On the larval and pupal stages of West African Culicidae / by W. Wesché ; with field-notes by the collector, W.M. Graham.

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(Plates I.–VII.)

In dealing with this extremely interesting and valuable collection of Mosquito larvæ and pupæ from Lagos, which we owe to the industry of that indefatigable collector and observer, Dr. W. M. Graham, I have endeavoured to give a practical and not too technical description of each species, and I have given illustrations of all the principal characters, and of some points of more general interest. If technicalities are indulged in, they are explained in the preliminary text, and in the plates. It has been my object to make it impossible for the careful worker to mistake any one of these larvæ for that of another species, but persons who have experience of such work, know the difficulty of arriving at such results without a knowledge of all known forms, and that knowledge I have no pretensions to possess.

In my keys I have taken the most simple and obvious characters as guides, and I may point out for the information of those who approach the subject as novices, that with a little experience it ought to be easy to recognise the two most dangerous groups of mosquitoes in their larval stages: the Anophelines by the absence of the respiratory tube or siphon, and the presence of long feathered plumes on the thorax; and the *Stegomyiæ* by the short stumpy siphon, often with serrated spines, and the numerous star-like, or stellate, hairs scattered all over the body (Pl. III, figs. 3 & 7); while larger heads and longer stout siphons suggest, if the spines are serrated (Pl. II, fig. 10), a relationship to the genus *Ædes*; and the very long thin siphons have been recognised as sometimes belonging to the restricted genus *Culex*. The paper is arranged in the following order:—

1. Technique, including measurements and the examination of living larvæ.
2. Characters of the larvæ and pupæ.
3. Keys to the species described, larvæ and pupæ.
4. Separate description of each species.
5. Plates and explanation.

Technique of Examination.

The larvæ and pupæ were preserved in tubes of formalin ; it was desirable that they should be examined in the medium they had been in, so they were taken out of the tubes by a small lifter * and transferred to a shallow glass trough, half full of formalin ; this was placed on the stage (flat) of the compound microscope, and the larvæ examined with a magnification of about 60 diameters. In those with very long siphons, and in all the pupæ, some difficulty will be met with in getting dorsal views, and even more difficulty in getting ventral views. In the larvæ, when material is abundant, this is got over by detaching the head, or the siphon. In cases where it is not desirable to damage the specimens, and with the pupæ, the difficulty can be got over by using a rectangular trough with sides about 2 mm. deep, when the head or the upright siphon can be placed in the angles †.

In manipulation it is well to use a bristle in a handle, or, better still, the finest entomological pin with the head off, and fixed in a handle till only 4 mm. remains visible ; the point must be pared down (on a glass slip is best) with a penknife, till only a fine strip of metal remains, and the last half millimetre is slightly bent.

A dorsal examination gives the best view of the antennæ and of the facial plumes and eyes, but the ventral side shows the mouth better. To understand the mouth structures properly, they must be carefully dissected and teased apart ; the fragments cleared in phenol and xylol, spread on a glass slip, and mounted in balsam.

The thorax and abdomen must be looked at from both sides. The weight of the siphon will, except in the case of the Anopheline larvæ, or in those with very short siphons, turn the last two segments of the abdomen partially round, so that a lateral view, or semi-lateral view, is obtained of the seventh segment. If there is any difficulty, wedge the head in a corner.

The siphon, comb and anal segment are best seen laterally, except in the case of very dark larvæ ; the pupæ are also to be examined in this way ; but when the anal plates are looked at, a dorsal or ventral view is necessary, and then the creature has the last three segments broken off, or is placed on its back with its head in a corner, or is hung on a bent pin, as suggested in the note below.

Measurements and Comparisons.

These are best made with a numbered scale dropped in the eyepiece of the microscope, when the units can be read off and compared.

* A strip of zinc 2 mm. broad, and of suitable length, fixed in a handle, answers well.

† A much bent mosquito pin (silver and as thin as possible) shaped so that it forms a cradle or a little elevation, can be placed in the trough, and the larvæ and pupæ arranged on it, so as to give particular angles ; this has been found very useful.

1. The abdomen will be measured from the base of the thorax to the end of the eighth segment ; the anal segment being excluded.

2. The siphon, from the chitinous ring at the base to the tip ; the valves being excluded, and the breadth being that of the chitinous ring.

3. The measurements of the anal segment will be the greatest length and breadth of the chitinous plate of which it is formed.

4. To measure the whole larva or pupa, the trough is placed on a metric scale of metal or ivory ; the contained creatures are then arranged on the scale, and the measurements read off with a lens magnifying 12 to 15 diameters. In the case of the pupa the only measurement used is the greatest length of the thorax, as the tail varies so much in its curves and positions that no useful comparisons can be made.

Examination of Living Larvæ.

For this purpose a well made Rousselet live-box, or a compressorium, is necessary ; the larvæ are transferred with a pipette, and with a little practice it will be found that they can be kept quiet without injury, and can after examination be returned to an aquarium or other breeding arrangement.

Characters of various Parts.

The Hairs.

The hairs of aquatic larvæ constitute one of their most striking features, and those of the Culicidæ present an extraordinary variety, often affording very beautiful objects for the higher powers of the microscope. For the purposes of determination and comparison, a certain amount of exactness in definition will be found of use. I therefore propose the following :—

1. A *hair* is elastic, may be long or short, exceedingly thin or moderately stout.
2. A *bristle* is not elastic, never very short ; it is stouter than a hair, and may be curved, sharp or blunt, or even thickened at its end.
3. A *spine* is of any length, it is otherwise a thick bristle which is straight and sharply pointed.

Hairs may be further subdivided, and I follow the classification of these structures suggested by Nuttall and Shipley.

a. *Feathered hairs.*—This term is used when the secondary hairs are all in one plane and are very long, as in the thoracic plumes of the Anophelinæ (Pl. VI, fig. 3).

b. *Plumose hairs* are those in which the secondary hairs are shorter and are, or are not, in the same plane : such as the antennal plume in most larvæ (Pl. I, fig. 1).

c. *Subplumose hairs.*—Refers to those in which notches can be seen with a magnification of 60 diameters, but having only very short secondary hairs. A rare condition. (Pl. III, fig. 17.)

d. *Branched hairs.*—Applied to hairs which bifurcate into one or more branches, such as the end hairs of some antennæ (Pl. V, fig. 3).

e. *Simple hairs.*—Signifies that the hair is without secondary structure.

f. *Plumes* may all spring from a number of sockets or be the outgrowths of a single hair—consequently their bases may or may not be in the same plane. The hairs may be simple, plumose or feathered.

g. *Tufts* are short, and the hairs are never in the same plane at the base (Pl. VII, fig. 9).

h. *Palmate hairs* consist of a fan-like arrangement of flat spines, springing from a single basal hair, and are found in various stages of development on the larvæ of the ANOPHELINÆ (Pl. V, fig. 22).

i. *Stellate hairs* are simple hairs, usually not less than three, or more than five, springing from a single base (Pl. VII, fig. 3).

THE HEAD.

The size and shape of this part present many variations; the chitin is also often different, some heads being transparent and others semi-opaque, or even opaque.

THE ANTENNÆ.

The colour is variable, and minute spines are present on the surface in varying degrees. A plume may or may not be present, and may consist of simple or plumose hairs; it may be inserted at varying distances along the shaft and the antennæ may be constricted at the insertion. The distal joint is usually shorter than the basal; it bears spines at its end which vary in colour and length, and a small number of hairs which may be simple or branched.

THE MOUTH-PARTS.

Judging from the nomenclature adopted by Theobald, Nuttall and Shipley, Giles, Felt and Mitchell, little or nothing has been done on this subject since Meinert published his paper in 1886 *. I arrive at this conclusion because in several of my preparations I find at least three structures that are not mentioned by any of these writers. Nuttall and Shipley say †: "There is nothing which can be homologised with the second pair" (of maxillæ); though this statement was made only in regard to *Anopheles maculipennis*, Mg. In an undetermined Culicine larva from Ceylon in my collection, there is, under the small piece between the brushes, which I call the labrum, an organ of some complexity, which I also find in one of these larvæ, *Culex dissimilis*, Theo. (Pl. IV, fig. 6). But in this species and in *Culex caliginosus*, Graham, are homologous organs of great complexity, which appear to represent the labium. This is found immediately under the "under lip" of Meinert, that serrated chitinous shield that forms so prominent a part of the ventral side of

* Dan. Selsk. Skr. III. Die eucephale Mygelarver. Copenhagen, 1886.

† "The Structure and Biology of *Anopheles maculipennis*." Jour. of Hygiene, Jan. 1901, p. 55.

the h ad. At its back are muscular and glandular (?) structures, and passing into it is the pharynx ; the part itself is formed of a number of minute chitinous structures. I shall content myself with figuring this part as I have found it in one species (Pl. IV, fig. 2), reserving for a future paper the discussion as to its homologies ; yet I will say that I doubt the accuracy of Meinert's determinations of the other parts, but as his nomenclature has been adopted in all the best known works on the subject, I have no option but to follow it in the descriptions in this paper ; for to do otherwise, would only hamper its utility and practical application.

The Brushes.

These are two chitinous processes studded with a multitude of sockets, in which are inserted hairs which vary, in the different species, in degrees of thickness and complexity. They are moved by the four largest muscles in the head, and are often the most prominent part of it (Pl. IV, figs. 8, 9, 19).

In most cases the individual hairs are simple, but in two of the larvæ examined very remarkable developments were found. Those in *Culex caliginosus*, Graham, are very beautiful microscopic objects, each hair having at its end a minute comb.

In *Culex tigripes*, var. *fusca*, Theo., the hairs are much fewer and stouter, and each hair is regularly pectinated for a great portion of its length (Pl. III, fig. 15).

Nuttall and Shipley have beautifully described the manner in which the brushes are used in *Anopheles maculipennis* to sweep the water (*l. c.* p. 56); but the *maculipennis* hairs are simple, and it seems probable that even the most minute living organism would fail to elude these more modified and complicated brushes.

The Labrum.

Looking down on the front of the head a plate is seen, often with two curved short bristles at its sides ; this is the clypeus. In the middle, between the brushes and below the clypeus, is a semi-circular plate with a rather roughened edge. When this is dissected out, or a preparation is made permitting of its examination with high powers, it is found to cover an organ of some complication (Pl. IV, fig. 7). The central portion consists of two spines on an oblong base, which is behind a shorter piece of somewhat similar form ; this is flanked on either side by a spine and a tuft of hair. It is a little more than $\frac{1}{10}$ mm. in breadth (Pl. IV, fig. 6). I find it in a Sinhalese larva, and also in the African *Culex dissimilis*, Theo.

The Mandibles.

These are far more highly complicated than is usual in insects. The two I have dissected out, namely, those of *Culex caliginosus*, Graham, and *C. dissimilis*, Theo., are easily homologised, part for part, with Nuttall and

Shipley's figure 11 of Plate ii (*l. c.*), and bear the two stiff bristles which, as they observed, were used to clear the brushes. When the head is looked at from the ventral side, the chitinised teeth can be seen in the interior of the mouth, under the maxillæ and just above the under lip (Pl. II, fig. 10 ; Pl. IV, fig. 5).

The Maxillæ.

These occupy a very prominent position when the mouth is looked at from the under side, and are very diverse and characteristic in appearance. In *Anopheles* well developed palpi are present, but in other forms these organs are much atrophied, and in *Culex caliginosus*, Graham, I think they are completely aborted. The maxillæ in this species are small, hairy and palpiform in appearance. In *C. dissimilis*, Theo., they are less palpiform, and have a strong brush at the apex, besides rows of spines ; palpi are present, but in an atrophied condition. In this species the maxillæ have several short claws at the end (Pl. IV, fig. 4), and I have also seen these on *Pectinopalpus fusca*, Theo., ? (I) as very insignificant appendages to the long maxillæ.

The Labium.

This organ may be represented by the complicated structures found in the heads of *Culex caliginosus*, Graham, and *C. dissimilis*, Theo.

It presents a very different appearance in the two species. In the former there is a central brush of spines from which proceed paired rods which curve outwards ; in the spaces between the spines and the rods are two pairs of stout blunt hairs, which do not differ in appearance from the "taste hairs" on the mouths of insects ; the parts are flanked by complicated toothed plates, and have above them two longer stout blunt hairs, and a pair of minute two-ended processes. The whole is very small, as at its greatest width it is but $\frac{1}{15}$ mm.

In *Culex dissimilis*, Theo., the organ is dissimilar in appearance, though of about the same size. In the centre is a three-pointed process, on either side of it being the four "taste hairs," and it is flanked by toothed processes; from the central process proceeds a short rod, which extends to an opening of a hexagonal shape in a plate of complicated folds ; at the top is a curved plate with spines at its outer ends (Pl. IV, fig. 2). From the middle of these organs runs down the pharynx, a transparent membranous tube.

Near this part in *C. dissimilis* is a pair of circles with transparent cilia (Pl. V, fig. 1), which are identical in structure with similar circles or ovals found in the same portion of the head of some Isopods—such as our common wood-louse (*Porcellus scaber*) *.

* Miall, 'Aquatic Insects,' p. 117, notices this organ in *Corethra* and *Culex* larvæ.

THE LOWER LIP.

This part is very similar in both Anopheline and Culicine larvæ, being a striking, much chitinised, serrated shield, which lies in the median line of the under side of the head (Pl. IV, fig. 3).

THE FACE.

This part, the dorsal front of the head, varies in size and character, as well as in the number of the plumes; pigment-spots are often present, especially two half-moons near the bases of the brushes.

There are usually six plumes on the fore part of the head, each having from three to eight hairs; and behind these are four minute stellate hairs, flanked by two longer plumes (Pl. II, fig. 11).

THE EYES.

The eyes are variable in shape; in some stages of the Anophelines examined they were reduced to small round bodies, but in others they are of a sub-lozenge or half-moon shape, and have often a small pigmented mass of eye-structure behind. As, however, the eyes appear to undergo great changes in the larval moults, these characters are unreliable, and it is best to record only the condition of the mature forms.

THE THORAX.

The relative size of this part undergoes many changes, particularly in the Anopheline larvæ, but the plumes on it are fairly constant. It must be examined on both sides; the dorsal anterior edge has many plumose hairs which often reach forward, quite over the head, and there are two pairs of plumes behind these and two on the shoulders (Pl. II, fig. 11).

The majority of the plumes are on the ventral side, and three or four hairs usually spring from a chitinous tubercle. All these plumes in some measure accentuate the three segments of the thorax (Pl. II, fig. 10).

In the mature larvæ of *Pyretophorus costalis*, Lw., there is a regular and geometric pattern on the ventral side, and this character appears confined to the mature larval stage (Pl. VI, fig. 1).

THE ABDOMEN.

The abdomen consists of nine segments of which the first two bear plumes, usually of a similar character to those on the thorax. The dorsum is studded with innumerable combinations of small and large stellate and other hairs, but except when the part is unusually hairy, as in *Stegomyia africana*, Theo. (Pl. III, fig. 7), the characters are rarely specific. The eighth segment is, however, a striking exception, as it bears on each side a patch of spines known as the comb and on the dorsum the highly important siphon or respiratory tube; the ninth or anal segment is also of great use on account of its appendages. On the posterior side of the siphon, and usually on the membrane between the eighth and anal segments, are two plumes, usually

socketed on short tubercles; these I call the *sub-siphonal* plumes; the lateral plumes at the base of the siphon itself I call the *siphonal* plumes (Pl. I, fig. 4). There is often a third plume (laterally) at the base of the anal segment, and this is generally of simple hairs, it being exceptional to find that condition in the other two.

The Comb.

This consists of a number of spines or scales on each side of the eighth segment, which present remarkable specific characters * when they can be seen; but the difference in their appearance, brought about by the angle from which they are viewed, is so great that, in discriminating species, it would be dangerous to rely upon this character alone. The combs are best seen on the lighter-coloured larvæ, and from a lateral view, with the siphon lying as flat as possible in the trough; if they cannot be made out then, as sometimes happens, a dorsal view will partially show them. To secure this, the siphon must be perpendicular, often out of the liquid: as I have already explained, this is managed by placing the head in a corner of the trough.

The combs on the Anopheline larvæ are on the lateral supports of the platform on which the spiracles open.

When mounted in balsam the combs are rendered so transparent that they are exceedingly difficult to see with the best of objectives and substage illumination, and in this condition I find it almost impossible to count the scales with any degree of accuracy. As I propose to describe only what I can see with 60 diameters, I shall not rely on the combs more than I can help for specific characters. The difficulty of using these structures for such a purpose is illustrated by my personal experience. I possess a beautiful preparation of the larva of our British *Ædes cinereus*, Mg., in formalin, made and given to me by Mr. H. J. Waddington, F.L.S., of Bournemouth. Though I am able to use a very good $\frac{1}{7}$ on the comb, I cannot satisfactorily count the scales or be sure of their real shape either with a high or a low power objective.

I also drew some of the scales of the comb of *Stegomyia fasciata*, F., and of *S. africana*, Theo., from larvæ lying in the trough of formalin, using a $\frac{3}{4}$ objective, and I could not separate these two species on what I saw, as my drawings were practically the same. I suspect that with a little imagination I could see on *S. africana*, Theo., the elaborate structures that are figured, as existing in *S. fasciata*, in Goeldi's 'Os Mosquitos no Para' (Brazil, 1906, Plate F). Indeed at the present moment I am by no means sure that they do not exist, nor can I be certain without making careful stained preparations, capable of being examined with higher powers than those employed.

The Siphon.

This part varies so much and has so many subsidiary hairs and spines that

* Since the above was written I have been able to examine a greater number of preparations; I am now inclined to think that they are more of generic than specific importance.—W. W.

it is perhaps the most important character in the larva. The species contained in the present collection exhibit a great variety in the form of this organ, which is extraordinarily developed in some of them. In the Anopheline larvæ it can scarcely be said to be present, but the homology of the parts is at once evident, if one of the stouter siphons, such as that of *Culex tigripes* (Pl. III, fig. 14), is arranged so as to enable the observer to look directly down on the spiracles (Pl. V, fig. 19), when a similar arrangement to that which exists in the Anophelines will be seen.

The siphon, be it long or short, contains the spiracles of the two trunks of tracheæ that run down the dorsum of the larva : at the ends of these tracheæ are flaps or valves, which apparently may serve different purposes. In some cases they appear to be pulled down by muscles so as to close, or rather plug, the mouth of the siphon ; while in *Culex tigripes* the presence of certain sclerites, which have the appearance of apodemes, suggests that they flap over the openings of the spiracles. I find in the larvæ of *Phorocera serriventris*, Rondani (=*P. concinnata*, Mg.) such apodemes at the anal spiracles, and they are constantly present in the imagines of all Diptera, so that when they are seen, one may infer, with great probability of correctness, that they are used to open and close the breathing apparatus.

The siphon has a highly chitinised ring at its base, which is useful for comparative measurements, and often, on the ventral side, a median ridge on which are sometimes inserted plumes or hairs ; in other cases double rows of plumes are found, one on each side of the median line.

