cx - coxa; em - epimeron; es - episternum; f. pl - fossa of the pleural apophysis; lb. i - internal lobes of the sacs; l. em - epimeral lobe; l. es - episternal lobe; p. pt - pleural wing process; sac. em - epimeral sac; sac. es - episternal sac; s. pl - pleural suture; tn - trochantin; umb - outgrowth of the pleural apophysis at the apex of its cavity.

apodema as far as the base of the wing process; here the crest of the apodema and the parallel carina described coalesce indistinctly. Between the crest of the apodema and the parallel carina in front of the apex of the cavity of the apophysis, a clear marginal canaliculus (can) is formed. The apex (anterior margin) of the apophyseal bridge, following the flexure of the apex of the cavity of the apophysis, bends downwards and forms the posterior surface of the wall of the marginal canaliculus.

The katapleural part of the apodema, running close to the cavity of the apophysis, anteriorly along the sides of the carina of the apodema over the whole breadth of its walls, gives rise to two lobes - an episternal one and an epimeral one. The epimeral lobe is shorter and smaller, being separated from the crest of the apodema by the apophyseal bridge. The lobes run parallel to the anapleural part of the carina of the apodema; their external margins, turned towards the body wall and the base of the pleural apodema, make no contact with the wall or the apodema. All free margins of the lobes, i.e. the external anterior and internal ones, are joined by a continuous membrane with the adjacent wall of the apodema itself so that two closed areas are formed on the sides of the carina of the apodema in front of the cavity of the apophysis - the episternal and epimeral sacs.

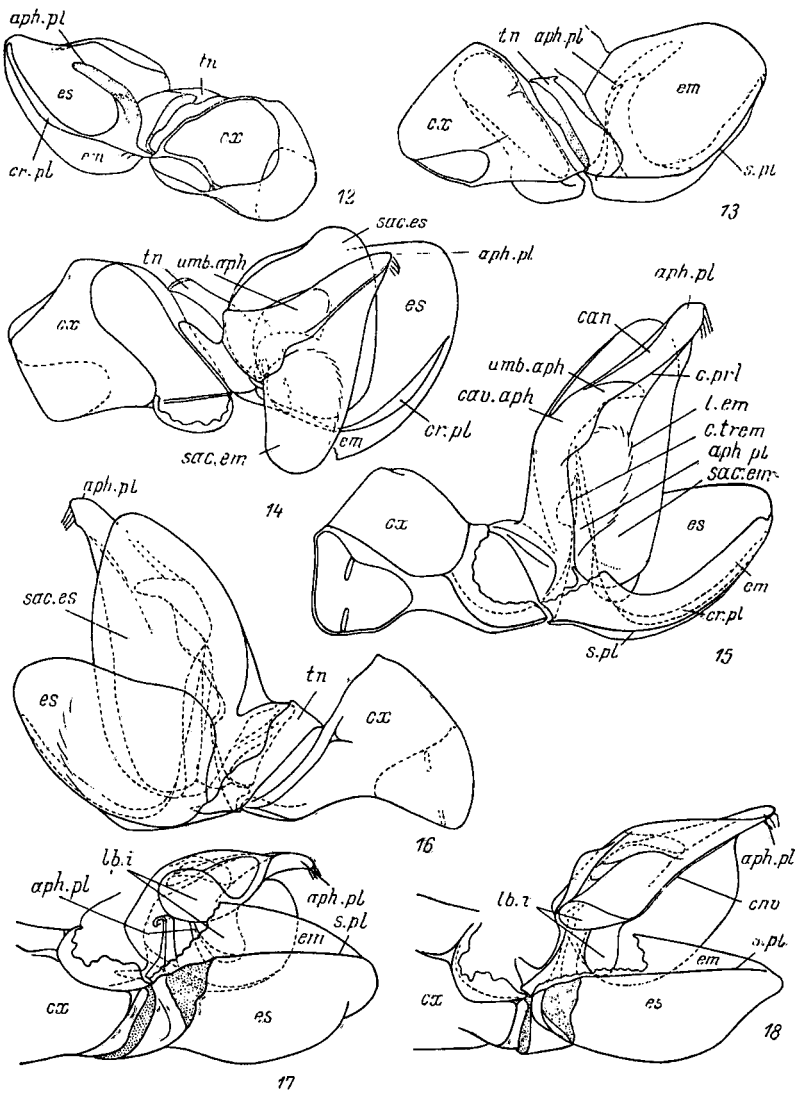
The membrane connecting the lobes with the body of the apodema nowhere touches the inner walls of the pleurite itself, except for some small areas adjacent to the base of the apophysis. Externally, these areas located at the sides of the osculum of the apophysis are discernible because of the particular shagreened texture of their surface. The line of junction of the membranous walls of the sacs with the body of the apodema runs from the base of the apophysis to the base of the wing process, almost parallel to the wall of the pleurite, but diverging from it. Under the wing process, the membranous wall of the episternal sac extends to the crest of the apodema, running along it to the junction of the lobe with the posterior end of the apophyseal bridge. The membranous wall of the epimeral sac under the pleural process extends to the carina parallel to the crest and analogously runs to the junction of the lobe with the posterior margin of the apophyseal bridge, on its side.

