

## THE NOMENCLATURE OF THE THORACIC SCLERITES IN THE CULICIDAE, AND THEIR SETAE.

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We owe to F. W. Edwards (1) a great forward step in the generic classification of mosquitoes, based in large degree upon distinctions found in the thoracic chaetotaxy, which applies equally well to both sexes. The bristles or setae of the pleural sclerites, as pointed out by him, are characters of excellent generic value. His early observations have been extended and confirmed by others, and assist materially not only in defining generic limits, but in identifying many closely allied species.

In too many instances the practicing systematic entomologist is called upon to identify poorly preserved female adult mosquitoes, minus legs, wing-markings, and other characters of importance in specific differentiation. Any characters which will avail in such a predicament are welcomed by the taxonomist. The distinctions pointed out by Edwards are of this sort, as even in badly denuded specimens they can be made visible by suitable treatment.

Recently developed methods of collecting adult mosquitoes, such as various forms of light-traps, usually give catches in a relatively poor state of preservation. The majority of specimens which have been collected from airplanes serving South American airports were in rather poor condition. Sometimes it is of extreme importance to know, as nearly as the material permits, the species of mosquito taken in airplanes coming from yellow fever areas. In many cases, if the genus of the specimen can be determined, a close guess can usually be made as to the species, if the fauna of the region from which it comes is well known.

In attempting to use the excellent method devised by Edwards, the lack of uniformity of nomenclature used by authors who have given later descriptions of the pleural sclerites and their setae became apparent. Further inquiry disclosed a deplorable situation, which should be rectified if the method is to prove universally useful.

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No attempt is made in this paper to amend current conceptions regarding the homologies of the various sclerites of the mosquito thorax. Its conclusions are offered, not as the studies of a trained morphologist, but as the findings of a taxonomist who, in the course of his daily work, uses the system of differentiation worked out by Edwards. It is hoped that, if the situation with regard to nomenclature is disclosed, more general agreement as to terms will result. Even if this consummation does not occur, the paper may have value as a reference-work for all those who find the pleural setae of use in mosquito taxonomy.

The morphology of the dipterous thorax, and the homologies of its sclerites, have been the subject of exhaustive study by insect morphologists, of whom Crampton (2) (3) has done relatively recent work in the nematoceros forms. While his work has been concerned largely with forms not particularly closely related to the mosquito, his findings have been of great service in clarifying our conceptions of the morphology of the pleural sclerites of the culicid thorax. They thus serve as a basis for a nomenclature resting on a sure foundation of morphology.

#### THE STRUCTURE OF THE CULICID THORAX.

At the risk of seeming unduly elementary, but in order to orientate the reader, who may have forgotten most of his insect morphology, it may be well to review briefly the structure of the pleura of the dipterous thorax, so that the names used later for the various sclerites will have significance.

The thorax of a dipterous insect is composed of three segments, prothorax, mesothorax, and metathorax, in order from the head to the tail. Those authorities who have studied the subject believe that in their primitive condition the sides of the thorax were composed of three plates, forming the lateral portions of these three thoracic segments. Each of the three lateral plates is known as a pleuron (the plural of which is "pleura"). The three lateral plates corresponding to the three segments were each divided into two sclerites, an anterior one called the *episternum*, and a posterior one called the *epimeron*. These terms are used with the prefixes *pro-*, *meso-*, and *meta-*, to indicate that they are parts of the *prothorax*, *mesothorax*, and *metathorax*. Sometimes these sclerites were divided into an upper and a lower portion, a condition designated by the prefixes *an-* and *kat-* (Gr. *ana-* up, *kata-* down). Thus the term *mes-an-episternum* means the upper portion (*an*) of the anterior sclerite (*episternum*) of the mesothorax (indicated by the prefix *mes-*). Other terms are compounded in the same way.

A complication enters in those insects which are winged, and

in which therefore certain parts of the thorax are enlarged to give room for the wing-muscles. The plates overlying these muscles are enlarged and the other plates may be correspondingly reduced. This is true of the Diptera as a whole, in which the mesothorax is greatly enlarged.

In some instances, this increase in size of the mesothorax proceeded so far that the sclerites forming the prothorax and metathorax, anterior and posterior to the mesothorax, are so reduced and fused that they are difficult or impossible to distinguish.

The parts of the dorsum of the thorax need not detain us here, except to note that the dorsum of the prothorax is known as the pronotum, and is divided into two portions, anterior and posterior. In primitive Diptera, as in some Tipulidae (crane-flies), the two portions are dorsal in position, and are separated by a well-marked suture.