On either side, usually beginning at the base, and on the ventral side are two rows of spines ; judging from a rather obscure description by Felt *, these are his "*pectens*." I shall mention them as spines, or siphonal spines ; they form a very important character in their various arrangements, and in some cases their shapes. Besides these spines, there are often present stellate and other hairs that afford specific characters.

The Anal Segment.

This is the ninth segment of the abdomen, and makes the thirteenth of the whole larva, the number usually found in Nematocerous forms. The part has four appendages at its end which are called the papillæ, and are of various lengths, shapes and colours ; and in at least one species, two of them are quite chitinous (*Culiciomyia cinerea*, Theo.). On the dorsal edges of the segment are long hairs and plumes, and on the ventral side a number of plumes, which may be quite at the end, or fringe the side ; this I call the ventral beard. It is curious that however plumose the hairs may be on the thorax and rest of the abdomen, the hairs on this segment, like the plume at its base, are usually simple (Pl. I, fig. 4). In one species, *Culex tigripes* var. *fusca*, Theo., which presents a number of peculiarities in the mouth and siphon, the surface of this segment is quite rough (Pl. III, fig. 12).

* New York State Ed. Dep., 20th Report of the State Entomologist—Bull. 97 : Entom. 24, pp. 445–9

THE PUPÆ.

These are comparatively simple, and consequently difficult to differentiate, but characters will be found in the respiratory trumpets and in the short plumes and bunches of hair at the base of the thorax ; there are also small plumes on the points of the seventh segment of the abdomen. This segment also supports two plates (the anal plates), which vary in shape, in the character of the thickening ribs, in the short bristles at the end of the central rib, and in one instance (*Culex quasigelidus*, Theo.) in having a dark patch or cloud at the end.

The eighth segment lies under the anal plates, and in some cases is furcate, containing the large forcipes of the male (Pl. VII, fig. 5, & Pl. VI, fig. 13). In mature pupæ the sex of the future mosquito can be seen by an examination of this part. The hairs on the segments of the abdomen are variable, but from the difficulty of judging the angle of vision, they are unreliable characters.

The respiratory trumpets are not jointed, and form a single valve outside the thoracic sac. In certain specimens, however, owing to the transparency of the pupal skin, the trumpets present the false appearance of an external articulation ; but the button-shaped object at their base is actually on the under side of the pupal skin, and below that is a tube running to the thorax of the contained imago.

I may point out that I have purposely described the abdomen of the pupa as only consisting of eight segments, as this is the appearance of the organism, when cursorily examined. The true first segment is very small and difficult to make out ; in the case of *Culex dissimilis*, Theo., which I have mounted and carefully examined, it is certainly in a degenerate condition.

KEY TO THE LARVÆ DESCRIBED.

1. Siphon long and thin, nearly as long as, or two-thirds the length of the abdomen ..... 2.
   Siphon moderately short and thin, sides never curved, one-half, or one-third the length of the abdomen ..... 7.
   Siphon short and stout, less than one-half the length of the abdomen ..... 8.
   Siphon longer than abdomen. Antennæ with dark distal joint and black spines at the tip ..... *Culex guiarti*, Blanch., p. 37. (Pl. VII, fig. 4.)
   Siphon undeveloped. (ANOPHELINÆ.) (Pl. V, fig. 20.) ..... 23.
2. Anal papillæ very long, three times as long as the anal segment. *Culex pallidothoracis*, Theo., p. 36.
   Papillæ short ..... 3.
3. Papillæ equal in length ..... 4.
   Papillæ unequal in length ..... 5.
   Siphon over ten times as long as its base ; anal segment with simple hairs on the dorsal edge ..... *Pectinopalpus fuscus*, Theo. ? (II), [p. 48.
   Siphon thirteen times as long as its base ; anal segment with plumose hairs on the dorsal edge ..... *Culex pullatus*, Graham, p. 46.

5. Spines run one-sixth of the length of the siphon ..... 6.
Spines run one-quarter of the length of the siphon. *Culex aquilus*, Graham, p. 43.

6. Siphon ten times as long as its base; the longer papillæ half as long again as the anal segment ..... *Pectinopalpus fuscus*, Theo.? (I), [p. 48.
Siphon about eight times as long as its base; the longer papillæ slightly shorter than the anal segment ..... *Culex nigrocostalis*, Theo., p. 39.

7. Siphon four times as long as its base, with spines for one-third of its length; papillæ unequal and longer than the anal segment, ventral pair longer than the dorsal ..... *Culex quasigelidus*, Theo.*, p. 38. (Pl. VII, fig. 7.)
Siphon four times as long as its base, spines absent or vestigial, papillæ equal and about as long as the anal segment, the surface of which is roughened ..... *Megaculex pincerna*, Graham *, [p. 47. (Pl. II, fig. 7.)
Siphon more than six times as long as its base, with spines for one-third of its length; papillæ unequal, the dorsal pair longer than the ventral and about equal to the anal segment ..... *Culex lividocostalis*, Graham, p. 45.

8. Antennæ with plume, hairs plumose ..... 9.
Antennæ with plume, hairs simple ..... 14.
Antennæ without plume ..... 17.

9. Hairs on end of antennæ branched ..... 12.
Hairs on end of antennæ simple, not branched ..... 10.

10. With an extra joint on the end of the antennæ; spines on siphon absent or vestigial ..... *Megaculex pincerna*, Graham, p. 47.
Without such a joint; spines developed ..... 11.

11. Siphon with plumes of plumose hairs on the ventral side; characteristic plume on head near antenna ..... *Culex quasigelidus*, Theo., p. 38.
Siphon with plumes of simple hairs on the ventral side; plume on head simple ..... *Culiciomyia freetownensis*, Theo., [p. 32.

12. Siphon quite four times as long as its base ..... 13.
Siphon not quite four times as long as its base; papillæ unequal, double as long as anal segment, dorsal pair one-third longer than the ventral ..... *Culex albovirgatus*, Graham, p. 41.

13. Siphon more than four times as long as its base; two rows of scales on the comb; papillæ only slightly unequal, the longer nearly twice as long as the anal segment ..... *Culex duttoni*, Theo., p. 34. (Pl. V, fig. 2.)
Siphon four times as long as its base; three rows of scales on the comb; dorsal pair of papillæ are nearly double the ventral which are nearly equal to the anal segment ..... *Culex dissimilis*, Theo., p. 40. (Pl. III, fig. 17.)

14. Anal papillæ short ..... 16.
Anal papillæ long and tapering, at least 2½–3 times as long as the anal segment ..... 15.

15. Anal papillæ nearly equal in length ..... *Culex caliginosus*, Graham, p. 44.
Anal papillæ very unequal in length ..... *Ædimorphus domesticus*, Theo., p. 31.

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* These two species appear again under 8.

16. Anal papillæ equal in length; siphon very hairy on the ventral side.
Culiciomyia cinerea, Theo., p. 33. (Pl. V, fig. 6.)
Papillæ not equal in length; siphon without such hairs. [p. 49.
Myxosquamus paludosus, Graham, (Pl. V, fig. 15.)
Papillæ unequal; spines on siphon run for $\frac{5}{12}$ of the length followed by a plume ..... *Scutomyia marshalli*, Theo., p. 30. (Pl. IV, fig. 16.)

17. Papillæ short, or moderate in length, less than three times the length of the anal segment .. .. 18.
Papillæ very long and thin, more than four times as long as the anal segment ..... *Ædimorphus punctothoracis*, Theo., [p. 31.

18. Siphon short and stout, less than or about $2\frac{1}{2}$ times as long as its base .. 20.
Siphon at least 3 times as long as its base ..... 19.

19. Face with four very thick hairs; papillæ shorter than anal segment.
Uranotænia balfouri, Theo., p. 50.
Face without such hairs; dorsal papillæ at least equal to the length of the anal segment, the ventral papillæ strikingly small.
Stegomyia pollinctor, Graham, p. 29.

20. Siphon of peculiar shape, with very rough surface, and spined and plumed on the whole length of the ventral side. [p. 36.
Culex tigripes, Grandp., var. *fusca*, Theo., (Pl. III, fig. 13.)
Siphon of normal shape and with smooth surface ..... 21.

21. Abdomen dorsally studded with short triple or stellate hairs, moderately hairy ..... *Stegomyia africana*, Theo. p. 27. (Pl. III, fig. 3.)
Abdomen strikingly hairy ..... *Stegomyia africana*, Theo., immature form. (Pl. III, fig. 7.)
Abdomen without such hairs dorsally, or in a much less developed state ..... 22.

22. Siphonal spines running very diagonally .... *Stegomyia apicoargentea*, Theo., p. 28. (Pl. V, fig. 9.)
Siphonal spines running nearly parallel with the sides.
Stegomyia fasciata, F., p. 25.

23. Antennæ without plume ..... 24.
Antennæ with plume ..... *Myzorhynchus mauritianus*, Theo., p. 24.

24. With small palmate hairs ..... *Pyretophorus costaiis*, Lw., p. 20.
With very large palmate hairs ..... *Cellia pharoensis*, Theo., p. 22. (Pl. VI, fig. 10.)

Key to the Pupæ described.

1. Trumpets longer than half the length of the thorax * ..... 2.
Trumpets shorter than half the length of the thorax ..... 5.

2. Anal plates of unusual shape and having a slight serration on the edges.
Megaculex pincerna, Graham, p. 47.
Anal plates of normal shape ..... 3.

* This is a character of which it is very difficult to be certain in some cases—the pupæ with rather long trumpets therefore appear again at 12.

3. The small plumes on the seventh (anal) segment are of branched hairs .. 4.
The small plumes on the seventh segment are of simple or subplumose hairs ..... *Culex nigrocostalis*, Theo., p. 40.
Culex lividocostalis, Graham, p. 45.
The small plumes on the seventh segment are of plumose hairs.
Culex pullatus, Graham, p. 46.
4. The anal plates have a dark cloud or stigma in the centre, the trumpets have a lighter ring or band in the middle .. *Culex quasigelidus*, Theo., p. 39.
Without such a stigma ..... *Culex guiarti*, Blanch., p. 38.
5. The trumpets though short, are stout or very much developed laterally, with very wide mouths, the openings of which end in a sharp angle on the inner side. (ANOPHELINÆ) ..... *Pyretophorus costalis*, Lw., p. 22.
Cellia pharoensis, Theo., p. 23.
Myzorhynchus mauritianus, Theo., p. 24.
Trumpets with ordinary normal openings ..... 6.
6. With short trumpets, not longer than the ANOPHELINÆ ..... 7.
With longer trumpets ..... 11.
7. Anal plates of unusual shapes ..... 8.
Anal plates normal as in *Cellia* ..... 9.
8. With two long hairs in front of the thorax .. *Culiciomyia cinerea*, Theo., p. 34.
Without such hairs ..... *Uranotænia balfouri*, Theo., p. 50.
Myxosquamus paludosus, Graham, [p. 49.
9. With tree-like plumes of branched hairs at the base of the thorax and with the anal plates sometimes with ciliated edges.
Steyomyia fasciata, F., p. 25.
,, *apicoargentea*, Theo., p 29.
,, *africana*, Theo., p. 28.
Thorax without such plumes, but with a distinct thick pubescence in the same place ..... 10.
10. With two long hairs in front of the thorax .. *Culiciomyia freetownensis*, Theo., p. 33.
Without such hairs; all pubescence abnormally short. [p. 32.
Ædimorphus punctothoracis, Theo.,
11. With rather wide-mouthed trumpets ..... 12.
With narrow-mouthed trumpets ..... 13.
12. With long plumose hairs on the abdomen .. *Culex dissimilis*, Theo., p. 41.
Without such hairs ..... *Culex tigripes*, var. *fusca*, Theo., p. 36.
13. With the plumes on the seventh segment of branched hairs ..... 14.
Plumes absent on the seventh segment; only a single hair present.
Ædimorphus domesticus, Theo., p. 31.
Plumes on the seventh segment of simple or subplumose hairs.
Culex nigrocostalis, Theo., p. 40.
Culex lividocostalis, Graham, p. 45.
14. Anal plates with a dark stigma in the centre; the trumpets have a lighter ring or band in the middle ..... *Culex quasigelidus*, Theo., p. 39.
Anal plates without such stigma ..... 15.
15. With stellate hairs on the edges of the abdominal segments.
Culex guiarti, Blanch., p. 38.
(Pl. VII, fig. 3.)
Without such stellate hairs ..... *Culex albovirgatus*, Graham, p. 43.
,, *caliginosus*, Graham, p. 45.
,, *duttoni*, Theo., p. 35.

1. **Pyretophorus costalis**, Lw.

LARVA.

In the mature larva, which from the smaller size of the plumes and the great amount of confervoid growth is, probably, a quiescent stage, the head is very small in proportion to the thorax, but this condition is not maintained through the various larval moults, as in Dr. Graham's series there are four different stages, which I shall describe separately, under the obvious character of size :—

Larvæ 3 mm., 4½ mm., and 6 mm. long. Those of the length of 3 mm. are of two types :—

Type I.—*Head nearly as large as the small thorax.*

Type II.—*Head of usual Anopheline type, half the width of the thorax.*

a. (Type I).

Head nearly as large as the small thorax. Antennæ without plume ; two spines are present at the end, and several hairs, one of which is branched (Pl. VI, fig. 2). In one of the two specimens the antenna has a darker tip. Eye large, with pigment spot behind. Brush very bushy ; the plumes on the face are of feathered hairs ; the plume on the mandible shows prominently at the base of the antennæ. The base of the head seen from above, shows a dark chitinous collar ; on the dorsum this is broken in the median line.

The thorax is scarcely differentiated, but is very hairy with large plumes of feathered hairs.

The first three segments of the abdomen bear feathered hairs laterally ; and on the dorsum paired palmate hairs are present on the second to the seventh segments (Pl. V, fig. 22). The combs seem homologous with the rows of spines which form lateral supports to the rudimentary siphon ; in this species they consist of a double row of spines, a short one in front and a long one behind (Pl. V, fig. 20).

The siphon may be said to be differentiated but is only membranous.

The anal segment is long, with still longer hyaline papillæ ; there is a dorsal plume of peculiar long branched hairs, and the ventral beard is strong, and springs from a bulb ; it also consists of long branched hairs (Pl. V, fig. 19).

Described from two larvæ.

b. (Type II).

On these larvæ, the antennæ are without branched hairs or the branches are very minute ; the eyes are very small, apparently only the pigment spot remains ; the collar at the base of the head is very much broader ; the thorax is subglobular and well marked ; the abdomen bears five pairs of palmate hairs, similar in shape and size to those on type I.

Described from three larvæ.

c. 4½ mm. larvæ.

Head small, but not so small as the head in (*b*). The eye with a darker pigment in front (dorsal view) ; all the plumes on the face are of single feathered hairs. The hairs at the end of the antennæ are branched, but are difficult to see ; the collar is broader than in (*a*), but narrower than in (*b*).

The thorax is well differentiated ; the anterior dorsal plumes are short, but the ventral plumes are much larger, there being four large ones on the third segment. There are two simple hairs anteriorly on the under side of the first segment with a short curved bristle at the base ; all the other hairs are feathered (Pl. VI, fig. 3).

The abdomen has on the first three segments two lateral long feathered hairs, one above the other. There are small palmate hairs on the dorsum of the first segment, and on segments 2–7 palmate hairs of the same large size as in (*a*). The comb is much of the same type.

The siphon is rather less differentiated than in (*a*), but this cannot be stated with certainty.

Anal segment and papillæ much as before, but the ventral beard is exceedingly large.

Described from three larvæ.

d. 6 mm. larvæ.

The head is very small, 5 units of breadth as compared with 11 of the thorax. The antennæ have now a serrated inner edge ; the collar is very broad seen dorsally, and the brush very prominent. The eyes are again large with a pigment spot behind.

Thorax very large ; the surface is wrinkled on the dorsum, and on the ventral side bears a regular pattern (Pl. VI, fig. 1). All the plumes and hairs are shorter than in the previous stage ; the simple hairs noticed then are again present, and appear to mark the limit of the anterior segment.

The abdomen has plumes of feathered hairs on the first three segments, but only simple double hairs on the others. The palmate hairs appear very liable to denudation, as one only is present on the seventh segment, in one specimen ; on the other, one can be seen on the third segment and a pair of modifications (Pl. V, fig. 21) on the first segment. The bars and spots figured by Nuttall and Shipley on the dorsal segments can be made out in this species (Pl. V, fig. 23).

Both the larvæ have vorticellæ and diatoms, besides algal growth, on them.

The character of the comb remains the same, four short spines followed by a long one ; the anal armature as regards the plumes is less, but the papillæ appear constant.

Pupa.

The pupa has small trumpets, hollowed out on the inner sides; the plumes on the seventh segment are characteristic in structure, being a modification of a branched hair. The anal plates have two ribs developed, the central or inner ones bearing rather curious wavy hairs (Pl. VI, figs. 4, 5 & 6).

Length of thorax 2 mm.

Described from ten larvæ and three pupæ.

[Larvæ and pupæ found in large water-holes and in the road puddles containing opaque water, especially when such water has been fouled by the excreta of cattle or of man. This is the commonest Anopheline larva and can be found readily from April to November and probably all the year round. The colour and markings of the larvæ differ greatly at different ages.—W. M. G.]

2. **Cellia pharoensis**, Theo.

Larva.

The larvæ of this species brought home by Dr. Graham are also of various stages; there are two of over 3 mm., and three of 4½ mm. in length.

The two smaller larvæ present diversities of structure in the face, antennæ and palmate hairs.

a. Head nearly as broad as the thorax, certainly longer, even leaving out the space occupied by the brushes which are large; the colour is rather dark. The antennæ are light in colour, as are also the rather weak spines at the tips. The plumes on the face seem represented by very minute stellate hairs, but those on the under side show as outer plumes, and consist of a single very much feathered hair, which is as long as the antennæ; the eyes are long and comparatively thin, and have a large pigment spot at the lower end.

The thorax is small; it bears the usual plumes of feathered hairs and the two simple hairs noticed in *Pyretophorus costalis*. There are rather characteristic thick feathered hairs in the middle of the dorsal side, each with a decided socket.

The abdomen has feathered plumes on the first three segments; palmate hairs are present on the third to the seventh segments which are rather small in size compared with the very large type found in other stages. They are best seen on a semi-ventral, or semi-dorsal view, the larva lying partially on its side. The comb is closely similar to that in the preceding species, but the long spines are longer, and the pigment differs.

The anal segment is large and of much the same type as in the preceding species.

Described from a single specimen.

b. This differs from the above, in having the antennæ with a black hair at the tip, and in having six plumes on the face, besides the two outer under plumes (Pl. VI, fig. 7).

The thorax has the two characteristic hairs more markedly socketed, and the two simple hairs have quite a spine at their base (Pl. VI, fig. 8).