Characteristic of the pleural apodema in the Cercopoidea are the absence of the pleural apophysis, though its cavity is present in the body of the apodema; the presence of special lateral lobes, covering closed cavities - sacs, included between the lobes and the body of the apodema; and desclerotization of the lateral walls of the apodema, adjacent to the apophyseal cavity in the region of contact with the posterior inner areas of the sacs.

The lateral sacs and lobes of the pleural apodema have no clear mechanical function. No muscles are attached to the lobes. The sacs are in contact with the cavity of the apophysis through the desclerotized walls, which weakens the apodema as a strengthening rib; this is important in operating the saltatorial pleurotrochanteral muscles. All these considerations oblige us to look for other functions for the particular structures of the metapleural apodema. Most probably, the sacs with the broad cavity of the apophysis serve either as auditory or sound-amplifying resonators.

The formation of the metapleural apodema in the larvae of the Cercopoidea before moulting to the adult indicates that the structures of the primary apodema is to a large extent masked by secondary formation, associated with it.

The pleural apodema in the immature larvae in the final fifth instar in the Cercopoidea (*Aphrophora, Lepyronia*) has the initial structure occurring in all



Figs. 12-18. Pleural region of the metathorax in fifth-instar larvae in the Cercopoidea.

12-13 - normal development of the larva of *Lepyronia coleoptrata*: 12 - viewed obliquely and medially, 13 - viewed obliquely and laterally; 14-18 - preecdysial larva of *Aphrophora* sp.: 14 - viewed medially and from above, 15 - viewed from above, 16 - viewed from below, 17 - viewed obliquely and from the side, 18 - viewed from the side-above (part of the epimeron provisionally removed).

insects (Fig. 12, 13). The low pleural carina closer to the coxal end bears an elongated apophysis, curving arcuately to the apex anteriorly. The pleural apophysis in the larvae has no open cavity, the site of its origin is marked only by a depression in the pleural groove and the origin of the groove of the transepimeral carina. The apophysis consists of a more markedly sclerotized basal part and an unsclerotized terminal one. The basal part bears the closed rudiments of the apophyseal cavity, uncovered externally in the adult, while in both larvae and adults the terminal part is uniform.