In mosquitoes a secondary complication arises in assigning morphologically correct terms to the parts of the prothorax. The anterior and posterior pronotum, normally *dorsal* in position in primitive Diptera, have migrated ventrad (towards the sternum) and caudad (towards the tail). These parts in their altered position apparently form portions of the *lateral* plates of the anterior portion of the thorax.

The sclerites of the pleura (sides) of the anterior segment of the thorax (the prothorax), which are termed the proepisternum and the proepimeron, are thus crowded downwards and reduced to insignificant proportions. Their places are occupied to a large extent by the parts of the pronotum, which have migrated ventrally.

This migration of the dorsal portions of the prothorax has been overlooked or disregarded by several authorities; thus it has followed that the true posterior pronotum, a *dorsal* part of the prothoracic segment, has been called the "proepimeron," which by definition is the posterior portion of the prothoracic pleuron, a *lateral* part.

The corresponding anterior sclerite of the prothoracic pleuron has been called the propleuron, but morphologically it is the proepisternum, the anterior sclerite (much reduced in size) of the prothoracic pleuron.

No reference has been found, in a limited search, to the term "propleuron" as applied to mosquitoes. Many authorities use the term in connection with the setae found on this part, calling them the "propleural setae." It would seem that "proepisternal setae," being morphologically significant, is the better term.

The anterior portion of the pronotum, normally dorsal in position and part of the prothoracic segment, has likewise migrated ventrally, and has divided into two lobes, more or less completely separated. This migration and separation of

these lobes, often called the "prothoracic lobes," has proceeded farther in the Anophelini than it has in some of the other Culicidae. In the genera *Sabethes* and *Sabethoides*, the prothoracic lobes are very large, and nearly contiguous dorsally.

The sclerites of the pleura of the *metathorax* are of little importance taxonomically, with the exception of the meron. This is the small sclerite at the base of the mesepimeron, posterior to the middle coxa, and is known also as the meso-merocoxa, and incorrectly as the "lateral metasternal sclerite." The position of its upper margin with reference to the base of the hind coxa serves to differentiate the tribe Megarhinini and the tribe Sabethini (of Dyar) from the other three tribes of the Culicinae recognized by him. (Exception: *Haemagogus*, which is Aedine, but has the base of the hind coxa in line with the upper margin of the meron, as in the Megarhinini and Sabethini.) Crampton (2) has shown that the meron is derived from the posterior half of the middle coxa, by a process of fission and migration dorsally.

#### TERMINOLOGY OF THE PLEURA AND THEIR SETAE.

To show the confusion which exists in the nomenclature of the pleural sclerites, and the consequent confusion in the terms applied to their setae, two tables and two figures have been prepared. The first table lists the terms applied to the pleural sclerites, according to Edwards (1), (4), Freeborn (5), Dyar (6), Patton (7), Matheson (8), Root (9), Shannon (10), Christophers (11), and Gater (12).

The second table lists the terms applied to the setae of the pleural sclerites, according to the same authorities. The list of terms applied to the setae by Patton and Evans is taken from the first volume of their work (13).

The first figure has the sclerites named in the first table indicated by numbers, which correspond to the numbers in the left-hand column of the first table. Reference to these numbers will enable the reader to learn the various terms which have been applied to the sclerites.

The second figure shows the pleural setae, and is composite, as no one species of mosquito possesses all the setae shown in the diagram. The same system of numbers and reference to the table of setae is used. The numbers in the second figure do not correspond to those in the first figure, but refer to the second table.

In the first table (of sclerites), it will be noted that the mesepimeron (No. 6) is the only term used in common by all the authors listed. The proepisternum (No. 2) is known under five different names. The anterior pronotum (prothoracic lobes, No. 1) is likewise designated by five different terms. The