The palmate hairs on the abdomen are very large, though that on the first segment is smaller ; fourteen are present, a pair on each segment ; sixteen curved scales can be counted on each hair, rising from a stout base ; the complete hair fills a space, at its greatest width, equal to $\frac{2}{3}$ of the length of a segment (Pl. VI, fig. 10).

Described from a single specimen.

c. Larvæ of $4\frac{1}{2}$ mm.

The head is still very large in proportion, and I think that it is not the mature form. It is the same colour as (*b*). The antennæ have two strong hairs on the end, and a small dark plume between them. The face is similar to that of (*b*), as are also the eyes.

The thorax is even more hairy than in (*b*) ; the simple hairs are present, but like the two posterior plumes they are socketed in a striking outgrowth and have spines at their bases on the ventral side ; the dorsal side shows the characteristic hair referred to in previous stages, and this also has a markedly chitinous socket (Pl. VI, fig. 18) ; the anterior plumes are short ; on either side of the median line is a pair of short stiffly haired plumes, rather striking in character ; they are also present in (*b*) in a much less developed condition, but not in (*a*) ; all these plumes are feathered.

The palmate hairs are of the same type as in (*b*). The scales of the comb are darker (Pl. VI, fig. 9).

The papillæ are much contracted at their base, pointed and hyaline in colour ; ventral beard large, and of the same type as in the previous species.

Described from three specimens.

Pupa.

The pupa is characterised by remarkably wide-mouthed trumpets ; the plume is present on the seventh segment ; of the same type as *Pyretophorus costalis*, Lw., but the spines on the other segments are stronger. When the imago is a male the forcipes are contained in two hyaline sacs which come down below the middle of the plates (Pl. VI, figs. 11, 12 & 13).

Length of thorax under 2 mm.

Described from five larvæ and one pupa.

[Larvæ and pupæ found in a large water-hole behind the Medical Research Institute and in road puddles in June and July. They resemble the larvæ of *Pyretophorus costalis*, but are somewhat longer and more slender.—W. M. G.]

3. **Myzorhynchus mauritianus**, Theo.

Larva.

Two stages are present, but as they are similar in all important characters, I shall not describe them separately.

The whole larva is stout and very dark in colour; the head is very chitinous, almost opaque, and much smaller than the thorax. The antennæ have a plume in the middle of simple dark hairs; there are two strong spines at the end, and between them a branched hair (Pl. VI, fig. 17). Above the brushes are two characteristic fan tufts of short black hairs which are less developed in the immature form (Pl. VI, figs. 14 & 15); the usual plumes of the face are of strong dark hairs and are also less developed in the immature form; the eyes are very small and the pigment spot behind them is darker.

Thorax rather small, the simple hairs have only a short spine at their base; the anterior dorsal plumes are very short, but some well-developed longer ones are found on the ventral side, and on either side of the median line are two branched hairs and 5–8 simple hairs.

On the abdomen, besides the usual plumes and accessory hairs, are large beautiful palmate hairs, of rather dark pigmentation, which differ in the shape of their scales from those of the two previous species, while the points are hyaline. They are found on both forms, being large on segments 3–7, and rudimentary on the first and second segments (Pl. VI, fig. 16). The comb consists of very long spines with shorter ones at the base (Pl. VI, fig. 19).

The anal segment is serrated and ciliated on its lateral edges, and has the papillæ subequal and a little longer than the segment. The beard is strong but much denuded in the mature larvæ.

Mature larvæ nearly 6 mm. long; less mature form thinner, and with less developed thorax, but nearly as long.

Pupa.

The mouth of the trumpets is even larger than in the preceding species, and the outer buttress of the anal plates is less developed (Pl. VI, fig. 20).

Described from five larvæ and one pupa.

[Larvæ and pupæ found in the large water-holes behind the Institute and in road puddles in July and August. In young larvæ the abdomen is black with 4 to 6 pale bands; full grown larvæ have a black abdomen with usually two brown bands.—W. M. G.]

4. **Stegomyia fasciata**, F.

LARVA.

Small, with a large head, which is lighter in colour in the earlier, than in the more mature stages. Antennæ light, very simple, without any plume, and the few minute hairs that are present at the tip are only a shade longer than the width of the antenna. Face without long plumes, with only single or double hairs (all apparently varying in the different stages of growth) or short quintuple or quadruple hairs, but these seem to be constantly simple. Hairs on the labrum noticeably thick and bushy, as are also the brushes. The eyes are very small and round, but these organs are usually variable; this character is constant in all the larvæ (two stages) collected by Dr. Graham.

The thorax is small, broader than the head in only one specimen; the anterior dorsal plumes are absent, or represented by small stellate hairs; the part is well haired, the plumes on the ventral side, in the middle and posterior portion, have a large chitinous bristle or hook at their bases. All the plumes and hairs are with difficulty seen to be subplumose, and that only at the bases.

The abdomen has long double hairs (subplumose at their bases, like those on the thorax) on the first five segments, besides numerous stellate and short hairs, all being simple. The comb, though consisting of very large dark scales, is only easily seen on light larvæ; it consists of a single row of 8–9 barbed scales; those nearer the anal segment appear smaller and are difficult to see. The siphonal, sub-siphonal and anal plumes are all small and of simple hairs.

The siphon is rather more than a quarter of the abdomen in length (unreliable character) and is about $2\frac{1}{2}$ times as long as its own base; the spines which are long, and much barbed at their bases, run for half the length, nearly parallel with the sides of the siphon; their number and shape are not reliable characters, as the first is variable, and the second has its counterpart in many species. The spines are followed by a triple hair, and the valves are small.

The anal segment is very short, only a little longer than the breadth of the siphon; the papillæ are equal, stout, and with strikingly blunt ends; they are twice as long as the segment; the dorsal edge carries 4 (?) long simple hairs and there are some of similar length on the ventral edge—the ventral beard is on the end but is very liable to denudation.

Length about 4–5 mm.

PUPA.

The pupa has short trumpets, and large tree-like plumes of branched hairs at the base of the thorax (only one can be seen in one focus at the lateral view).

There are single hairs on the abdomen, and plumes of branched hairs on the seventh segment which are longer in a more mature pupa. The anal plates are subcircular with fine dark short hairs on the lower edges.

Greatest length of thorax $1\frac{1}{2}$–2 mm.

Described from four larvæ and five pupæ.

[Larvæ found in a small quantity of water in an empty fish-tin upon the dust-heap behind the kitchen.—W. M. G.]

Siphon and anal segment of *Stegomyia fasciata*, F.

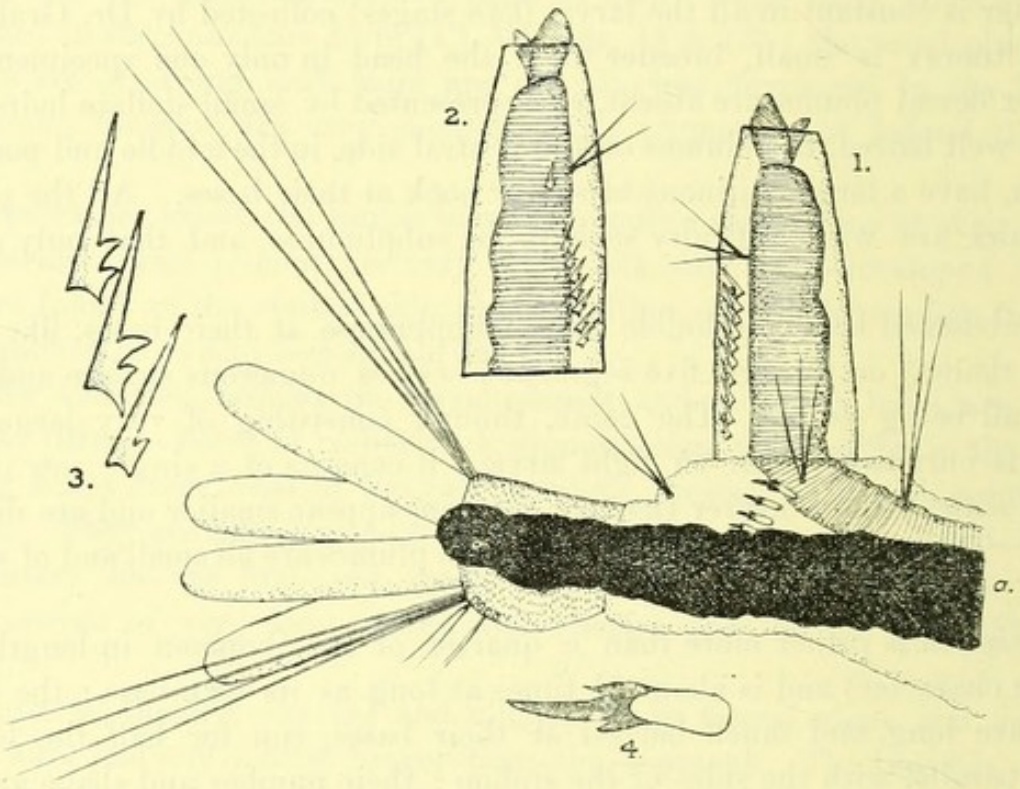


Fig. 1. Lateral view of the parts: *a*, bowel; it will be noticed that the view of the comb is obscured, though the remaining scales are above the bowel; they are eight or nine in number. The structures are those seen with a magnification of about 60 diameters; the animal, quite unprepared for microscopic examination, lying in a trough of formalin, or in water. The long hairs on the ventral side of the anal segment have been curtailed by the exigencies of space; they are as long as those on the dorsal edge. The ventral beard has been denuded, and is drawn as it exists on the specimen.

2. The same siphon reversed showing the abnormal condition of the spines on the left side.

3. The three lowest spines on the left side drawn larger, though seen with the same magnification.

4. A scale of the comb drawn larger but seen with the same magnification as fig. 1. Goeldi figures more teeth on the part, but these obviously require much more magnification for resolution.

5. Stegomyia africana, Theo.

LARVA.

The head is rather small and peculiar in shape, dark in colour and very chitinous. Viewed both dorsally and ventrally, the brush, which is so prominent in the Anopheline and other larvæ, does not show, or is only partially visible. The antennæ are without plumes, and only carry a few short hairs at the end. Face without plumes, and with only short stellate hairs on each side of the median line, and two longer ones, which appear to be split at their ends, or they may possibly be two hairs; all these are simple.

Thorax rather small, with the usual plumes, but these are of simple hairs; the dorsal anterior hairs are short, and also simple. Some of the side plumes are slightly pubescent at the base. The plumes on the ventral anterior sides or ends of the thorax have chitinous sockets and a rather prominent bristle at the base.

The abdomen is long and thin, and is symmetrically studded with an arrangement of short triple hairs on the dorsum, and several long simple hairs on each segment (Pl. III, fig. 3). It is very difficult to get a view of the sub-siphonal and siphonal plumes, but they consist of but a few simple hairs in the usual places; the relative proportions are the same as usual, the siphonal being smaller than the sub-siphonal. Viewed dorsally the combs appear as a series of short spines on each side of the eighth segment, but a lateral view shews them as a single row of about ten scales.

The best way to see the lateral view of the siphon is to prop the larva up with a piece of fine bent wire or entomological pin. It is only slightly over twice the length of the base; the spines run in a curve, very close to each other, and are at least 12 in number; at their upper end is a double hair; the valves are small (Pl. III, fig. 4).

The anal segment is short, with the papillæ a little longer, subequal and with very stout bases; the hairs on the dorsal edge are long, but the ventral beard is scanty, consisting of only a few simple hairs.

Larva about 4 mm. in length.

The following is a description of two immature larvæ of the same species :—

Head very large, dark and chitinous; in one specimen it is darker than in the other, which is much lighter. Antennæ small and without plume; no plumes on the face, only single or stellate hairs; it has also the two split hairs found in the previous form, which it much resembles in the head.

Thorax rather small; instead of the anterior hairs it has four large stellate hairs; it is also studded with similar hairs on all the sides, and has longer single hairs standing out from the shorter stellate ones. These single hairs are also collected, as in the mature stage, into plumes with a strong bristle at their base, and are slightly pubescent on their lower part (Pl. III, fig. 7); they occur in both stages also on the ventral side.

The abdomen is haired in the same manner as the thorax ; the hairs being stiff and short, stout at the end, and of a dark colour, give this larva quite a spiny appearance. Comb with a single row of about eight very long scales, but the exact number is uncertain (Pl. III, figs. 9 & 10).

The siphon is short and stout, being less than $\frac{1}{3}$ of the length of the abdomen ; and less than $2\frac{1}{2}$ times as long as the base; the spines are inconspicuous and difficult to see, but are exceedingly close to each other and run in a curve for about half the length ; there are long double hairs laterally ; valves very small (Pl. III, fig. 8).

The anal segment is as long as it is broad, with four stout papillæ which are a trifle longer than the segment and subequal (papillæ short and subequal) ; in the two larvæ examined they have a spotted appearance, but this may be accidental. There are eight long simple hairs on the dorsal edge; ventral beard thin, consisting of 12–16 very long hairs.

Length of larva $3\frac{1}{2}$ mm.

PUPA.

With short tubes; the hairs at the base of the thorax are well marked, forming a series of plumes ; the plumes on the seventh segment are also noticeable ; but the most characteristic thing is the ciliated anal plate (Pl. III, fig. 6), the rib or thickening of which is also unusually chitinous (Pl. III, fig. 5). A second pupa is figured to show the variation in the shape of the thorax (Pl. III, fig. 11).

Length of thorax less than 2 mm.

Described from four larvæ and two pupæ.

[Larvæ found in the water contained in the butt end of a large bamboo, early in June. The bamboo was cut through with a saw between the internal discs. These larvæ developed very slowly in the glass jar. Larvæ of *Scutomyia marshalli*, Theo., were also present.—W. M. G.]

6. **Stegomyia apicoargentea**, Theo.

LARVA.

Head rather small, very chitinous and semiglobular, so that the brushes do not usually show, when they are looked at from the dorsal side. Antennæ simple, without a plume, and with only a few short hairs at the tip ; all the part is dark, but is of a lighter tinge at the end.

Thorax with the usual plumes, but these are of simple hairs—at the most there may be a little secondary pubescence on the lower part of some, and a few may be seen with very careful focussing to be subpubescent.

There are short double and triple hairs on the sides of the abdominal segments, and there are longer double hairs on the ventral surface, all simple. The siphonal and sub-siphonal plumes are also simple.

The comb is very difficult to make out from a lateral view, but by propping up the larva on a much twisted and bent piece of metal I was able to count a row of ten, rather peculiarly shaped scales (Pl. V, figs. 11 & 12).

The siphon is very dark, short and stout, about twice as long as the base; the spines are strong, serrated, and run up in a curved line from the base to nearly the middle; there is a double hair (simple) beyond the spines; the valves are small (Pl. V, figs. 9 & 10).

The anal segment is short with stout subequal papillæ, light yellow in colour; one specimen has one pair almost hyaline, though the other pair is of a yellow colour; the papillæ are longer than the segment; there are long hairs on the dorsal edge, and the beard is on the end and rather thin, but very long, equal to the long hairs on the dorsal side.

Larva less than 3½ mm. in length.

PUPA.

The pupa has very short stout dark trumpets, and very marked plumes on the thorax. There are no plumes on the sixth segment, only a single hair on each corner; the plumes on the seventh segment are small and of subplumose hairs; the anal plates have some minute scales on their basal outer edge, and the ribs are very chitinous (Pl. V, figs. 13 & 14).

Length of thorax less than 2 mm.

Described from three larvæ and three pupæ.

[Larvæ found in the water in an earthen fetich-pot standing under a palm tree outside Yaba village in June.—W. M. G.]

7. **Stegomyia pollinctor**, Graham.

LARVA.

Large-headed forms with rather thin abdomen.

Head not quite so broad as the thorax, dull opaque yellow, and with rather marked pigmentation; the base of the mandibles, the base of the under surface, the parts leading to the under lip, and the usual marks at the bases of the brushes, are all of a darker colour. The antenna is dark and has, or appears to have, a few simple hairs in the usual place of the plume; the solitary specimen is much damaged and one antenna is missing. The maxillæ have dark hairs at their ends, and the brushes are large. The face is much denuded, but on one side a plume remains, small in size and having four simple hairs; there are besides a few single and double simple hairs. The eyes are very large, as are also the pigment spots behind them.

The thorax has the usual plumes, small in size and of subplumose hairs; and on the anterior portion of the dorsum, two stellate hairs of fair size, close to and on either side of the neck; these, if they are a constant character, are obvious, and of use in determination.

The plumes on the first two segments of the abdomen are short and subplumose; the hairs on the other segments are simple and consist of moderately long hairs on the ventral sides, with stellate hairs higher up; the seventh segment has from three to four minute tufts on its sides, and a larger quadruple hair (the hair equal to half the breadth of the segment); all these

hairs are paired laterally. The comb appears from the ventral side to consist of small black scales, each scale with a central spine flanked by some indistinct ciliation. Owing to the dark colour of the larva I cannot see anything laterally. The sub-siphonal plume consists of simple hairs.

The siphon is short (six units as compared with thirteen of the abdomen), and is about $3\frac{1}{2}$ times as long as the base ; very dark, and darker round the base ; the spines are very dark, close to each other, and becoming longer as they run up for nearly a third of the length of the siphon ; they are slightly serrate on the outer base. The valves are very small (Pl. VII, figs. 10 & 11).

The anal segment is small, little shorter than twice the width of the base, on the dorsal side; the papillæ are quite yellow and do not contract at the base ; the ventral pair is strikingly small, half the size of the dorsal, which equals the segment. The dorsal edge is slightly serrated with some minute spines ; it carries besides two long, and some shorter hairs ; the ventral beard is a little longer than the papillæ and runs for nearly half the ventral surface. The figure shows the state of the segment on the larva as I found it ; the under hairs are probably denuded (Pl. VII, fig. 12).

The larva is 5 mm. long, siphon $\frac{4}{5}$ mm.

Described from one specimen ; pupa unknown.

[Larvæ found in a hollow tree in August ; they were small and did not become imagines till October.—W. M. G.]

8. **Scutomyia marshalli**, Theo.

LARVA.

Head as large as, or larger than the thorax, dark, smooth, and semiglobular. Antennæ large, no constriction at the plume, which is of subplumose hairs ; the end is darker with a few short hairs. The brush is not visible dorsally ; all the face plumes are large and of plumose hair, being very stiff and fan-like.

Thorax and the first two segments of the abdomen with very large side plumes, the latter also having minute stellate hairs. The comb is difficult to see, and consists of two rows of minute scales. Sub-siphonal plumes large but of simple hairs.

Siphon stout, highly chitinised, less than half the length of the abdomen (as 6 to 15) ; spines strong, barbed on their lower sides, they run for $\frac{5}{12}$ of the length, and there are plumes of six simple hairs above the spines on each side (Pl. IV, figs. 16 & 17) ; it is quite four times as long as the base.

The anal segment is longer on its dorsal side than its ventral (as 10 to 7) ; the papillæ are yellow in colour, short, with pointed ends and unequal ; the longer pair are shorter than the segment ; there are very long hairs and a shorter plume on the dorsal edge, and a bushy strong ventral beard ; all the hairs are simple and longer than the papillæ (Pl. IV, fig. 18).