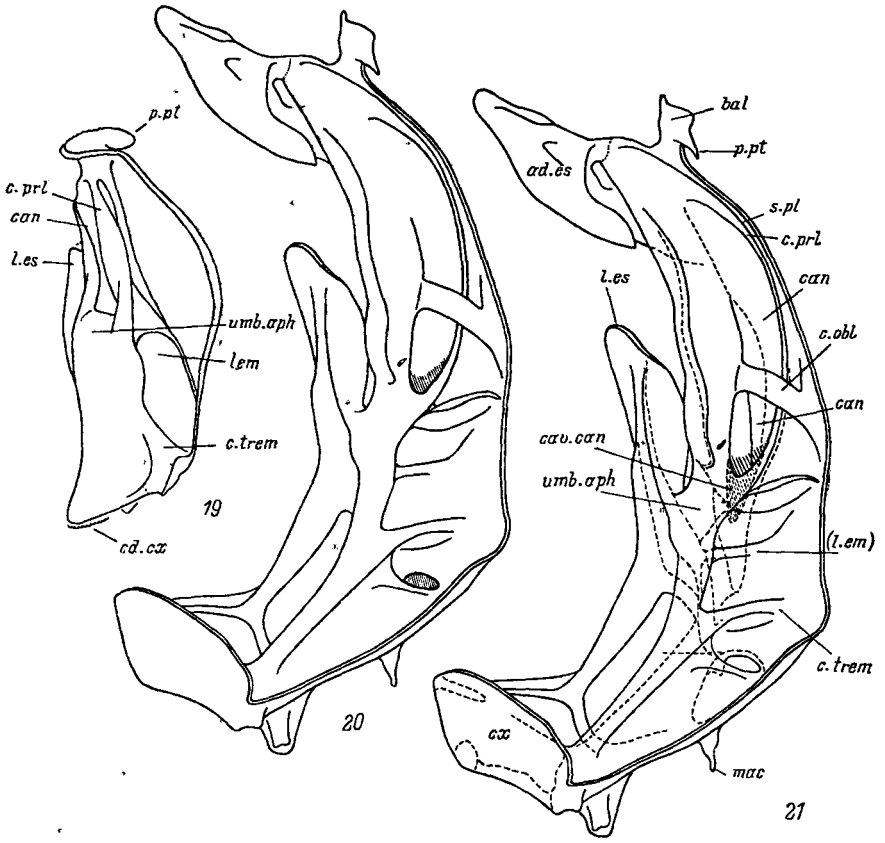
In the fifth-instar larvae, ready to moult to the adult, a sacciform formation folded in two (Fig. 14-18) is formed around the pleural apophysis and the katapleural part of the pleural carina. This formation to the rear and at the sides envelops the apophysis and is enclosed by its wall anteriorly and laterally, completely masking the apophysis in its cleft. The posterior part of the formation behind the base of the apophysis is flattened as far as the closure of the walls and encircles the katapleural area of the pleural carina and the transepimeral carina, reduplicating their contours. The margin of the sacciform formation above the primary pleural crest is furnished with a much higher carina, the posterior trimmed margin of which forms the rudiments of the linear adult coxal condyle above the larval coxal condyle. The primary pleural carina and its coxal condyle, which functions in the larvae, is discernible because of the marked sclerotization, which contrasts with the transparent fleshy secondary formations. The coxal carina, forming the second part of the adult pleurocoxal articulation, is completely undeveloped in the larvae.

The sacciform formation envelops the opophysis up to its apex. The paired sacs, swollen areas of the sacciform formation (the episternal and epimeral sacs described above in the adult), are detectable rudimentarily by differentiation in the sclerotization of their walls, which is sharply manifested in the adult. The apical part of the cavity of the apophysis surrounded by the sacciform formation is swollen, while the basal part is closed as previously.

The contiguous inner walls of the sacs are sclerotized, beginning from the anterior half of the body of the apophysis, against which they are pressed. In the lower part of the sacs, the sclerotization of their contiguous walls appears in the form of small lobes (lb.i) on the free surfaces at the sides of the base of the apophysis - on those areas which in the adult come into contact with the wall of the pleurite. The crests of the secondary walls of the posterior part of the pleural and transepimeral carinae, formed by a sacciform formation, as in the adult, pass through the convex apex of the cavity of the apophysis into the margins of the marginal canaliculus. Unlike the adult, however, in the larvae the canaliculus and carinae are less well defined, while the apex of the apophysis and the margins of the sacs, turned towards the primary pleural crest, are separated from it by an uninterrupted lumen.