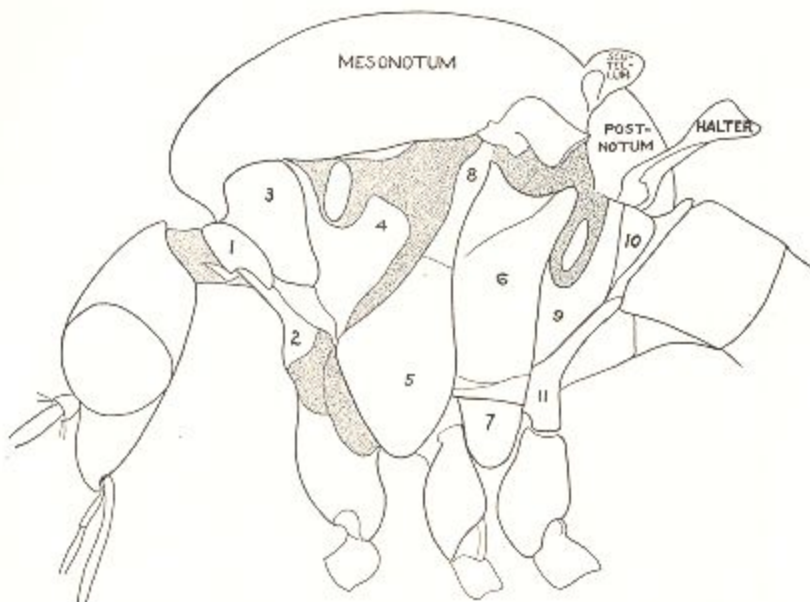


FIGURE 1. Nomenclature of sclerites of pleura of Culicid thorax. 1. anterior pronotum; (prothoracic lobes). 2. proepisternum. 3. posterior pronotum. 4. mesanepisternum. 5. sternopleuron. 6. mesepimeron. 7. meron. 8. prealar area. 9. metepisternum. 10. metepimeron. 11. meteusternum.

posterior pronotum ("postspiracular area," No. 4) is known under three different names.

In the second table (of setae) there is a little more agreement in nomenclature, as four terms are used in common by all the authors.

#### SOME NECESSARY CORRECTIONS IN TERMINOLOGY.

In the paragraphs which follow, certain errors in nomenclature made by the authors cited are corrected.

Edwards (4) uses the terms "pleura" (singular) and "pleurae" (plural) for the sclerites of the sides of the thorax. While not absolutely incorrect, "pleura" being a secondary meaning of "pleuron" (as the latter term is used by entomologists) according to Webster, most morphologists use the word "pleuron" (singular) and its plural form "pleura."

Edwards also uses the term "proepimeron" for the posterior pronotum, in accordance with earlier conceptions of this sclerite; he states that this use of "proepimeron" is probably incorrect.

TABLE I.  
SCLERITES OF PLEURA.

	Edwards I (1921)	Freeborn (1926)	Dyar (1928)	Patton (1930)	Matheson (1929)
1	prothoracic lobes	anterior pronotum	prothoracic lobes	anterior pronotum	prothoracic lobes; pronotum*
2	prosternal lobes	episternum	propleura	proepisternum	proepisternum
3	proepimeron	posterior pronotum	pronotum	posterior pronotum	pronotum
4	not definitely named	(mes)anepisternum	postspiracular area	mesanepisternum	upper portion of mesepisternum
5	mesepisternum and mesosternum	(meso)sternopleurite	sternopleura	meskatopisternum†	posterior half of mesepisternum
6	mesepimeron	mesepimeron	mesepimeron	{ mesanepimeron meskatopimeron	mesepimeron
7	not mentioned	meron	lateral metasternal sclerite	meron‡	not mentioned
8	prealar prominence	upper portion of (mes)anepisternum	not mentioned	not mentioned	dorso-posterior projec- tion of mesepisternum
9	not mentioned	(met)anepisternum	not mentioned	metepisternum	not mentioned
10	not mentioned	(met)epimeron	not mentioned	metepimeron	not mentioned
11	not mentioned	(meta)sternopleurite	not mentioned	mesusternum§	not mentioned

\*Erroneously designated. See discussion.

†In Fig. 58, p. 71 of Part II, the sclerite labeled "mkep" is erroneously stated to be the "meskatopimeron," in the small type below the figure. This is undoubtedly merely a typographical error, as the true "meskatopimeron" is properly labeled. The part is correctly designated in the legend below Fig. 57 of Patton and Evans, p. 86, Part I (15).

‡In the same figure, the labels denoting the "meron" and the "mesusternum" are transposed.

§The "mesusternum," according to its prefix "mes," is a portion of the mesothorax. Freeborn and Christophers consider the part labeled "mseau" to be a part of the metathorax.