Length of larva $2\frac{1}{2}$ mm., siphon $\frac{2}{3}$ mm.

No pupa.

[Larvæ found in water in the butt-end of a large bamboo early in June.—W. M. G.]

9. **Ædimorphus domesticus**, Theo.

LARVA.

This larva is very like that of *Culex caliginosus*, Graham, in the shape of the head, antennæ, and the simple character of the hair of the plumes, but can at once be separated on the characters of the siphon ; the comb also has only six scales, though these, when seen from the side, appear alike in type.

The spines on the siphon are at least fourteen in number, placed in a close and regular row ; at their upper end they are longer and more separated, and quite in the upper third is a small stellate hair like that in *C. caliginosus*.

The siphon is over five times as long as its base (Pl. III, fig. 2).

The anal segment is also similar except the papillæ, which are very unequal ; the longer are nearly four times as long as the segment (55 units against 15) and much longer than the shorter pair (55 units against 35).

The larvæ are 4 mm. long.

PUPA.

The pupa is even harder to differentiate from that of *Culex caliginosus*, except that the hair at the base of the thorax seems more bushy, and it appears not to be so broad from a dorsal view ; but it can be distinguished by the absence of the small plume on the seventh segment, which is represented only by a single hair (Pl. II, fig. 16).

Length of thorax $1\frac{3}{4}$ mm.

Described from seven larvæ and two pupæ.

[Larvæ found in borrow-pits along the side of the railway early in June.—W. M. G.]

10. **Ædimorphus punctothoracis**, Theo.

LARVA.

Head as broad as thorax ; with curious hyaline bladders on the mouth by the maxillæ, quite singular in appearance ; antennæ without plume (Pl. I, fig. 15).

The hairs of the plumes on the face are triple and quadruple, but they appear serrate, not even subplumose. The side plumes on the thorax are distinctly bushy, and have the usual plumose hairs.

The abdomen has some long single hairs standing out from the sides, which are also serrate ; a higher magnification shows that they bear a very minute pubescence ; they appear characteristic in structure. The plumes at the base of the siphon are large, with plumose hairs. The comb can only

be seen with difficulty; the scales are large, and taper somewhat suddenly from a broad base to a point.

The siphon is characteristic; rather short and stout, and four times as long as its base; remarkably long strong spines reach halfway up; between the rows of spines are two plumes of stiff straight hairs which have some pubescence on them; the valves are small (Pl. I, fig. 16).

The anal segment is short, only slightly longer than its base, with four very long hyaline papillæ, which are $4\frac{1}{2}$ times as long as the segment; there are some hairs on the dorsal edge which are longer than the papillæ in some specimens and shorter in others, and a moderate beard and some shorter hairs on the ventral side, all simple.

Length of larvæ, which are very curved, 3 mm., siphon $\frac{2}{3}$ mm.

Pupa.

This is rather characterless and light in colour; the plume on the anal segment is very small, with only a few simple hairs; the trumpets are small (Pl. I, figs. 17 & 18).

Length of thorax $1\frac{1}{4}$ mm.

Described from three larvæ and three pupæ.

[Larvæ found in borrow-pits along the side of the railway from June to middle of July. The behaviour of the larvæ is peculiar. They very rarely come to the surface of the water, but lie upon their backs at the bottom with the anal gills widely expanded, or crawl sluggishly about upon the sides of the jar.—W. M. G.]

11. **Culiciomyia freetownensis**, Theo.

Larva.

Head moderate in size and rather dark in colour. Antennæ all pale, with the usual fan-shaped plume, the hairs being only moderately plumose and the secondary hairs fewer and shorter; with three short simple hairs and a short spine at the tip. On the face, six plumes of moderate length (plumose) may be seen from a dorsal view, and behind these a pair of small stellate hairs, close to each other, lie on each side of the median line.

Thorax much as in *Culex pullatus*, Graham.

The abdomen with large stellate subplumose hairs on segments 3 to 7; there being two hairs on each side of each segment, one near the dorsum and the other lower down. Sub-siphonal plumes long, but containing few hairs; siphonal plumes also thin; the anal plumes are subpubescent, but this is very difficult to see, and is more marked in some specimens than others. Comb difficult to see laterally; from the dorsal view, it shows as a number of curved spines.

Siphon short and stout, scarcely three times the base in length, with

marked valves at the end, and 4–5 pairs of stiff triple long hairs (subplumose) on the same line as the spines, which are obvious, and run about half-way up ; there is a pair of compound hairs on the dorsal side, and lateral hairs (all subplumose) as well (Pl. I, fig. 10).

The anal segment is about as broad as it is long, and has four stout papillæ with blunt ends, which are nearly equal in length. On the dorsal edge are two long, and a number of shorter, strong hairs. The ventral beard is only moderate in size, at its longest not equalling the papillæ. All the hairs on the anal segment are simple.

Larva 5 mm. in length.

Pupa.

The trumpets are short, the hairs at the base of the thorax are paired plumes (Pl. I, fig. 11), and the stellate hairs on the segments of the abdomen are well marked. Two long double hairs which spring from near the eyes are rather conspicuous, and the small plumes on the last two segments are of plumose hairs (Pl. I, fig. 12).

Length of thorax $1\frac{2}{3}$ mm.

Described from six larvæ and eight pupæ.

[A raft of about 140 eggs was laid upon some water in a glass jar in the veranda of the bungalow at the end of May. Eggs hatched in two days; larvæ became pupæ in eight days ; pupal stage lasted three days.—W. M. G.]

12. **Culiciomyia cinerea**, Theo.

Larva.

Large stout larvæ, with the head considerably narrower than the thorax, and rather dark in colour (deep reddish brown—almost vandyke). Antennæ with a plume of simple, or sub-simple hairs; distal joint fairly stout, more so than usual ; very short hairs on the end (Pl. V, fig. 5). Brush and mouth-parts hairy ; the plumes on the face all developed, moderate in size but of quite plumose hairs. Eyes large, with the pigment spot not at all conspicuous.

Thorax with the usual normal plumes of plumose hairs.

The abdomen has on the third to the sixth segments symmetrical quadruple hairs of moderate length, which are subplumose, and on the ventral side symmetrical long triple hairs, which are also subplumose, but difficult to see. The abdomen in all the specimens is quite dark, which renders it difficult to make out the comb without much manipulation ; when clearly seen, it shows as a row of small scales close to each other, followed by a second row of longer, more separated scales, and a third row of about five scales. Siphonal and sub-siphonal plumes particularly large, the latter reaching to the end of the anal segment.

The siphon is a little less than three times the length of the base, very dark, and with a curious appendage at its base, which is very unusual in the species here described (Pl. V, fig. 6). It has many plumes of subplumose hairs on its ventral side ; the spines do not begin at the base, being short and dark, and about 5–6 in number. There are also lateral quadruple hairs.

The anal segment is short, but is remarkable for its papillæ, which are longer than the segment and subequal, two of them being distinctly chitinised, and the other two darker in colour than the usual type. There is a tuft of long hairs on the dorsal edge ; the beard is at the end, and not on the ventral side ; at its longest it equals the papillæ in length ; all the foregoing hairs are simple, but there are lateral plumes inserted in the last third, which are subplumose.

Larva $4\frac{1}{2}$ mm. long, siphon $\frac{2}{3}$ mm.

Pupa.

The pupa has short trumpets, which are more yellow in colour at their ends than usual, and there are rather long characteristic hairs on the front of the thorax ; it is broad and consequently the hair characters are at various foci ; the plumes on the sixth and seventh segments are large and plumose. All the long hairs on the abdomen are subplumose and not at all easy to see.

But the most striking feature is one that is even more difficult to see ; the easiest way is to break off the last three segments of the abdomen, and it will be seen that the anal plates are notched in the centre (Pl. V, figs. 7 & 8).

Length of thorax 2 mm.

Described from six larvæ and three pupæ.

[Larvæ found in July in the same barrel of stinking water which contained *Culex dissimilis*, Theo. ; they are very active in their movements.—W. M. G.]

13. **Culex duttoni**, Theo.

Larva.

Head very large in proportion to the thorax, light in colour, and rather of the type of *Culex pallidothoracis*, Theo.

Antennæ with a large tuft of plumose hairs, and the hairs at the end, like those in *Culex albovirgatus*, Graham, and *C. dissimilis*, Theo., are branched, perhaps a little more so than in the others (Pl. V, fig. 3). Brushes conspicuous ; the mouth-parts are bushy, but the plumes on the face are but moderate in size, though of plumose hairs. Eyes with strongly differentiated edges ; the pigment spot behind as in *C. pallidothoracis*, and with the small plume of simple hairs present.

Thorax scarcely differentiated, but with long plumes of plumose hairs.

The first two segments of the abdomen carry the usual plumes of plumose

hairs, but the long hairs on the other segments are only subplumose. All the other hairs on the segments are short and simple, including a number of the minute stellate form. The sub-siphonal plumes are moderate in size and are of plumose hairs, the pubescence being rather thick, though short; the siphonal plumes are small, and the anal plumes are also shortly plumose. The comb is very difficult to see; under favourable conditions it appears as an anterior row of about sixteen suboblong scales, and a posterior one of six.

The siphon is about half as long as the abdomen, stout but tapering, more than four times as long as its base, the end is light in colour for about $\frac{1}{3}$ of the length; this is followed by a dark ring which gradually becomes lighter to the base, where the usual chitinous ring is present; this character is very marked in five out of six larvæ, and in the sixth it is fairly obvious (Pl. V, fig. 2). The spines do not begin till a short way from the base; three to five are present, being rather small, and running for less than one-third of the length; they are followed by two long subplumose hairs (four, counting both rows), and in the dark ring is sometimes a single lateral hair and a short triple or double one—these appear variable; the valves at the much tapered end are small, and have a few bent short hairs on them; the contained tracheæ are large, as is usually the case.

The anal segment is short, as long as broad (it widens posteriorly), with stout papillæ of slightly unequal length; the longer nearly twice the length of the segment; they have a spotted appearance, though fairly hyaline. There are four long strong hairs on the dorsal edge; the ventral beard is small, not longer than the smaller papillæ, and mostly at the distal end.

Larva $4\frac{1}{2}$ mm. long, siphon $1\frac{1}{3}$ mm.

Pupa.

The pupæ are variable in colour, as one is quite dark, and the other quite light, and they are rather characterless; the plumes on the seventh segment are short but thick and of subplumose hairs; in the same place on the sixth segment is a triple hair. In this case the dark form is easily seen to be that of the mature pupa, as the rather large scales on the abdomen of the imago can be seen when the pupa is examined from the dorsal side (Pl. V, fig. 4).

Length of thorax $1\frac{1}{2}$ mm.

Described from six larvæ and two pupæ.

[Larvæ found in a tub of dirty water in July. The larvæ are very common in barrels, tubs and ponds in June, July and August. The egg-raft is 4 to 6 mm. long, formed of 170 to 250 bottle-shaped eggs disposed in 4 to 9 rows. The eggs are laid between sunset and dawn, and hatch in about 24 hours.—W. M. G.]

14. **Culex tigripes**, Grandpré, var. **fusca**, Theo.

LARVA.

Head moderately large, light in colour. Antennæ short and simple, plume absent, only a few short hairs at the tip. Mouth with remarkable stout chitinised hairs on the brush, which, seen with higher magnification, show a beautiful microscopic structure of minute pectination on a large portion of each hair (Pl. III, fig. 15). No plumes on the face.

Thorax well differentiated, with moderate-sized plumes of plumose hairs.

Abdomen with plumes of plumose hairs on segments 1–4 and double hairs on segments 5–7. Comb with about 30 scales in several rows, which are rather small; seen dorsally they have a spinose appearance.

The siphon is peculiar and characteristic; it has a very rough surface, and is bearded down the ventral side between the rows of spines with long plumose hairs; it is under three times as long as the base (Pl. III, figs. 13 & 14).

The anal segment is strikingly prolonged at its dorsal edge, and has an even rougher and more serrate surface than the siphon; the papillæ are short, and there is a long ventral beard (Pl. III, fig. 12).

The larvæ are 5 mm. long.

PUPA.

The pupa has rather stout trumpets; the plumes on the seventh segment consist of plumose hairs, and there are similar plumes on the sixth segment; the ribs that strengthen the anal plates carry two minute hairs instead of a spine; there are no hairs on the head (Pl. III, fig. 16).

Length of thorax 2 mm.

Described from six larvæ and three pupæ.

[Larvæ found in a large water-hole, the water of which was milky-coloured and opaque. These larvæ were very carnivorous, and fed upon other specimens of larvæ, or upon each other when other species were not available. The attack was usually made by seizing the victim's siphon near the base and biting it through. The larvæ of *Pyretophorus costalis* were found in the same water-hole. It is possible that this carnivorous larva may be useful by acting as a destroyer of the larvæ of *Pyretophorus costalis* and of *Myzorhynchus mauritianus*. Egg-raft small, rounded, of 25 to 40 eggs; the latter brown, with black apex. The eggs hatch in about 24 hours.—W. M. G.]

15. **Culex pallidothoracis**, Theo.

LARVA.

Head very large in proportion to the thorax. Antennæ covered on both joints with minute spines, and carrying a large plume of plumose hairs; the distal joint is slightly darker, and has one strong black spine at its end

and several shorter ones. Brush with exceedingly long hairs; maxilla very large. Side plumes on face very large, comprising 8–10 plumes of plumose hairs. Eyes with the pigment spot behind; a small plume of simple hairs underneath them.

Thorax scarcely differentiated, but covered with long strong plumes of plumose hairs.

The abdomen, besides the usual plumes which are of plumose hairs, has a few moderately long simple hairs on each segment. Comb consisting of seven scales, which are sharp spines, well separated, and in a single row. Sub-siphonal plume large, consisting of eight plumose hairs; the siphonal plume smaller with only four simple hairs.

Siphon nearly as long as the abdomen, thin and tapering; a shade more than eight times as long as the base. Spines marked, simple, running to nearly $\frac{2}{3}$ of the length; closer together at the base than at the upper end; four simple hairs show on the ventral side, and some at the tip; valves moderate, the tracheæ that are enclosed are noticeably thin (Pl. IV, fig. 15).

The anal segment is short, a third longer on its dorsal side than on its ventral; the papillæ are more than three times as long as the longest part of the segment, and are of nearly equal size; they taper to sharp points; a trachea can be traced down each papilla; the dorsal edge of the segment carries long hairs, half as long again as the papillæ; there is a short plume, but no beard on the ventral edge.

Length of larva $3\frac{3}{4}$ mm., siphon 2 mm.

No pupa.

[Larvæ found in borrow-pits along the side of the railway late in June. The behaviour of these larvæ resembles that of the larvæ of *Ædimorphus punctothoracis*.—W. M. G.]

16. **Culex guiarti**, Blanch. (=*viridis*, Theo., *nec* Rob.-Desv.).

LARVA.

Big headed forms with extraordinarily long siphons (Pl. VII, fig. 4). Head light, subhyaline, as broad as, or broader than the thorax. Antennæ long, and carrying a large plume of plumose hairs; distal joint dark and with three long black spines, and a fourth short one, besides a subhyaline process which is not always present; the spines are at different planes and consequently only three show at one focus, using a magnification of 60 diameters. The maxillæ carry very long hairs and the mouth-parts are very hairy—this shows best in a lateral view; the hairs on the face are much developed. The eyes are large and have a small pigment spot behind them.

The thorax is of fair size; the dorsal anterior hairs are many, and reach

forward well over the head; the lateral plumes are strong and of very plumose hairs.

The abdomen carries the usual plumes on the first two segments; these are of plumose hairs, the remaining long hairs (except the siphonal plumes) are only subplumose; on the sides and dorsum are a number of small stellate hairs, but possibly owing to denudation, I fail to recognise any symmetrical arrangement. The comb shows (dorsally) as 12–6 sharp scales, irregularly distributed, the longest being in front. The siphonal plumes moderate, the sub-siphonal fairly developed, with plumose hairs.

The siphon is considerably longer than the abdomen; 12–13 units as compared with 10 of the abdomen. The spines are few and run for less than a quarter of the length of the siphon, which is 20 times as long as its base.

The anal segment is long, being twice the length of its base. The papillæ are about the same length as the segment, but some are a little longer; on the dorsal edge are four very strong dark hairs and some of less length; the ventral beard is moderate but bushy, and runs for one-third of the segment.

The larvæ are about 5 mm. in length, siphon $3\frac{1}{3}$ mm.

Pupa.

This is characterised by very long thin trumpets and a series of stellate hairs on the dorsum of the abdomen (Pl. VII, figs. 1, 2, 3).

Length of thorax $1\frac{1}{2}$ mm.

Described from six larvæ and five pupæ.

[Larvæ found in the large water-hole behind the Institute in July.—W. M. G.]

17. **Culex quasigelidus**, Theo.

Larva.

Very dark, with large head and antennæ; head highly chitinised, quite opaque.

Antennæ with a very large plume of plumose hairs; the lower part is dark, but the part below the plume and the distal joint are much lighter in colour; it is much constricted at the root of the plume and the spines at the end are long and dark (Pl. VII, fig. 8). Brush very prominent, and also the hairs on the maxillæ. Central plumes on the face moderate, but those near the antennæ are unusually thick, the hairs not being in the same plane and being black in colour (Pl. VII, fig. 9).

Thorax differentiated, and with the usual plumes.

Abdomen with the usual plumes on the first two segments, but symmetrical

plumes of six simple hairs show on the posterior portion of most of the other segments, on the dorsum. At about the same focus, minute stellate hairs or plumes may be seen, and right on the back are a few long subplumose single hairs. The comb is very difficult to see, but by arranging the larva so as to obtain a horizontal view along the back (the head balances on the long antennæ) three unusually long strong dark spines are visible on the edge of the segment. Siphonal plumes moderate in size, sub-siphonal large, and both of plumose hairs.

The siphon is short, four times as long as the base, about one-third of the length of the abdomen ; a dark ring encircles it in one specimen which is absent in the other (Pl. VII, fig. 7). The spines are weak and run for about one-third of the length ; on the median line is a single hair, and it is followed at equal distances by four plumes of about six plumose hairs ; in the upper third are lateral triple hairs ; the valves are very large, particularly the ventral.

The anal segment is small, as are also the papillæ, which swell from a narrow base and diminish to pointed ends ; they are longer than the segment, and the ventral pair is longer than the dorsal, which is unusual ; in one specimen the ventral ones are slightly chitinised. On the dorsal edge is a curious hair, which is strong at its base and has others springing from it. The ventral beard is longer than the papillæ and runs for about a third of the segment.

Larva 4½ mm. long, siphon over 1 mm.

Pupa.

Very dark, with long and thin trumpets, which have a lighter ring in the middle ; there are plumes on both the sixth and seventh segments, both of branched hairs, and the anal plates have a distinct dark cloud in the middle (Pl. VIII, figs. 5 & 6).