In the adult, the apex of the pleural apophysis together with the adjacent area of the sacciform process adheres to the primary pleural crest under the pleural wing process itself, while the closed walls of the sac extend downwards to the junction with the crest of the primary pleural carina in front of the base of the apophysis. Finally, this is how the secondary pleural apodema is formed in the Cercopoidea.

The picture described above of the development of the structures of the pleural region in the ontogenesis of the Cercopoidea makes it possible to suggest that in the phylogenesis of the Auchenorrhyncha, the sacciform process developed around the apophysis as a resonator parallel to the dilation of the cavity of the apophysis. The extension and deviation of the apex of the apophysis anteriorly might have been connected with the enlargement of the sac-resonators, the medial advance of which was limited by various thoracic muscles. The adherence of the apex of the apophysis to the pleural carina enhanced the rigidity of the structures, absorbing the saltatorial force from the coxae. The sclerotization of the lateral walls of the sacs in the form of lobes extending towards the apodema may serve to reinforce the resonator function. Virtually simultaneously with the fixation of the lobes and the formation of the posterior part of the sacciform process, the process made contact with the coxa, as a result of which the long linear adult pleurocoxal articulation was formed, which works effectively during great saltatorial stress.



Figs. 19-21. The pleural synapodema, viewed from above.

19 - Cercopoidea (*Aphrophora* sp.); 20-21 - Fulgoroidea (*Dictyophara europaea*), internal structures shown in Fig. 21.

ad. es - episternal apodema; bal - basalar; can - canaliculus of the synapodema; cav. aph - cavity of the apophysis; cav. can - niche of the canaliculus of the synapodema; c. obl - oblique carina; c. trem - transepimeral carina; cx - coxa, (l. em) - region of the epimeral lobe, fused with the body wall; l. es - episternal lobe; mac - meracantha; p. pt - pleural wing process; s. pl - pleural suture; umb - outgrowth of the pleural apophysis at the apex of its cavity.

The complex metapleural apodema in the Fulgoroidea has the same homologous composition as in the Cercopoidea, but slightly modified, being fused anteriorly with the episternal apodema and posteriorly with the coxa and the postcoxal bridge to form a single powerful synapodema (Figs. 19-23).

The height of the secondary pleural carina in the Fulgoroidea is less than in the Cercopoidea. The marginal canaliculus is enlarged and extends by its lateral margin to the wall of the epimeron along the base of the pleural margin. The fossa delimiting the canaliculus posteriorly at the apex of the swelling of the apophysis is characteristic of the Cercopoidea. In the Fulgoroidea, it is pressed down into an elongated niche (cav. can), which is pressed rearwards between the apophysis and the inner wall of the episternal sac to that part of this wall, which, as in the Cercopoidea also, conjoins with the outer wall of the episternum around the

base of the apophysis. The episternal lobe is well developed, while the epimeral lobe forms part of the wall of the epimeron, spreading along it. At the same time, the epimeral sac disappeared completely. The structures in the base of the epimeral lobe are maintained virtually in the same form as in the Cercopoidea.

Fusion of the coxa with the pleurite was preceded by strengthening and elongation of the pleurocoxal joint, the coxal condyle of which elongated and unites with the opposite margin of the basicoxal carina (Fig. 24-28)*. This explains the presence of an opening in the synapodema in the Fulgoroidea (Fig. 25, 27, 28). The extensive approximation of the pleural condyle with the opposite area of the basicoxal suture is already manifested in the Cercopoidea.

The pleural apodema in the Cicadelloidea appears simple when viewed externally and moderately well developed, but, as in the Cercopoidea and Fulgoroidea, it lacks the free apophysis and in many representatives it bears a small but distinct episternal lobe (Fig. 31). The characters described suggest homology of the metapleural apodema in the Cicadelloidea with the secondary apodema of the Cercopoidea and evidently secondary absence of the epimeral lobe. The pleural region of the metathorax in the Cicadelloidea is relatively small since the basic saltatorial musculature in them is located in the coxae.