	Root (1929)	Shannon (1931)	Edwards II (1932)	Christophers (1933)	Gater (1935)
1	prothoracic lobe	not mentioned	pronotum	anterior pronotum; anterior pronotal lobe; (prothoracic lobe)	anterior pronotum; pronotal lobe
2	propleura	propleura	propleura	propleuron: episternum	proepisternum
3	posterior pronotum	proepimeron	proepimeron	postpronotum	posterior pronotum
4	mesopleura	preanepisternum; meso- pleura; post-spiracular area	post-spiracular area	mesothoracic anepisternum	mesanepisternum
5	sternopleura	sternopleura	sternopleura	sternopleuron of mesothorax	meskatepisternum
6	mesepimeron	mesepimeron	mesepimeron	mesepimeron	mesepimeron: { mesanepimeron meskatepimeron
7	lateral metasternal sclerite	meso-metocoxa	meron	meron	meron
8	not mentioned	not mentioned	prealar knob	prealar area	upper portion of meskatepisternum
9	not mentioned	not mentioned	not mentioned	not mentioned	metepisternum
10	not mentioned	not mentioned	not mentioned	metathorax	metepimeron
11	not mentioned	not mentioned	not mentioned	sternopleuron of metathorax	not mentioned

TABLE II.  
NOMENCLATURE OF PLEURAL SETAE.

	Edwards I (1921)	Freeborn (1926)	Dyar (1928)	Patton & Evans (1929)	Matheson (1929)
1	pronotal	anterior pronotals	prothoracic	anterior pronotal	prothoracic
2	prosternal	episternals	proporeal	proporeal	prosternal
3	proepimeral	posterior pronotals or proepimerals	pronotal; proepimeral	posterior pronotal	pronotal
4	spiracular	spiraculars	spiracular	spiracular	spiracular
5	post-spiracular	postspraculars	postspracular	postspracular	post-spiracular
6	pre-alar	prealars	prealar	prealar	pre-alar
7	sternopleural	sternopleurals	sternopleural	lower sternopleural	sterno-pleural
8	mesepimeral { upper lower	mesepimerals { upper lower	mesepimeral	hypopleural { upper lower	mesepimeral { not men- tioned lower
	Root (1929)	Shannon (1931)	Edwards II (1932)	Christophers (1933)	Gater (1935)
1	prothoracic	prothoracic	anterior pronotal	anterior pronotal	anterior pronotal
2	proporeal	proporeal	proporeal	proporeal	proporeal
3	pronotal	not mentioned	posterior pronotal	not mentioned	not mentioned
4	spiracular	spiracular	spiracular	spiracular	spiracular
5	postspracular	postspracular	post-spiracular	not mentioned	not mentioned
6	prealar	not mentioned	pre-alar	prealar	prealar
7	sternopleural { upper lower	sternopleural	sternopleural	sternopleural { upper lower	sternopleural { upper lower
8	mesepimeral { upper mid	mesepimeral	{ sub-alar lower mesepimeral	mesepimeral { upper not men- tioned	mesepimeral { sub-alar lower mes- epimeral



Root (9) uses the term "mesopleura" for the mesanepisternum, but Crampton (3) states that this designation should be given to "both entire flanks or pleura of the mesothorax."

Shannon (10) also uses the term "mesopleura" for the mesanepisternum.

Matheson (8) states (p. 6, line 15), that the pronotal setae are located on the posterior margin of the "pronotum," evidently designating the posterior pronotum as the pronotum. On p. 11, line 16, he states that the pronotum is "represented by the two prothoracic lobes."

Patton & Evans (13), in Fig 163, label the setae on the propisternum (propleuron) as the "proepimeral" setae. There is no justification either on morphological grounds, or in entomological usage, for this designation.

Patton, in Fig. 58 of his second volume (7), designates correctly the sclerite on which the so-called "proepimeral" setae occur as the "propisternum."

Several typographical errors mar the accuracy of his Fig. 58. The meron is incorrectly designated the "meseusternum," and vice versa. The meseusternum, by definition, should be a part of the mesothorax, but it very evidently is a part of the metathorax, and should be designated the meteusternum.

The legend beneath the figure contains a misprint, in which the sclerite "mkep" is called the "meskatepimeron," when it is evidently the "meskatepisternum." The true "meskatepimeron" is labeled "mkepm."

Dyar (6) gives a figure, No. 1 on Plate I, page 473, of the lateral view of the thorax. In this figure, some of the pleural setae are named. The sclerites are not designated. It has been necessary, therefore, in drawing up his list of terms for setae and sclerites, to refer to the designations given in his table of tribes and genera on page 4. The incompleteness of figure 1 on Plate I renders this table of genera useless to the occasional taxonomist, who may have no knowledge of the location of the various setae mentioned in the table.

The location is not shown of the "proepimeral" setae (p. 6, line 14), which are incorrectly called the "pronotal" setae in the diagram; they should be designated the "posterior pronotal" setae. The prothoracic lobes (anterior pronotum) are figured, but not designated. The propleural setae are shown, but also not designated, although they are mentioned in the table (p. 6, line 26). The positions of the "mid-mesepimeral" setae (p. 7, line 14) and of the "prescutellar" setae (p. 6, line 3 from bottom) are not figured.