Length of thorax 1½ mm.

Described from two larvæ and three pupæ.

[Larvæ found in borrow-pits in June and July.—W. M. G.]

18. **Culex nigrocostalis**, Theo.

Larva.

Head not quite so broad as thorax, light in colour. Antennæ fairly long, also light in colour, with a small, darkened, chitinous ring at the base ; plume large, with plumose hairs ; the distal joint is a shade darker than the proximal one ; it carries three long simple hairs and a spine at the end. Face with short plumes, brush rather stiffly haired, pigment spots large at base of antennæ.

Eyes strongly defined; under part subtriangular at the corner; accessory posterior pigment spot large and black in some specimens—variable.

Thorax well differentiated, with the usual plumes; in some individuals the hairs appear to have lost their pubescence. One specimen shows a symmetrical pattern on the ventral surface like *Pyretophorus* (Pl. VI, fig. 1).

Abdomen rather long and thin; plumes on first two segments rather short; weak stellate hairs on all other segments—very light in colour. Comb large, consisting of a patch of 40–50 scales of moderate size (Pl. IV, fig. 10). Siphonal plumes fairly large, with plumose hairs; sub-siphonal plumes similarly haired, and also large. Anal plume consists of a simple triple hair of moderate length.

The siphon is nearly two-thirds of the length of the abdomen—six units to ten; it is thin and tapering, a little more than eight times the base in length; the spines run for just over one-sixth of the length; there are some minute hairs which appear to be variable; the valves are small (Pl. IV, fig. 10).

Anal segment long, a little less than twice its base in length; papillæ thin and pointed, compressed at base, unequal; the longer are slightly shorter than the segment. There are long hairs on the dorsal edge. The beard is inserted on a shield right in the mouth of the segment, and is longer than the papillæ.

Larva 4 mm. long, siphon $1\frac{1}{3}$ mm.

Pupa.

The pupa has a comparatively small body, long trumpets, and more hairs on the segments than usual; the plume on the seventh segment is thick but of only simple or subplumose hairs; the plates are without any ciliation at their edges (Pl. IV, fig. 11).

Length of thorax $1\frac{1}{2}$ mm.

Described from five larvæ and one pupa.

[Egg-raft found upon water in a tin can containing vegetable matter, in September. The rafts were sharp-pointed and composed of 80 to 120 small black cylindrical eggs.—W. M. G.]

19. **Culex dissimilis**, Theo.

Larva.

Head of fair size, light in colour. Antennæ like that of *Culex albovirgatus*, Graham, with a big plume and branched hairs at the tip. The mouth-parts have been dissected out and are separately described in the explanation of the plate (Pl. IV, figs. 2–9). Plumes on the face large, and with the secondary pubescence rather long.

Thorax marked, with all the plumes big and with very plumose hairs.

Plumes on abdomen of moderate size, hairs plumose ; on segments 3–7 are single long hairs, which are almost subplumose. Combs difficult to make out, but appearing as three rows of equal short oblong scales, about 30 in number, of which the anterior are the closest together (Pl. III, figs. 18 & 19). The plumes at the base of the siphon are very closely plumose, and an unusual feature is that the anal plume is also plumose, but in a much less degree.

The siphon is stout and tapers ; it is less than one-half the length of the abdomen and is four times as long as its own base, being slightly swollen above the latter ; there are no spines at the base, a space is bare for about $\frac{1}{6}$ of the length, then four short spines which run to about $\frac{1}{3}$; then there are some long subplumose hairs ; at the distal end of the middle third is a short triple hair ; and on the lateral surfaces, nearly in the middle, are single long hairs ; valves small (Pl. III, fig. 17).

The anal segment is narrow at the base, and carries stout blunt papillæ, the dorsal being about double the length of the ventral, which are nearly the same length as the segment ; there are four long simple hairs on the dorsal edge ; the beard is short and inserted at the end. There are single lateral hairs in the middle of the posterior edge of the segment which are slightly plumose, like the hairs on the abdomen ; the others are, as usual, simple.

Length of larva 5 mm., siphon $1\frac{1}{2}$ mm.

Pupa.

The pupa is rather light in colour ; the trumpets are moderately short, and have a slight cloud at their ends, being darker at the base ; there are some single long hairs on the segments of the abdomen which are subplumose—an usual condition in the pupæ (Pl. IV, fig. 1).

Length of thorax 2 mm.

Described from four larvæ and four pupæ.

[Larvæ found in July in a barrel standing in a water-hole. The barrel was used by the natives as a washtub and contained very foul, opaque, stinking water covered with froth.—W. M. G.]

20. **Culex albovirgatus**, Graham.

Larva.

Head rather narrow, nine units, as compared with thirteen units of thorax. Antennæ long ; at two-thirds from base is a fan-shaped plume of plumose hairs ; at the end, two short spines and three branched hairs ; a marked constriction at the plume ; the lower part is covered with dark short sharp hairs, which also show on the outer edge (Pl. I, fig. 1). All the mouth-parts very hairy. The face is furnished with the usual plumes, six in

number, consisting of compound hairs of about six plumose hairs or branches (Pl. I, fig. 2).

Thorax fairly large and differentiated, with the segments obvious ; with the usual series of single, double, and triple plumose hairs along its dorsal anterior edge, which reach forward over the head; the anterior segment bears lateral plumes, and on each of its upper sides one of those minute stellate hairs, which seem to represent an early stage of the "palmate hairs" in *Anopheles* (Pl. I, fig. 3). The middle and posterior segments bear some long dorsal single plumose hairs and two pairs of long lateral plumes.

The first three and the eighth segments of the abdomen are shorter than the others. The first two carry lateral plumes, the upper consisting of two and the lower of four and three plumose hairs. The other segments carry shorter single hairs of various lengths, the longer subplumose and the short simple. The third to the seventh segments carry minute stellate hairs on the dorsal side. The sub-siphonal plumes are moderate in size, as are also the siphonal; the hairs of both are very plumose ; the plume at the base of the anal segment consists of 3–4 subplumose hairs. The combs (on the eighth segment) are difficult to make out, but appear, anteriorly, as a number of minute scales in a long and regular row, followed by one or two irregular rows of bigger scales ; they show best if the transparent membrane between the eighth and anal segments can be brought into view ; the appearance of the scales is peculiar and I think there are at least 40, but I found it impossible to get the whole process into one focus of even low-power objectives, without dissecting the larva.

The siphon is thick and suboval; it is mostly without any colour or marks, and the length is not quite four times that of the base (Pl. I, fig. 4). The spines do not begin at the base, but after an interval which is $\frac{1}{7}$ of the length of the siphon ; they are fairly long, but are only three or four in number. They are immediately followed by a pair of long hairs, just before the middle, and midway between these and the end is another pair placed transversely, and following these a short triple hair (all these spines, hairs and triple hairs are symmetrically paired).

The anal segment, at its greatest chitinous length, is less than $\frac{1}{3}$ of that of the siphon. The papillæ, though hyaline, bear some markings ; they are unequal and fairly long ; two are double the length of the segment, and two (the dorsal) about a third longer—all fairly stout and with moderately pointed ends. At the dorsal edge of the segment are four long hairs which are longer than the longer papillæ. There appear to be no long hairs on the ventral edge, but there is a compound plume (ventral beard) which springs from six bases, and is longest at its posterior portion, where it about equals in length the shorter papillæ. It will be noticed that all the hairs on the anal segment are simple, and this is the prevailing condition ; they are more liable to injury and denudation than those on any other part.

Length of larva (without siphon) just over 5 mm., length of siphon nearly 2 mm.

PUPA.

Rather small, with moderate trumpets, which have a slight indentation at the mouth. At the base of the thorax is a brush of short hairs (not a plume), and a few longer hairs are more anteriorly placed ; there are also some compound hairs at the spot where the neck shows through the sac. These are the appearances seen under the compound microscope with an absolutely rigid angle of vision. Focussing down it will be seen that the brushes and hairs are double, but I think it will be best to keep to one focus in describing the pupæ.

On the edge of the first segment (or what appears to be the first segment) are paired plumes of stellate hairs, and all the segments are haired at their edges ; the seventh segment has a pair of small plumes of branched or subplumose hairs on the posterior angles (Pl. I, figs. 5 & 6). The anal plates are of the usual subcircular shape.

The thorax at its longest part is under 2 mm.

Described from eight larvæ and five pupæ.

[Larvæ found in an earthen fetich-pot placed upon a small mound outside a native village, in May. The pot contained clear brownish water above a deep layer of mud, decayed leaves and small twigs.—W. M. G.]

21. **Culex aquilus**, Graham.

LARVA.

Head large in proportion to the thorax, quite as broad in its widest part. Colour fairly light. Antennæ like those of *C. albovirgatus,* Graham, except that the distal hairs are simple and not branched ; the mouth-parts are very bushily haired, especially the brush. Plumes on face much denuded in four larvæ examined, but probably short and not conspicuous.

Thorax well differentiated from abdomen, with the normal plumes and frontal hairs.

Abdomen not conspicuously hairy, but on the fourth and sixth segments long single subplumose hairs are present in two of the four specimens. Small stellate hairs were seen on several segments, but were not sufficiently symmetrical to be described as characters. Comb rather larger, comprising four rows of scales reaching from the base of the siphon to the middle of the eighth segment and consisting of about 25–30 scales, of which the posterior are the largest (Pl. I, fig. 14). The sub-siphonal plumes are well developed, and formed of the usual plumose hairs. The anal plume consists of three simple hairs.

The siphon is fairly long and thin, being two-thirds of the length of the abdomen and 9–10 times as long as its base. The spines are fairly long and

close to each other; increasing in size as they leave the base, they run for one-quarter of the length of the siphon (Pl. I, fig. 13). There are about four pairs of double hairs showing on the ventral surface, and about the same on the dorsal, and the valves are fairly large.

The anal segment is moderately long, the proportion of the length to the basal width being as 7 to 4. The papillæ are unequal in length, two being about 14 units and the others about 25; they are hyaline and pointed. There are sockets for probably long hairs on the dorsal edge and a moderate beard on the ventral side, but the specimens have suffered considerable denudation.

Larva 3½ mm. in length, siphon 1¾ mm.

Described from four larvæ; pupa unknown.

[Larvæ found in borrow-pits along the course of the railway, early in June.—W. M. G.]

22. **Culex caliginosus**, Graham.

LARVA.

Head moderately large, dark, not so wide as thorax. Antennæ rather thin; plume small and of simple hairs (Pl. II, fig. 14). Maxillæ very hairy; brushes not so hairy as usual. The plumes on the face are of moderate size, of stiff straight simple hairs.

The thorax calls for no remark, except that the plumes on the sides are rather short, consisting of straight hairs, but they are so covered with parasitic growths, that I cannot be sure if they are plumose or not.

Plumes on the first and second segments of the abdomen comparatively short, and on the remaining segments shorter still, and simple. Comb consisting of a single row of at least ten scales; seen from a semi-dorsal view they are claw-like in appearance (Pl. II, fig. 15). The sub-siphonal plumes consist of simple hairs, each straight and not tapering; the siphonal ones insignificant.

Siphon rather short and stout, its length, compared with that of the abdomen, being as 5 to 13; rather less than 4 times as long as the base, perhaps 3½. The spines begin at the base with four small serrate dark ones close together, finishing with a fifth larger one*; then come at intervals three large ones with lighter bases, which extend slightly beyond the middle; beyond them on each side is a small stellate hair. It is as well to say that the spines are difficult to see at the base; the larger ones show quite easily, but a great deal of manipulation is necessary to get the siphon lying quite flat in the trough (Pl. II, fig. 13).

* These are the appearances with low powers. I have made a preparation of this siphon and find a very minute one below those mentioned; the serrations on the uppermost spine are more marked than those figured on Pl. II, fig. 12.

The anal segment is moderately long, with very long thin tapering papillæ of not quite equal size; they are about three times the length of the segment. This has a plume (very unusual) and two long hairs on its dorsal edge, and is heavily bearded all along its ventral surface; all these hairs are simple.

Length of larva 4½ mm., siphon over 1 mm.

Pupa.

The pupa is of fair size, with short trumpets and rather broad anal plates; the plumes at the ends of the seventh segment are small and apparently (with 60 diameters) of simple hairs (Pl. III, fig. 1).

Length of thorax 1½ mm.

Described from two larvæ and three pupæ.

[Larvæ found in borrow-pits early in June.—W. M. G.]

23. **Culex lividocostalis**, Graham.

Larva.

Head of moderate size, slightly dark in colour. Antennæ with a large plume of plumose hairs and simple hairs at the end. Plumes on face long, but of few hairs; the four central ones consist of two hairs each, and the outer of six hairs, all plumose.

Thorax well marked, with normal plumes.

Abdomen with but few long hairs, and those simple or subplumose, but a number of minute stellate hairs are to be found on the ventral edges of the segments, and also higher up on the sides. The comb is large, consisting of very small "comma" scales, anteriorly in a long row, and then forming three scattered rows of longer scales; under favourable conditions it can be seen that the larger carry some lighter structure at their end.

Siphon thin, moderately long, about one-third (9 to 24) the length of the abdomen; eight times as long as the base; about 12 spines, which are distinctly serrate on their edges, run for nearly a third of the length (Pl. IV, figs. 12 & 13).

Anal segment fairly long, with two of the papillæ about as long as the segment, and two perceptibly shorter; it carries long hairs on the dorsal edge, with a beard ventrally on the distal third, which is much denuded in the specimens; there are single simple lateral hairs on the upper part.

Larva 4½ mm. long, siphon 1½ mm.

Pupa.

The pupa has fairly long trumpets which are darker at the ends and base; it has rather more hairs on the abdomen, which are mostly stellate and always simple, as are the two plumes on the sixth and seventh segments; there are very minute hairs on the ribs of the anal plates (Pl. IV, fig. 14).

Length of thorax, less than 2 mm.

Described from two larvæ and two pupæ.

[Larvæ found in some water that had collected in an empty Portland cement barrel in July.—W. M. G.]

24. **Culex pullatus**, Graham.

LARVA.

Head fairly broad; at the eyes, nearly as broad as the thorax. Antenna with large plume of plumose hairs; the distal joint black, and carrying four strong simple hairs and a short spine at its tip; the spine is very liable to injury. Mouth-parts very hairy. Face with usual plumes.

Thorax much the same as in *Culex albovirgatus*, Graham, but no stellate hairs have been detected.

Abdomen rather long, with the third to the sixth segments carrying short lateral plumes of simple hairs (4 to 6). Sub-siphonal plumes rather large, and the root rather prominent; siphonal plumes also well marked. Anal plume consisting of few hairs, and these appear simple (difficult to see). Combs easily seen as dark scales, sixteen in number, the four posterior in a row and longer than the others.

Siphon nearly as long as the abdomen, very long and tapering, nearly thirteen times as long as the base. The spines are comparatively rather long at the base, and run for $\frac{1}{8}$ of the length, but are few and scattered. The siphon is otherwise bare, except for very minute pubescence.

Anal segment longer than broad, in the proportion of 20 to 17; papillæ equal in size, hyaline, slightly longer than the segment, and with sharply pointed ends. Long plumose hairs are present on the dorsal edge with the sockets much chitinised; the sockets of the ventral beard are also very evident; the latter is about as long as the papillæ (Pl. I, fig. 7).

Length of larva 4 mm., siphon $3\frac{1}{2}$ mm.

Several larvæ were covered with a parasitic growth, vorticellæ, etc.

PUPA.

Furnished with long thin trumpets, which, like many others, are darker at the base; hairs at base of thorax similar to those of *Culex albovirgatus*. Constriction at head marked in some pupæ. The small plume on the last segment consists of plumose, not branched hairs (Pl. I, figs. 8 & 9). There is also a plume (simple) on the sixth segment.

Thorax of pupæ under 2 mm. at greatest length.

Described from seven larvæ and four pupæ.

[Larvæ found in borrow-pits along the course of the railway. The species is plentiful from June to the middle of August. The colour varies considerably.—W. M. G.]

25. **Megaculex pincerna**, Graham.

LARVA.

Dark, larger species.

Head nearly as large as thorax, very dark. Antennæ curved and peculiar, the distal joint going off at an angle ; the base is dark, but they become lighter at the end ; about $\frac{3}{5}$ from the base a fan-plume of very plumose hairs is inserted ; at the base of the distal joint is a long spine and the joint itself carries two spines, a long and short one (Pl. II, fig. 5). The brushes with stiff long hairs, rather prominent. Plumes on the face large and of very plumose hairs.

The thorax is small, but very markedly plumed.

The abdomen has some long single hairs (subplumose) as well as short stellate plumes of single hairs (Pl. II, fig. 8), two of the latter on each side of a segment, placed transversely. The comb consists of a single row of 7–8 long scales.

The siphon is about half the length of the abdomen and only tapers slightly ; it is four times the length of the base. It is remarkable for the apparent absence of the spines, which are very minute and atrophied ; there are lateral plumes, inserted about the middle ; the valves are large (Pl. I, fig. 7).

The anal segment is long, and is also singular, as it is longer on its dorsal side and has a rough surface ; minute serrations can be seen with careful focussing on the dorsal side, and there are some minute spines on the edges of the sides (Pl. II, fig. 9). The papillæ are thin, pointed, equal, and of about the same length as the segment ; there are long hairs on the dorsal edge and the beard which is inserted at the end of the segment is thin, but much longer than the papillæ (Pl. II, fig. 9) ; all the hairs are simple.

Length of larva $3\frac{1}{2}$ mm.

PUPA.

The pupa is very dark and has remarkably long, thin trumpets ; the anal plates are also peculiar, as they are of unusual shape and dark, and the edges are minutely serrate. The small plumes at the ends of the seventh segment appear to be absent ; but as I had only one specimen, which from its curves was exceedingly difficult to manipulate, I am not sure (Pl. II, figs. 6, 6 *a*).

Length of thorax 2 mm., of trumpet $1\frac{1}{2}$ mm.

Described from two larvæ and one pupa.

Dr. Graham tells me that there is a white spot on the anal plate, but the action of the formalin has quite obliterated it in this specimen ; he states that it is a very distinctive feature in the living pupa, or in newly killed specimens.

[Larvæ found in borrow-pits early in June.—W. M. G.]

26. **Pectinopalpus fuscus**, Theo. ? (I) *.

LARVA.

Head as broad as thorax, light in colour. Antennæ with a big plume, the fine secondary hairs of which are longer than the normal ; there are 2–3 long simple hairs at the end ; the mouth-parts are very hairy, and the maxillæ are marked and carry long hairs at their ends ; these are best seen on the lateral view (Pl. II, fig. 10). Face with two single or triple hairs in the middle, two triple ones flanking these and two plumes of six hairs on the outside ; all the hairs plumose (Pl. II, fig. 11). Besides these, there is a row of minute stellate hairs between the eyes, flanked by short plumes, all very difficult to see.

The thorax is very hairy, with long plumose hairs of normal arrangement.