In the Cicadidae, Cicadoidea, there is a pleural carina, simple in form; no lateral lobes occur; and the free pleural apophysis (Fig. 29, 30) is developed. At a first glance, all these characters characterize the metapleural apodema of the Cicadoidea as being the primary one. The pleural apophysis, however, does not arise from the actual crest of the pleural carina, but from its lateral wall on the side of the epimeron. The apophysis is short, with a thick roundly blunted apex, constituting the simple wall of the apophyseal cavity. This place of origin in the Cicadoidea also recalls the position of the protruding wall above the cavity of the apophysis - the apophyseal bridge - in the secondary apodema in the Cercopoidea and Fulgoroidea. The apodema in the Cicadoidea may be thought to be the product of the simplification and transformation of the complex secondary apodema, characteristic of the other Auchenorrhyncha. The free pleural apophysis in the Cicadoidea may be the result of secondary swelling and evagination of the convex part of the lateral wall of the apophysis around the apex of its cavity, i.e. the apophyseal bridge.

In spite of the large number of ambiguities, the resonator sound-reception or sound-amplification function of the additional formations around the carina of the metapleural apodema is for the present only probable.

In the Cercopoidea and Fulgoroidea, besides the closed and unclosed cavities of the metapleural apodema, special adaptations are developed for close contact of the abdomen with the metathorax.

On the lateral parts of the second abdominal segment, sclerotized labiate folds occur oriented downwards, which grip the similar but upwards oriented labiate

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*The basicoxal suture is subparallel all around, not only on the fore coxae, but also on both the middle and hind coxae, to the basal margin of the coxa and separates the meron from the basicoxa, in those cases where the latter is developed. The meron itself is on the middle and hind coxae, exactly like the stylus in the Machilidae, while the meracantha is homologous to it in the Auchenorrhyncha. In spite of the view generally accepted, the meron does not belong to the basicoxa and is fringed distally by an independent (meral) carina.

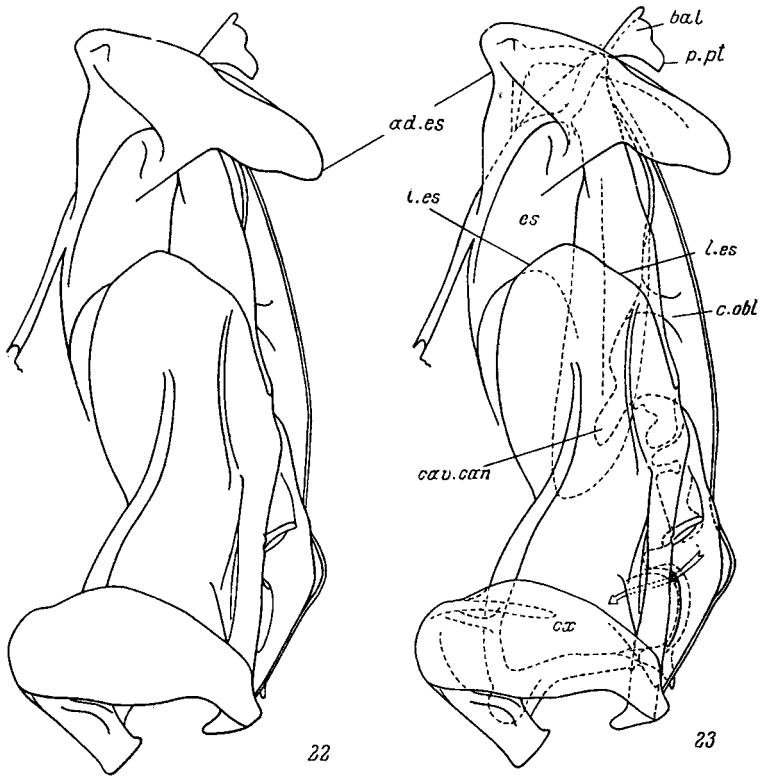

Fig. 22-23. Pleural synapodema in the Fulgoroidea (*Dictyophara europaea*), in Fig. 23 are shown the internal and masked structures.