The dichotomy (No. 9, p. 6) indicating the separation of the genus *Menolepis* from genus *Miamyia*, if worked backwards through the preceding dichotomies, is incorrect if the characters of the genus *Menolepis* are correctly given on p. 66. Thus:

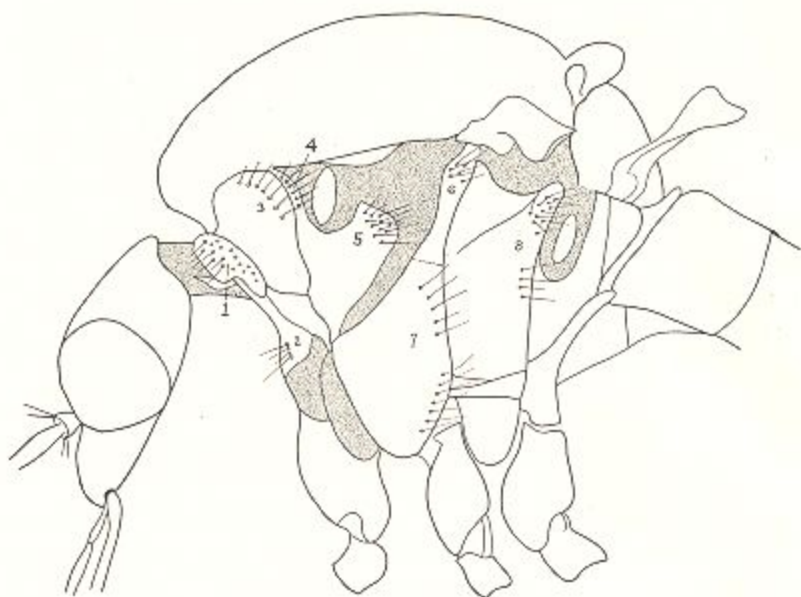


FIGURE 2. Nomenclature of pleural setae of Culicid thorax. 1. anterior pronotal (setae of prothoracic lobes). 2. proepisternal. 3. posterior pronotal. 4. spiracular. 5. postspiracular. 6. prealar. 7. sternopleural. 8. mesepimeral.

(9) Wing-scales narrow. (7) Lower sternopleural setae extending as far as, usually above upper margin of lateral metasternal sclerite. (6) Spiracular setae present. (4) Prealar setae present. (3) *No* [posterior] pronotal setae; prothoracic lobes *not* widely separated.

On page 66 it is stated: "Pronotal setae *present*, prothoracic lobes *widely separated*," in direct contradiction to the characters given in the key (second half of dichotomy 3, p. 6).

#### SUGGESTED TERMINOLOGY.

As an approach to an exact nomenclature, based on morphology, the following terms for the pleural sclerites are suggested as desirable. The numbers preceding the terms apply to the numbers in Figure 1, indicating the location of the pleural sclerites. These terms are given in the legend below this figure.

- (1) anterior pronotum; (prothoracic lobes)
- (2) proepisternum
- (3) posterior pronotum

- (4) mesanepisternum
- (5) sternopleuron
- (6) mesepimeron
- (7) meron
- (8) prealar area
- (9) metepisternum
- (10) metepimeron
- (11) meteusternum

A similar terminology for the setae of the pleura is listed below. The numbers preceding the terms apply to the numbers in Figure 2, indicating the pleural setae, and these terms are given in the legend below this figure.

- (1) anterior pronotal; (setae of prothoracic lobes)
- (2) proepisternal
- (3) posterior pronotal
- (4) spiracular
- (5) postspiracular
- (6) prealar
- (7) sternopleural
- (8) mesepimeral

Where the terms in earlier use are more familiar, or are preferred by the individual worker, it is recommended that these be given also in parentheses, after the correct morphological terms, in future publications. If the older term is simply an alternative designation, it may be enclosed merely in parentheses. If the term is morphologically incorrect, and therefore a misnomer, it may be enclosed in parentheses and quotation marks. Instances in which this procedure would be extremely useful are: anterior pronotum (prothoracic lobes), posterior pronotum ("proepimeron"), meron ("lateral metasternal sclerite").

#### CONCLUSION.

It is hoped that the tables and figures given in this paper will be of assistance to entomologists and others interested in mosquito taxonomy. They may be used as references in studying the works of the various authorities, and as guides to the proper use of terms in future publications.

That some such analysis as forms the subject of this paper seems necessary, in order to guard against further errors and confusion, ought to be self-evident from the chaotic situation disclosed regarding the nomenclature of the pleural sclerites and their setae.

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