The abdomen calls for no special remark. The comb is very difficult to make out, but in a favourable specimen it is seen to be rather away from the base of the siphon (or appears so from the angle of vision) and to have some particularly long scales on the posterior part.

The siphon is nearly as long as the abdomen and is ten times as long as its own base ; the spines, which are weak and colourless, run to a little over a sixth of the length ; a higher magnification shows them to be serrated (Pl. II, fig. 12) ; there are also short triple hairs on the surface, rather liable to be rubbed off (Pl. II, fig. 10).

The anal segment is distinctly long, about the same length as the seventh and eighth segments together ; the papillæ are unequal, and hyaline ; the comparative length of the longer pair to that of the segment is as 3 to 2, and the shorter pair are not quite so long as the anal segment ; they are moderately pointed. The dorsal edge bears long hairs and some shorter ones ; the ventral beard is as long as the longer papillæ, and covers the distal third of the segment.

The larva is 3 mm. long, the siphon $1\frac{2}{3}$ mm.

Described from three specimens ; pupa unknown.

[Larvæ found in borrow-pits along the course of the railway, early in June.—W. M. G.]

27. **Pectinopalpus fuscus**, Theo. ? (II).

LARVA.

Resembles the last described larva in some respects, but is stouter and longer. It has less pronounced maxillæ.

* From this and the succeeding species of larva only a single imago was bred, and owing to an unfortunate confusion it is not yet possible to say which of the two is the true larva of *P. fuscus*.—ED.

The siphon is proportionately short, its length, as compared with the abdomen, being as 2 to 3 ; it is over ten times as long as its own base. The spines are darker and stronger, running for only $\frac{1}{7}$ of the length ; the base of the siphon is narrower, and it is generally less stout.

The anal papillæ are all equal, much pointed and slightly yellow in colour, not hyaline. They equal the segment in length. The ventral beard is longer than the papillæ.

Length of larva $3\frac{1}{4}$ mm., siphon $1\frac{1}{2}$ mm.

Described from a single specimen ; pupa unknown.

28. **Myxosquamus paludosus**, Graham.

LARVA.

Head rather small, not dark, but darker than some species. Antennæ very long and thin, with a small plume of four (?) simple hairs, inserted distinctly below the middle, with short and simple hairs on the end (Pl. V, fig. 16). Brush very large. The face carries long plumes of subplumose hairs. Eyes large, and with the pigment spot not separated, but adhering to them.

Thorax with the hairs of the anterior edge short on the sides, and only subplumose—the middle ones are denuded ; the side plumes, however, are fairly long and of quite plumose hairs.

Abdomen with few hairs or plumes, and those are inconspicuous or normal. The comb appears as a patch of three to four rows of minute scales. Sub-siphonal plumes small ; only plumose at the base of the hairs. Anal plume of fine simple hairs.

Siphon rather short, its length, as compared with that of the abdomen, being as 7 to 30 ; $3\frac{1}{2}$ times as long as its base ; the spines are many and close together, and run for $\frac{3}{7}$ of the length ; single hairs are present laterally, but much liable to denudation (Pl. V, fig. 15).

The anal segment is short ; the papillæ pointed, unequal, not hyaline, dirty in colour, with the longer pair only slightly longer than the segment ; there is a tuft of hairs, and other longer hairs on the dorsal edge ; ventral beard thick, on about eleven black roots, considerably longer than the papillæ, and coming well over the ventral edge at the end.

Larva nearly 6 mm. long.

PUPA.

With short trumpets, without plumes on the sixth segment. Anal plates run at a sharper curve from the ribs, and no spine is present at the end of a rib (Pl. V, figs. 17 & 18).

Length of thorax fully 2 mm.

Described from one larva and one pupa.

[Larva and pupa found in the water of a crab-hole at the edge of the Ebuli-putta lagoon, early in September. The crab-hole communicated below ground with the lagoon, but no larva was found in the adjacent water of the lagoon, their existence being perhaps prevented by the presence of small fish. These fish were absent from the crab-hole.—W. M. G.]

29. **Uranotænia balfouri,** Theo.

LARVA.

These are small, very dark and rather elongate larvæ, with dark heads of peculiar shape.

The antennæ are small and without plumes: brush moderate; the face has four characteristic thick hairs and a plume on each side.

The thorax has the usual hairs on the anterior edge, and pronounced plumes on the sides; it can just be seen that the hairs are plumose. On the ventral side are two peculiar "star hairs" on each of the posterior angles (Pl. II, fig. 4).

From the second segment there are short plumes of stellate simple hairs, two on each side of the segment, one above the other, which give a fairly hairy appearance to the abdomen. The usual plumes on the eighth segment are present. Seen with a magnification of 60 diameters the comb appears as a row of 6–8 dark squares; seen with about double that magnification, it appears as a single row of six spines with double or split bases (Pl. I, fig. 19).

The siphon is short, being less than one half the length of the abdomen; it measures $3\frac{1}{2}$ times its own base, and does not taper to the valves, which are large; the spines are small, numerous and regularly disposed, they run for $\frac{2}{3}$ of the length from the base; in the middle of the ventral side are large lateral plumes; its structure is a very characteristic one (Pl. II, fig. 1).

The anal segment is long, with shorter papillæ; there are many long hairs on the dorsal edge, and a few on the ventral; no beard, but some long hairs on the edge and a plume on the ventral side.

All the hairs on this larva are either simple, or much less plumose than in the others.

Length of larva less than 3 mm.

PUPA.

This is also small, and has some hairs near the trumpets, which are only occasionally present. The shape of the anal plates is peculiar, being more knife-like than usual (Pl. II, figs. 2 & 3).

Thorax of pupa 1 mm. long.

Described from four larvæ and three pupæ.

[Larvæ found in borrow-pits along the side of the railway from June to the middle of July. In the resting position the larvæ lie almost horizontally.—W. M. G.]

EXPLANATION OF PLATE I.

Fig. 1. Antenna of larva of *Culex albovirgatus*, Graham.

2. One of the plumes on the face of the same larva to show the plumose character of the hairs.

3. Small stellate hair from the thorax of the same larva; unusually bushy and strong; the majority of small stellate hairs are like those figured on the abdomen of *Culex guiarti*, Blanch. (Pl. VII, fig. 4).

4. Seventh, eighth and anal segments of the same larva; lateral view (right side), showing the characters on the posterior portion of the larva.
   - *a*. Siphon or respiratory tube.
   - *b*. Anal segment.
   - *c*. Spines of the siphon, the "pectens" of Felt.
   - *d*. Comb.
   - *e*. Siphonal plume.
   - *f*. Sub-siphonal plume.
   - *g*. Anal plume.
   - *h*. Hairs on dorsal edge of anal segment.
   - *i*. Ventral beard of anal segment.
   - *k*. Papillæ, or anal papillæ.
   - *m*. Eighth segment.

5. Pupa of *Culex albovirgatus*, Graham; lateral view, with the animal lying on its side in the trough.
   - *a*. Trumpets or respiratory trumpets.
   - *b*. Anal plates or fins.
   - *c*. Seventh segment bearing plumes.

6. Portions of the seventh segment and an anal plate of the same pupa, more magnified, to show the plume of branched hairs: ventral view.

7. The anal segment and surrounding parts of larva of *Culex pullatus*, Graham; lateral view (left side), and more highly magnified than fig. 4; only a small portion of the siphon (which is very long) is shown.

8. Pupa of *Culex pullatus*, Graham; lateral view.

9. Portion of seventh segment of the same pupa, seen dorsally, to show the small plume of plumose hairs.

10. Siphon of the larva of *Culiciomyia freetownensis*, Theo., lateral view; the ventral side is on the right.

11. Pupa of *Culiciomyia freetownensis*, Theo., lateral view.

12. The same pupa seen from the dorsal side with the head bent quite under; the sockets of the frontal setæ give an idea of the angle at which the animal is seen. To show the real distribution of the plumes and hairs, compared with the appearance seen through the microscope from a lateral view.

13. Siphon of the larva of *Culex aquilus*, Graham; half lateral view, showing both rows of spines.

14. Comb of the same larva, magnified about 60 diameters.

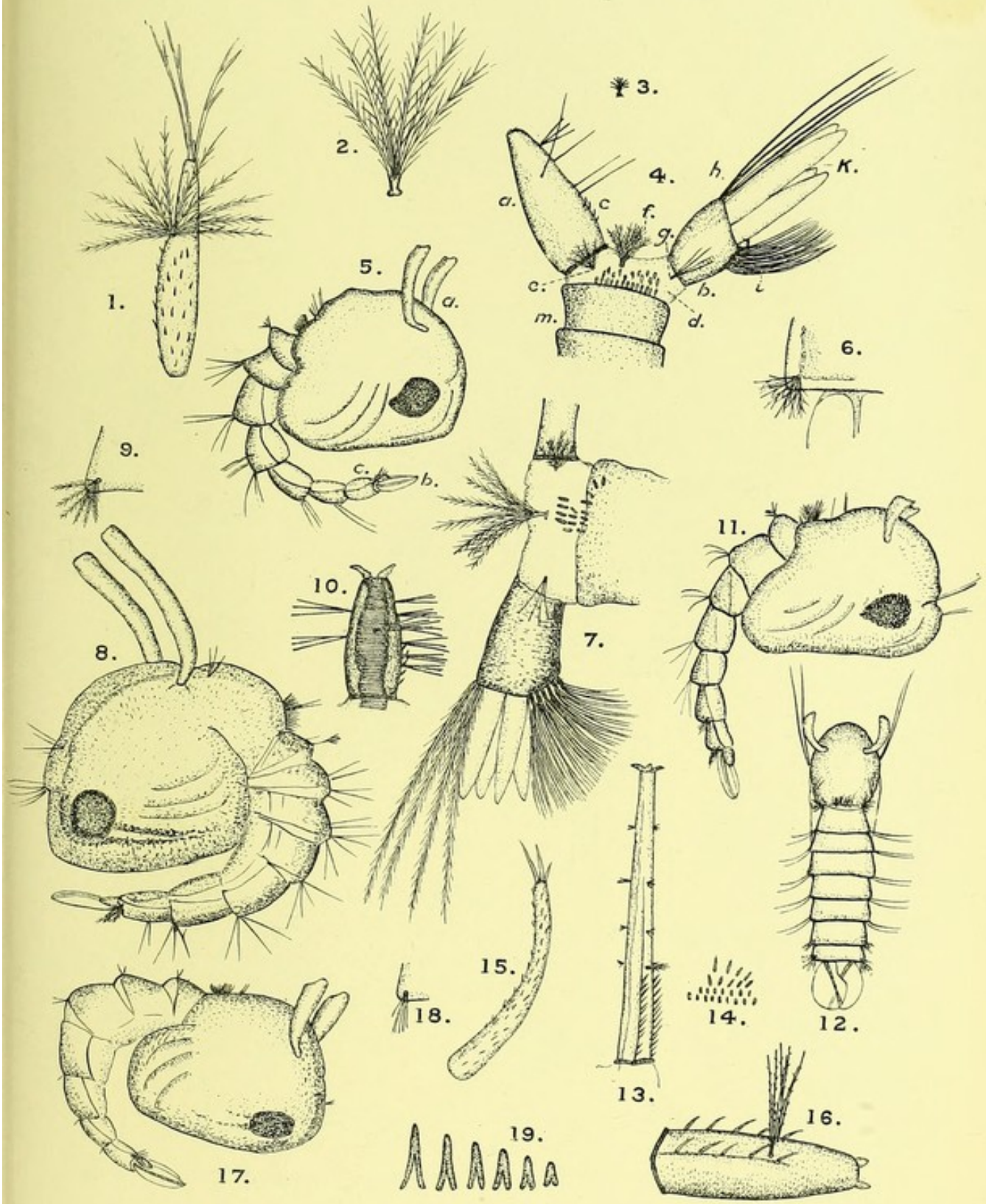
15. Antenna of the larva of *Ædimorphus punctothoracis*, Theo.

16. Siphon of the same larva, half lateral view.

17. Pupa of *Æ. punctothoracis*, lateral view.

18. Portion of the seventh segment of the same pupa, to show the small plume of simple hairs.

19. Comb of the larva of *Uranotænia balfouri*, Theo., as seen with low powers.



W Wesché *del. ad nat.*

WEST AFRICAN CULICIDAE.

EXPLANATION OF PLATE II.

Fig. 1. Siphon of the larva of *Uranotænia balfouri*, Theo.; lateral view, the ventral side on the left.

2. One of the anal plates of the pupa of *U. balfouri*.

3. Pupa of *U. balfouri*, lateral view.

4. The lower portion of the thorax of the larva of *U. balfouri*, seen on the ventral side to show the star hairs.

5. Antenna of the larva of *Megaculex pincerna*, Graham.

6. Pupa of *Megaculex pincerna*, lateral view.

6 *a*. One of the anal plates of the same pupa, enlarged. In life there is a conspicuous white spot on the plates, but all are bleached in the pupæ I have seen.

7. Siphon of the larva of *Megaculex pincerna*; lateral view, the ventral side on the right.

8. Third segment of the abdomen of the same larva, seen on the ventral side.

9. Anal segment of the same larva, lateral view.

10. Larva of *Pectinopalpus fuscus*, Theo. ? (I), seen on the ventral side, and with the siphon and anal segment twisted round so as to lie in the same plane as the rest of the abdomen. On the head: *a*, antenna; *b*, brush; *c*, eye; *d*, maxilla. On the thorax are found the usual plumes of plumose hairs. On the abdomen the first two segments also carry plumes of plumose hairs. The names of the parts on the eighth segment will be seen by comparing this figure with Pl. I, fig. 4.

11. Head and thorax of the same larva, showing the dorsal side. On the head: *d*, maxillary plume; *e*, labrum. On the thorax, the four frontal hairs and the four double hairs behind them are the "dorsal anterior plumes."

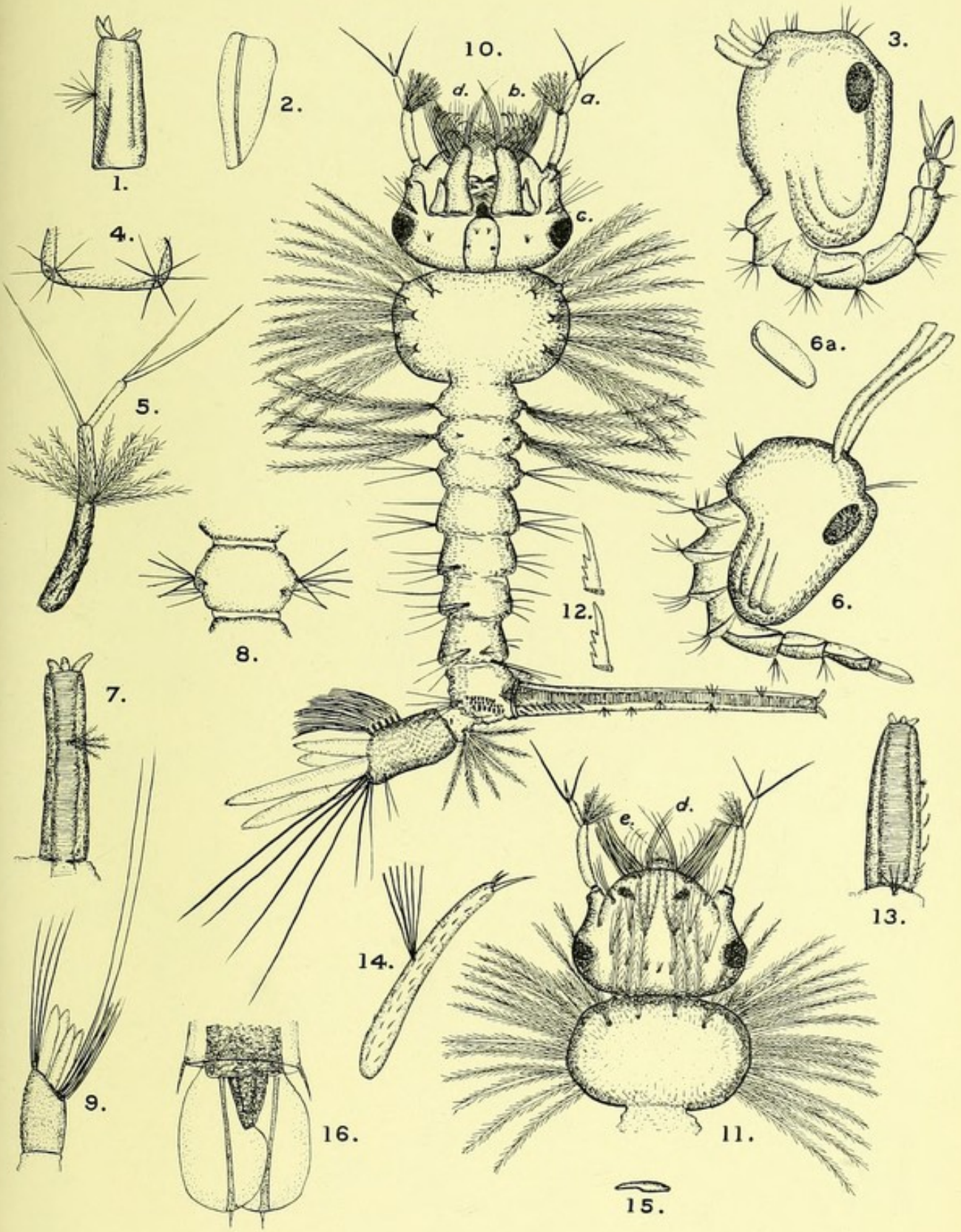
12. Two of the spines of the siphon of the same larva, highly magnified; they are very close to those on the larvæ of our British *Ædes cinereus*, Mg.

13. Siphon of the larva of *Culex caliginosus*, Graham; lateral view, the ventral side on the right; showing also one of the siphonal plumes with simple hairs.