Conventional symbols as in Fig. 19-21.

folds on the posterior part of the metapleura at the distal end of the transepimeral carina (Fig. 4, astr). When the abdomen is lowered, the lips become engaged and press against one another. In the Cicadoidea, formations occur homologous to the lips, but not serving for engagement. In them, lateral swollen areas of the second abdominal segment accommodate the auditory capsules, while the homologues of the thoracic lips are transformed into tympanal operculа (Fig. 2, operc).

In the Cicadelloidea, the labiate formations are not developed, but in areas of the second segment, homologous with the lips, here as also in the Cicadoidea, auditory organs are noted (Vondráček, 1949). These data enable us with a great degree of probability to suggest that homologous auditory organs occur in all the Auchenorrhyncha, including the Cercopoidea and Fulgoroidea, as well also as the sound-producing apparatus of abdominal segments I-II, detected in the Auchenorrhyncha (Myers, 1928; Ossiannilsson, 1949; Vondráček, 1949; Evans, 1957).

The simultaneous development of the thoracic-abdominal linkage and the sacs of the metapleural apodema in the Cercoipoidea and the Fulgoroidea, while both are absent in the Cicadelloidea and Cicadoidea, leads to the conclusion of a morpho-functional connection of the linkage and sacs with the sound-producing and auditory organs of the abdomen. If in the ancestors of the Cicadelloidea the sacs, as is very probable, were developed, while the actual thoracic-abdominal linkage possibly never existed, then in the Cicadoidea both the linkage and the sacs

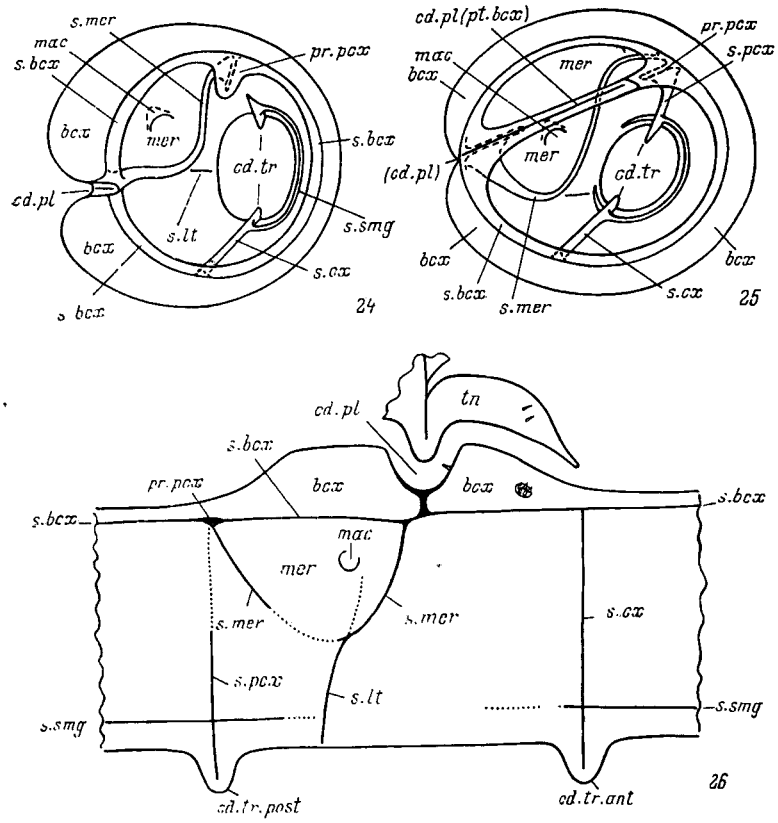

Fig. 24-26. Diagram of the structure of the pterothoracic coxa in the Fulgoroidea.

24-25 - schematic view of the coxa from the proximal pole in enhanced perspective: 24 - initial plan of the structure (as in Fig. 26), best shown from the middle legs; 25 - plan of the structure of the hind coxae, showing hypertrophy of the pleural condyle and its fusion with the basicoxal bridge and the opposite process of the coxal crest; here an operating (indicated by the arrow) appears in the pleurocoxal block. 26 - schematic diagram of the typically developed coxa (as in Fig. 24).

Conventional symbols as in Fig. 27 and 28.

evidently disappeared in connection with the hypertrophy of the sound-producing apparatus in the base of the abdomen.

The auditory or sound-amplifying nature of the accessory processes of the metapleural apodema is all the more probably since these formations, as well as the ability to sing, are characteristic only of the adults in the Auchenorrhyncha. The larvae of the Fulgoroidea, which jump well and possess a powerful synapodema consisting, as in the adult, of fused pleural and episternal apodemae, differ from the adult in that their pleural apodema is devoid even of traces of lobes, sacs, apophyseal cavity, or the niche of the marginal canaliculus. In the larvae of the Cercopoidea, as already indicated, there are also no secondary pleural processes or pleural apophyseal cavity.

The analysis made of the metapleural structures does not provide adequate grounds for firm conclusions as to the phylogenetic relationships of the four

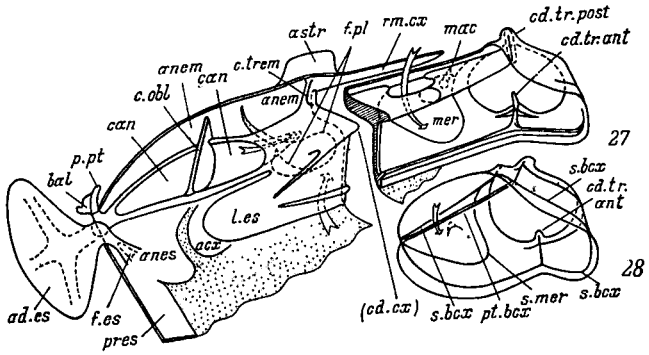

Fig. 27-28. Diagram of the structure of the complex metapleural apodema in the Fulgoroidea.

27 - general view inside, the coxa provisionally disconnected from the thorax; 28 - diagram of the structure of the hind coxa (as in Fig. 25), approximated in configuration and foreshortening to the position illustrated in Fig. 27.

acx - antecoxal; ad. es - episternal apodema; apem - anepimeron; anes - anepisternum; astr - heel of the epimeron; bal - basalar; bcx - basicoxa; can - canalicus of the pleural apodema; cav. can - niche of the canaliculus of the pleural apodema; (cd. cx) - site of the coxal condyle; cd. pl - pleural condyle of the coxa; cd. tr - trochanteral condyles of the coxa, fore (ant) and hind (post), c. obl - oblique carina; c. trem - transepimeral carina; f. es - foramen of the episternal apodema; f. pl - foramen of the pleural apodema; l. es - episternal lobe of the pleural apodema; mac - maracantha; mb. st - sternal membrane, desclerotized part of the sternal surface; mer - meron; p. pt - pleural wing process; pr. pcx - postcoxal process of the basicoxal crest; pt. bck - basicoxal bridge; s. bcx - basicoxal suture and carina; s. cx - coxal suture and carina; s. lt - lateral suture and carina; s. pcx - postcoxal suture and carina; s. mer - meral suture and carina; s. smg - submarginal suture and carina; tn - trochantin. Arrows indicate through openings and sinuses.

contemporary superfamilies of the Auchenorrhycha (Cicadelloidea, Cercopoidea, Cicadoidea, and Fulgoroidea), but it shows clearly the inadequacy of the view as to the (polyphyletic) origin of the Fulgoroidea independently of the other Auchenorrhyncha and the groundlessness of the view as to the earliest separation of the Fulgoroidea from the general line of the Auchenorrhyncha. The great similarity of the pleural structures in the Cercopoidea and Fulgoroidea lead us to the consideration of the close affinity of these groups.