14. Antenna of the same larva.

15. A side-view of a scale of the comb of the same larva, as seen with low powers, the animal being viewed from above.

16. Anal plates of the pupa of *Ædimorphus domesticus*, Theo., seen from the ventral side.



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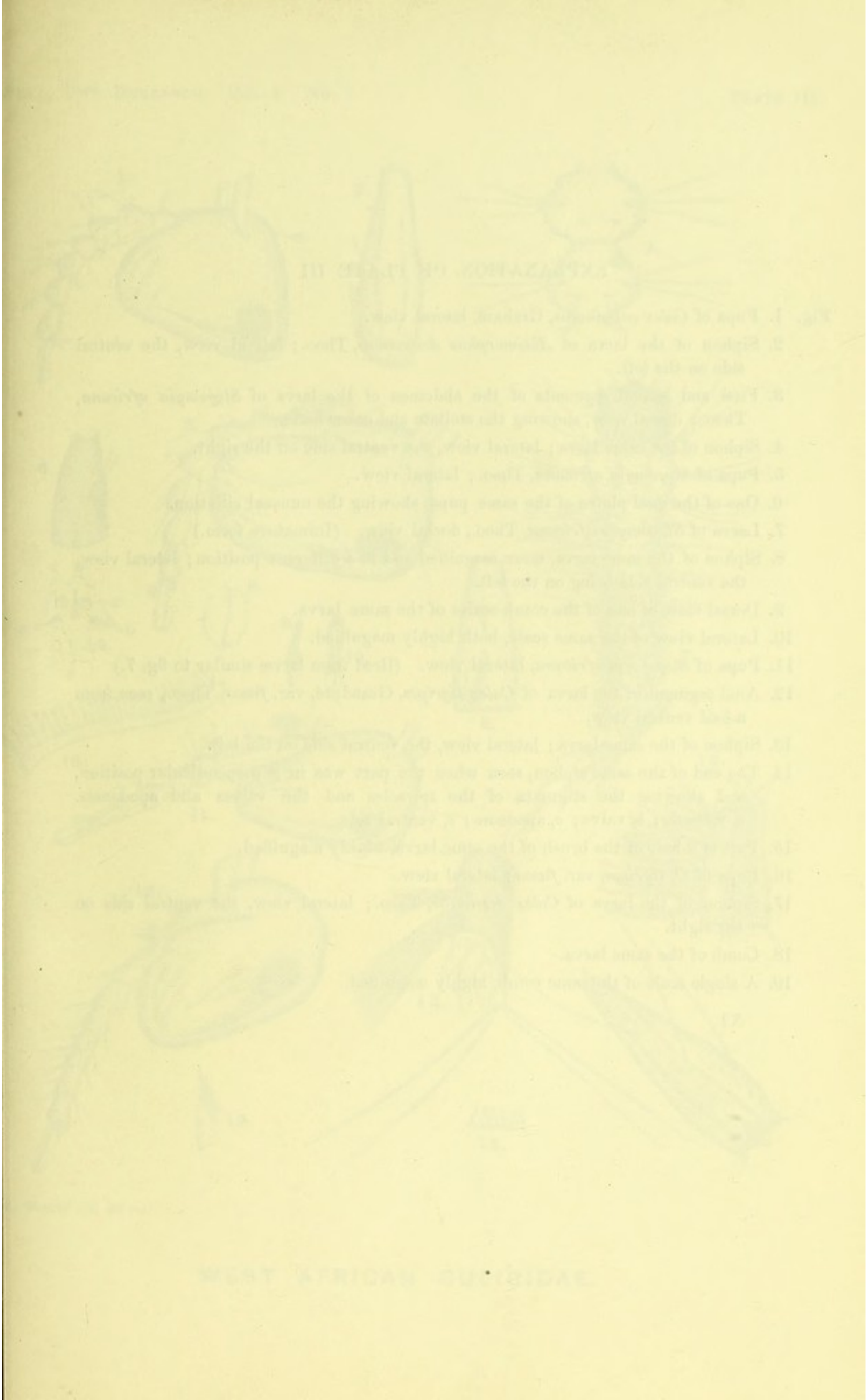


EXPLANATION OF PLATE III.

Fig. 1. Pupa of *Culex caliginosus*, Graham, lateral view.

2. Siphon of the larva of *Ædimorphus domesticus*, Theo.; lateral view, the ventral side on the left.

3. First and second segments of the abdomen of the larva of *Stegomyia africana*, Theo.; dorsal view, showing the stellate and other hairs.

4. Siphon of the same larva; lateral view, the ventral side on the right.

5. Pupa of *Stegomyia africana*, Theo.; lateral view.

6. One of the anal plates of the same pupa, showing the unusual ciliation.

7. Larva of *Stegomyia africana*, Theo., dorsal view. (Immature form.)

8. Siphon of the same larva, more magnified and in a different position; lateral view, the ventral side being on the left.

9. Dorsal view of one of the comb-scales of the same larva.

10. Lateral view of the same scale, both highly magnified.

11. Pupa of *Stegomyia africana*, lateral view. (Bred from larvæ similar to fig. 7.)

12. Anal segment of the larva of *Culex tigripes*, Grandpré, var. *fusca*, Theo., seen from a half ventral view.

13. Siphon of the same larva; lateral view, the ventral side on the left.

14. The end of the same siphon, seen when the part was in a perpendicular position, and showing the stigmata of the spiracles and the valves and apodemes. *a*, spiracle; *b*, valve; *c*, apodeme; *e*, ventral side.

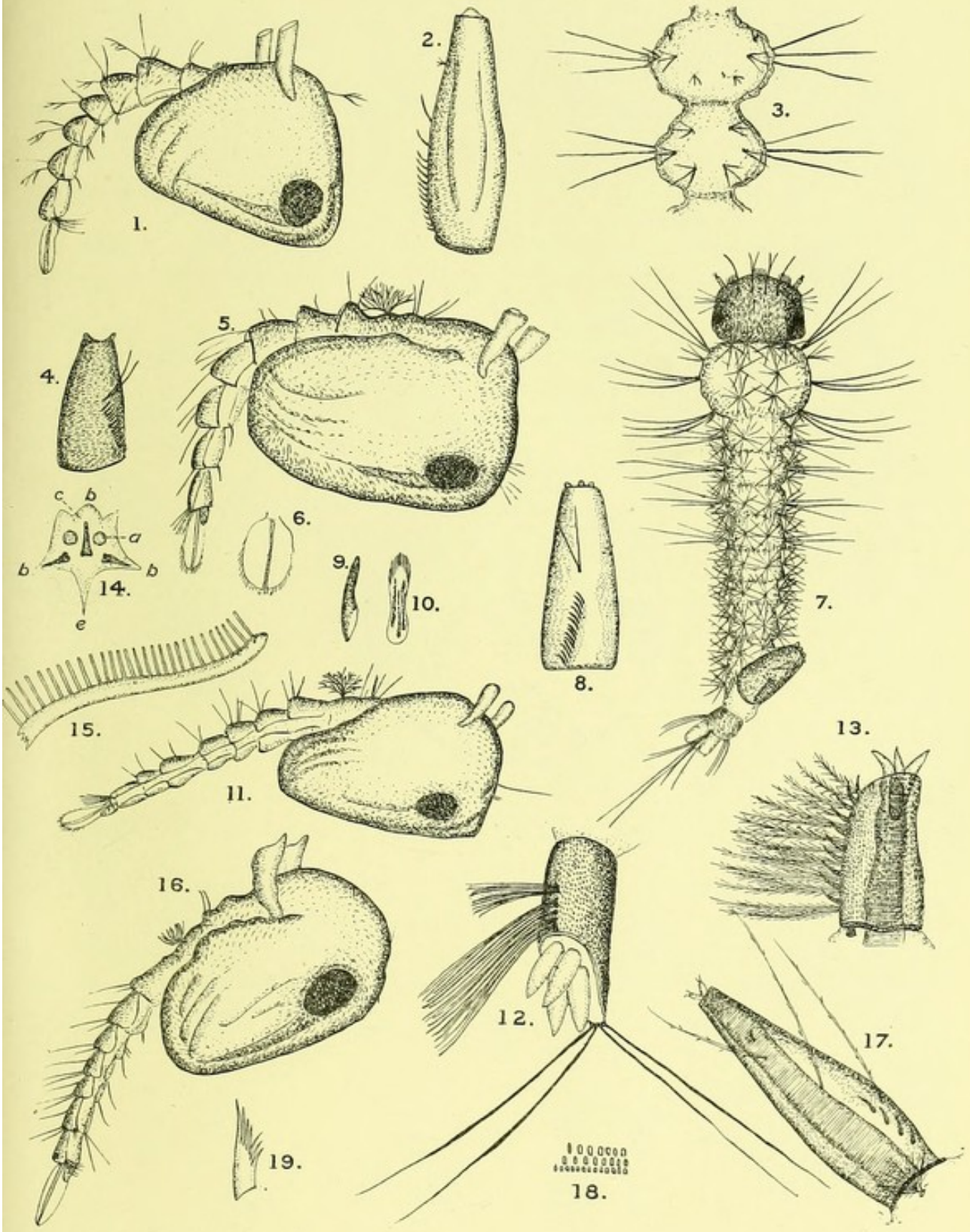
15. Part of a hair of the brush of the same larva, highly magnified.

16. Pupa of *C. tigripes*, var. *fusca*; lateral view.

17. Siphon of the larva of *Culex dissimilis*, Theo.; lateral view, the ventral side on the right.

18. Comb of the same larva.

19. A single scale of the same comb, highly magnified.



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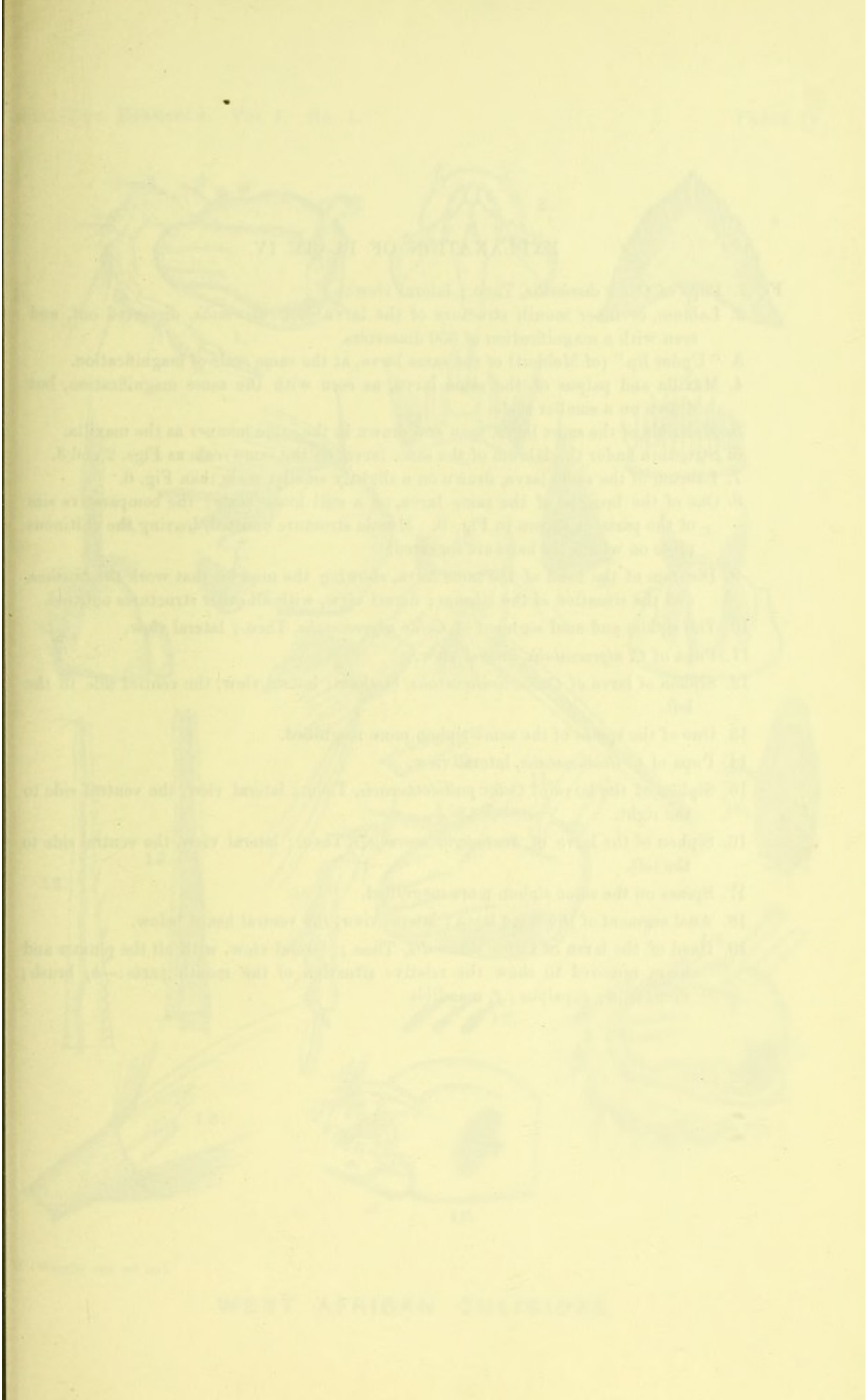
WEST AFRICAN CULICIDAE.



EXPLANATION OF PLATE IV.

Fig. 1. Pupa of *Culex dissimilis*, Theo.; lateral view.

2. Labium, or inner mouth structure of the larva of *C. dissimilis*, dissected out, and seen with a magnification of 350 diameters.

3. "Under lip" (of Meinert) of the same larva, at the same scale of magnification.

4. Maxilla and palpus of the same larva, as seen with the same magnification, but drawn on a smaller scale.

5. Mandible of the same larva, seen and drawn in the same manner as the maxilla.

6. Structure under the labrum of the same larva, on the same scale as Figs. 2 and 3.

7. Labrum of the same larva, drawn on a slightly smaller scale than Fig. 6.

8. One of the brushes of the same larva, on a still lower scale; the comparative size of the parts is shown in Fig. 9. Muscle structure omitted, leaving the chitinous piece on which the hairs are socketed.

9. Diagram of the head of the same larva, showing the muscles that work the brushes, and the situation of the labrum; dorsal view, with all other structures omitted.

10. The siphon and anal segment of *Culex nigrocostalis*, Theo.; lateral view.

11. Pupa of *C. nigrocostalis*, lateral view.

12. Siphon of larva of *Culex lividocostalis*, Graham; lateral view, the ventral side to the left.

13. One of the spines of the same siphon more magnified.

14. Pupa of *C. lividocostalis*, lateral view.

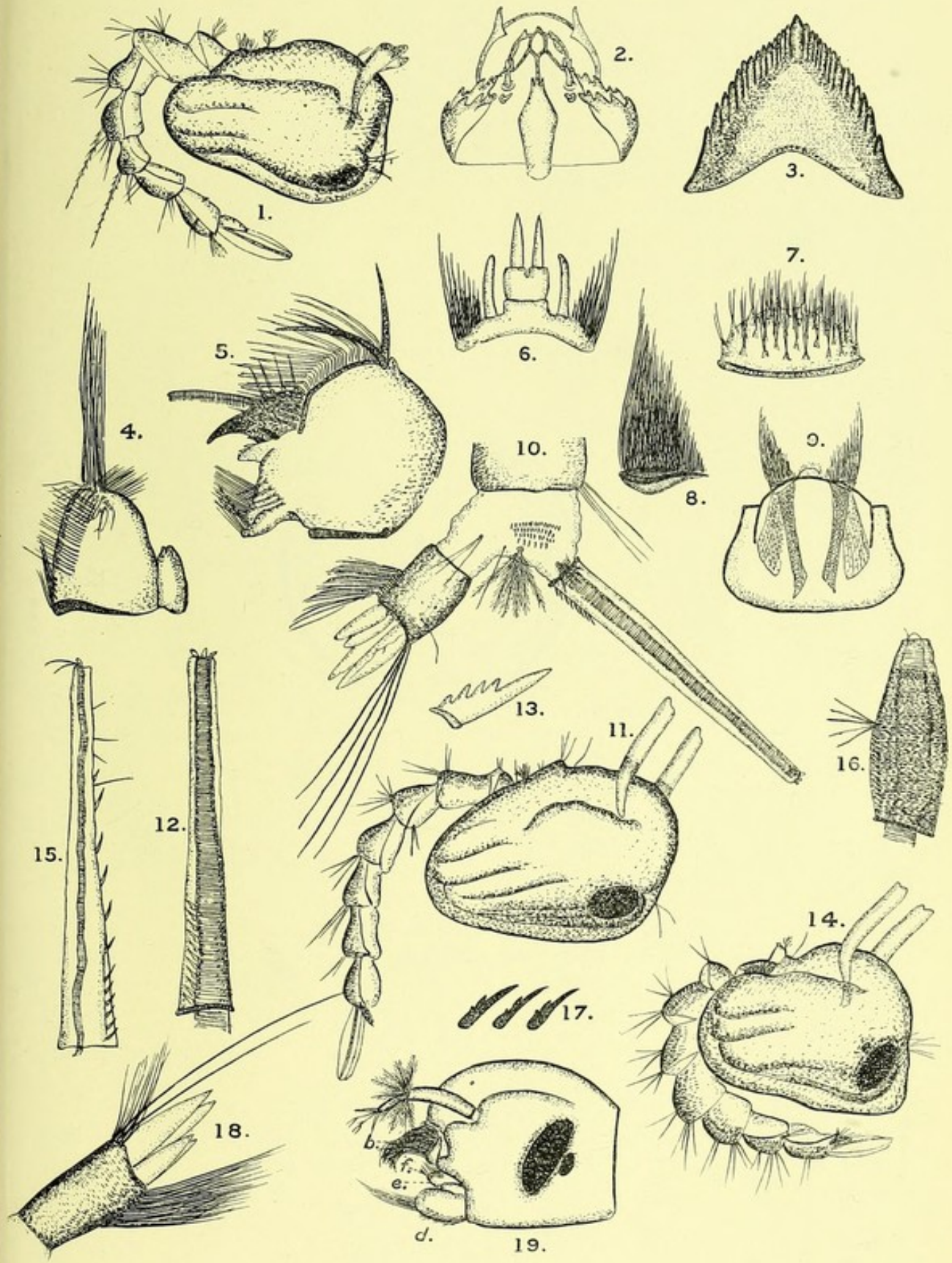
15. Siphon of the larva of *Culex pallidothoracis*, Theo.; lateral view, the ventral side to the right.

16. Siphon of the larva of *Scutomyia marshalli*, Theo.; lateral view, the ventral side to the left.

17. Spines on the same siphon more magnified.

18. Anal segment of the same larva; lateral view, the ventral beard below.

19. Head of the larva of *Culex dissimilis*, Theo.; lateral view, with all the plumes and hairs removed to show the relative situation of the mouth parts:—*b*, brush; *d*, maxilla; *e*, palpus; *f*, mandible.



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EXPLANATION OF PLATE V.

Fig. 1. One of a pair of ciliated structures in the pharynx of the larva of *Culex dissimilis*, Theo. The "weel" or "lobster-pot" arrangement of Professor Miall.

2. Siphon of the larva of *Culex duttoni*, Theo.; lateral view, ventral side on the left.

3. Antenna of the same larva.

4. Pupa of *C. duttoni*, lateral view.

5. Antenna of the larva of *Culiciomyia cinerea*, Theo.

6. Siphon of the same larva; lateral view, with the ventral side on the right.

7. Pupa of *Culiciomyia cinerea*, lateral view.

8. One of the anal plates of the same pupa, to show the characteristic shape.

9. Siphon of the larva of *Stegomyia apicoargentea*, Theo.; lateral view, the ventral side on the left.

10. One of the spines on the same siphon.

11. Dorsal view of the scales of the comb of the larva of *S. apicoargentea*.

12. Lateral view of the same scales, both diagrammatic.

13. Pupa of *S. apicoargentea*, lateral view.

14. Last two segments and anal plates of the same pupa; dorsal view.

15. Siphon of the larva of *Myxosquamus paludosus*, Graham; lateral view, the ventral side on the right.

16. Antenna of the same larva.

17. Pupa of *Myxosquamus paludosus*, lateral view.

18. Last two segments and anal plates of the same pupa.

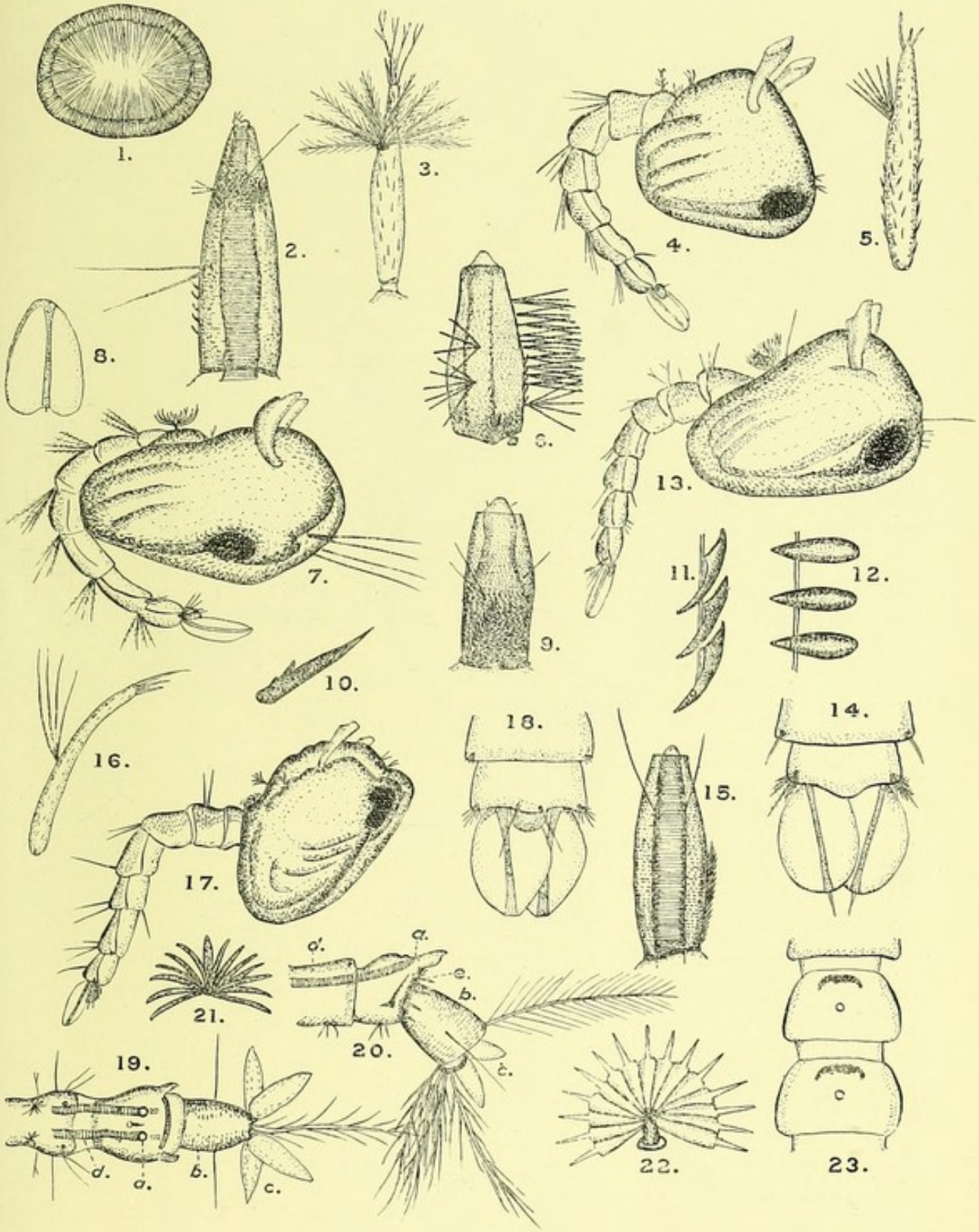
19. The seventh, eighth and anal abdominal segments of the larva of *Pyretophorus costalis*, Lw., to show the arrangement of these parts in the Anopheline larvæ, as they are seen from the dorsal view:—*a*, spiracles; *b*, anal segment; *c*, papillæ; *d*, respiratory trachea.

20. The same parts of the same larva, seen from the lateral view; the letters are the same, but *e* denotes the comb.

21. Modification of the palmate hair, seen on the first segment of the abdomen of the mature larva of *P. costalis*.

22. Palmate hair from the dorsum of the larva of *P. costalis*.

23. Pigment marks and central spot seen on the dorsal side of the abdominal segments of the mature larva of *P. costalis*.



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EXPLANATION OF PLATE VI.

Fig. 1. Thorax and head of the mature larva of *Pyretophorus costalis*, Lw., seen from the ventral side and showing the pattern mentioned in the text.

2. Antenna of the same larva.

3. A plume from the thorax of a 4½ mm. larva of *P. costalis*; a typical "feathered hair."

4. Pupa of *P. costalis*, lateral view.

5. A trumpet of the same pupa, enlarged.

6. Anal plates of the same pupa; seen from the ventral side, to show the greater development of the ribs of the plates and the curious wavy hair at the end of the central processes.

7. Antenna of the larva of *Cellia pharoensis*, Theo.

8. Thorax of the same larva, seen from the ventral side, to show the simple hairs and the large bristle at their bases.

9. Comb of the same larva.

10. Palmate hairs on the abdomen of the (*b*) stage of the same larva. To show the relative proportion with the segments of the abdomen.

11. Pupa of *Cellia pharoensis*, Theo., lateral view.

12. Anal plates of the same pupa, seen from the ventral side and with the eighth segment removed.

13. Eighth segment of the same pupa removed from its position on the ventral side of the anal plates; to show the male "forcipes" enclosed.

14. Face plume of the larva of *Myzorhynchus mauritianus*, Theo., in the immature stage.

15. The same, on the mature, or more mature larva.

16. Palmate hairs on the same larva.

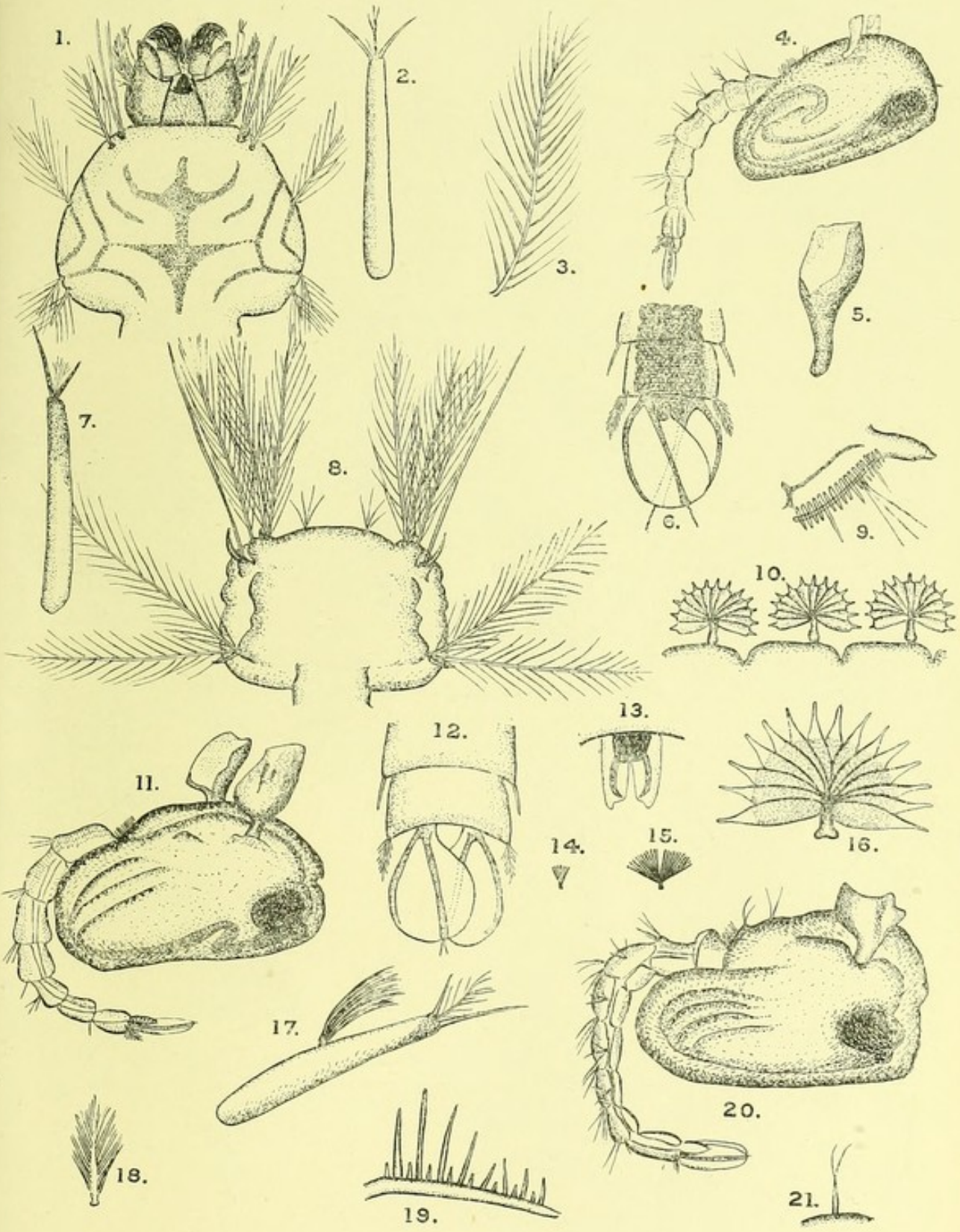
17. Antenna of the same larva.

18. Characteristic hairs on the dorsum of the thorax of the larva of *Cellia pharoensis*.

19. Comb of the larva of *M. mauritianus*.

20. Pupa of *M. mauritianus*, lateral view.

21. Characteristic double hair on the front (face) of the larva of *M. mauritianus*.



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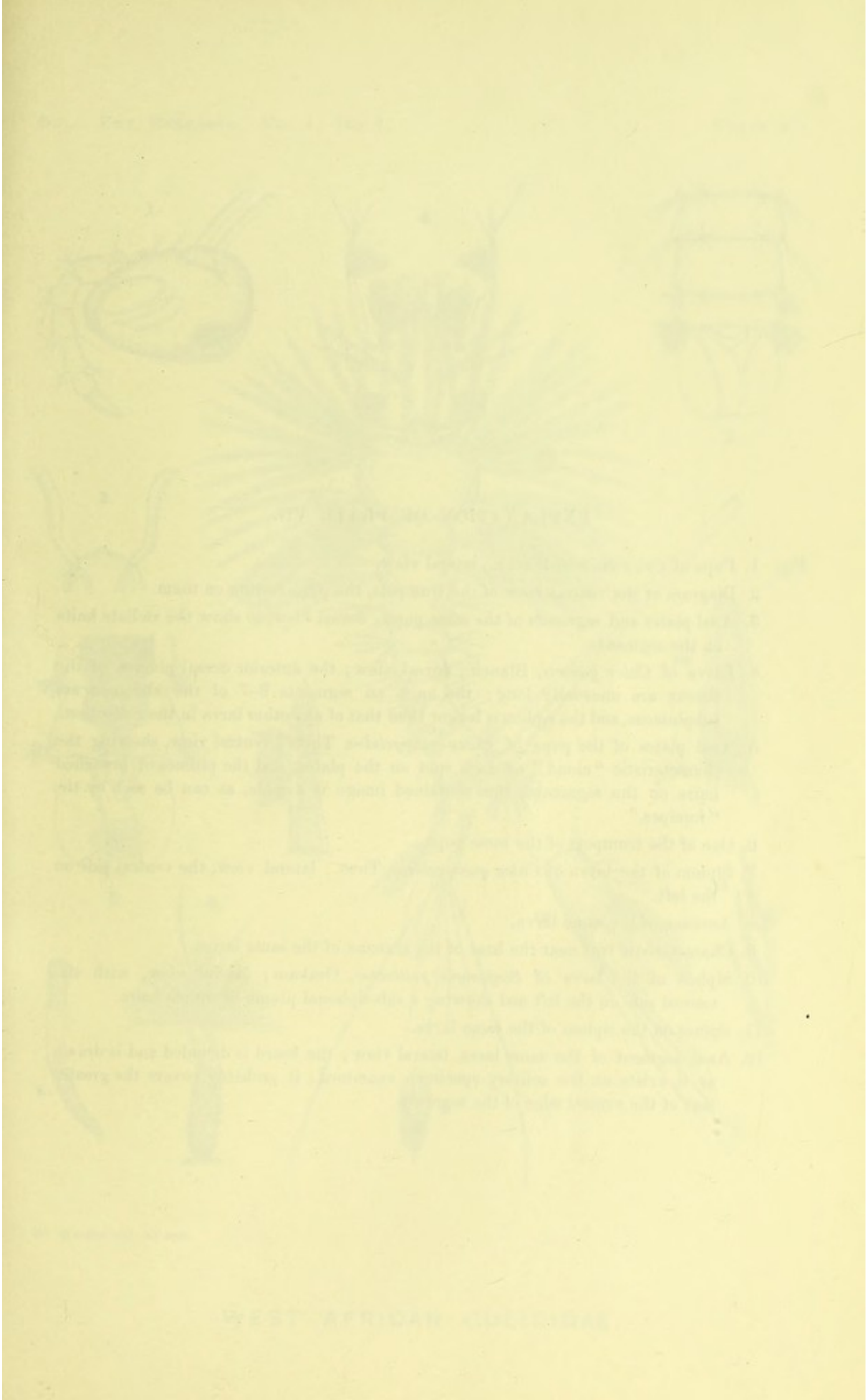


EXPLANATION OF PLATE VII.

Fig. 1. Pupa of *Culex guiarti*, Blanch., lateral view.

2. Diagram of the ventral view of the trumpets, the pupa resting on them.

3. Anal plates and segments of the same pupa; dorsal view, to show the stellate hairs on the segments.

4. Larva of *Culex guiarti*, Blanch., dorsal view; the anterior dorsal plumes of the thorax are unusually long; the hairs on segments 3–7 of the abdomen are subplumose, and the siphon is longer than that of any other larva in the collection.

5. Anal plates of the pupa of *Culex quasigelidus*, Theo.; ventral view, showing the characteristic "cloud" or dark spot on the plates, and the plumes of branched hairs on the segments; the contained imago is a male, as can be seen by the "forcipes."

6. One of the trumpets of the same pupa.

7. Siphon of the larva of *Culex quasigelidus*, Theo.; lateral view, the ventral side on the left.

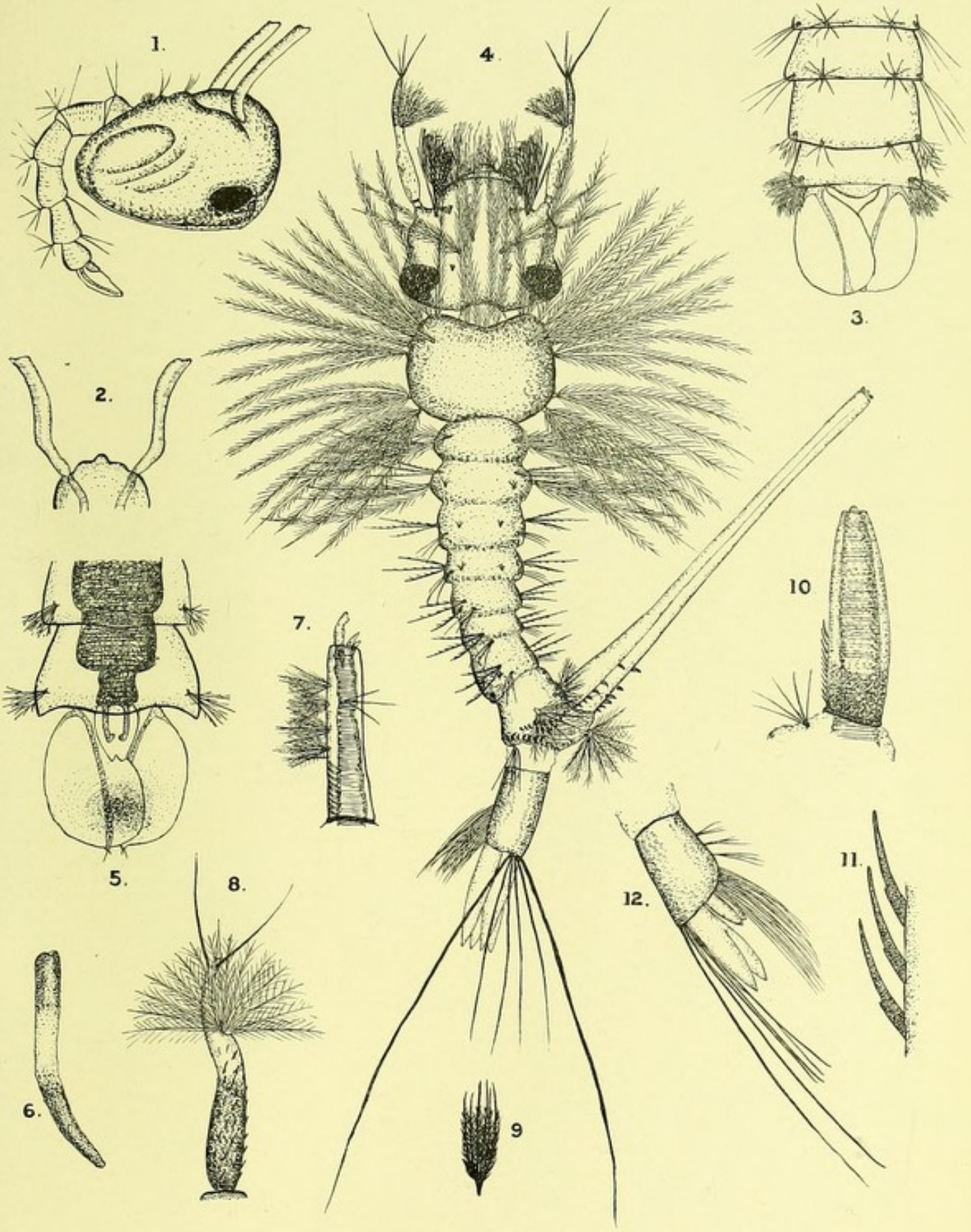
8. Antenna of the same larva.

9. Characteristic tuft near the base of the antenna of the same larva.

10. Siphon of the larva of *Stegomyia pollinctor*, Graham; lateral view, with the ventral side on the left and showing a sub-siphonal plume of simple hairs.

11. Spines on the siphon of the same larva.

12. Anal segment of the same larva, lateral view; the beard is denuded and is drawn as it exists on the solitary specimen examined; it probably covers the greater part of the ventral edge of the segment.



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