CONCLUSIONS

Characteristic of the Auchenorrhyncha is the secondary pleural apodema of the metathorax, complex in structure, typically developed in the Cercopoidea, progressively modified in the Fulgoroidea and, as may be suggested, simplified in the Cicadoidea and Cicadelloidea. The primary pleural apodema of the metathorax with the apophysis developed is covered inside and posteriorly by a new process in the form of a sac folded in two. The sac is flattened posteriorly and is coalescent by its margin with the pleurocoxal joint. Laterally the walls of the sac, sclerotized in the form of lobes, delimit its two individual cavities, which together with the dilated cavity of the apophysis presumably fulfill the function of resonators. The apex of the apophysis masked by the sac is recurved anteriorly and is

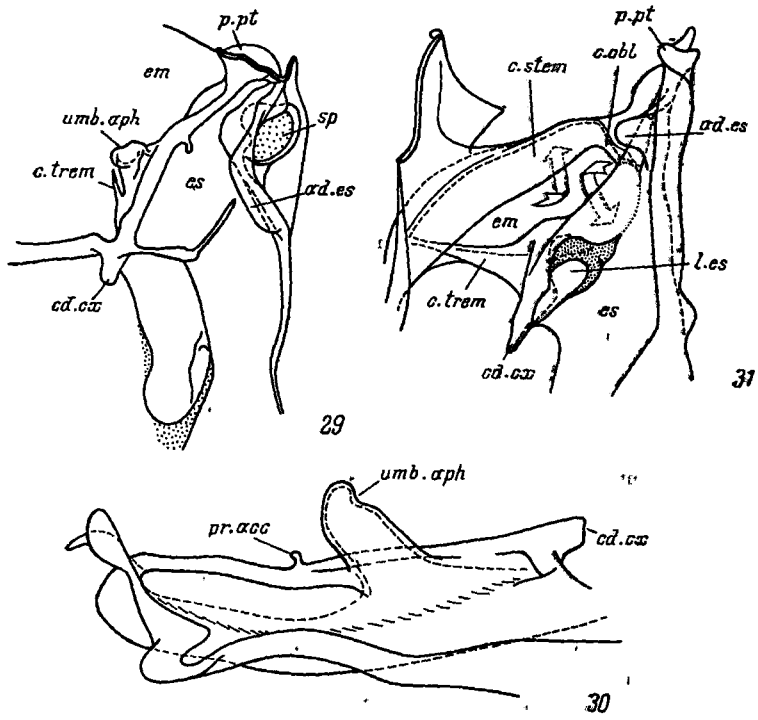

Fig. 29-31. Walls of the metathorax, viewed from inside (fragmentarily) in the Cicadoidea and Cicadelloidea.

29-30 - *Melampsalta caspia*, Cicadoidea (30 - view from rear-above); 31 - *Cicadella viridis*, Cicadelloidea.

ad. es - episternal apodema; c. stem - sternepimeral carina; pr. acc - accessory process.

Sinuses indicated by arrows. The remaining symbols as in Fig. 6-11.

fused with the primary pleural carina under the wing process. All the structures described are developed in the Cercopoidea, while in the Fulgoroidea, the cavity located beside the epimeron is reduced and the corresponding lobe is fused with its wall.

In all the Auchenorrhyncha, except the Cercopoidea and some of the Cicadelloidea, a special metepisternal apodema is developed, possibly homologous to the depression of the scent gland in the adult bugs. The episternal apodema in the Fulgoroidea is fused with the anterior end of the pleural apodema under the wing process and serves for attachment of the pleurotrochanteral saltatorial muscles.

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