

Morphology of the Mouthparts of Larval Aedes communis  
(DeGeer): (Diptera: Culicidae)

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Introduction

The mouthparts of larval mosquitoes have received attention in many papers although very little has been done of a detailed nature. Few of the early investigators made cross reference to other works on mouthparts. Consequently, a variety of terms have arisen for some of the substructures of the mandibles, maxillae, and labia.

Independent terminologies also evolved as the result of disagreements among investigators in the interpretations of the homologies of the structures, particularly of the maxilla and the labial complex. Most notable of those who have investigated the homologies of the mouthparts of mosquitoes are Christophers (1960), who worked with Aedes aegypti (L.); Farnsworth (1947) and Menees (1958a, 1958b), who worked with Anopheles; Cook (1944 and 1949), Shalaby (1956, 1957a, b, c and d, 1958, 1959), and Snodgrass (1959), who evaluated and interpreted the homologies of the maxilla and labium of several genera. Chaudonneret (1962) and Pucac (1965) reevaluated the homologies of the mouthparts using as their models a species of the genus Culex and of several species of Aedes, respectively.

Pao and Knight (1970a) described the structures of the head, giving detailed analysis of the substructures of the head capsule, labrum, mandible, maxilla, and labium, using Aedes vexans (Meigen) as their model. They proposed that a unified terminology, which is a composite of terms from Shalaby, Snodgrass, and Yamaguti and LaCasse, with modifications and additions of their own, be applied to the various structures. Knight (1971) illustrated the mandibles of species of most of the genera of the family Culicidae and of the families Dixidae and Chaoboridae, and in addition he modified and supplemented the terminology for the mandible of larval mosquitoes.

Methods and Materials

Dissections of the mouthparts of the 30 specimens of fourth-instar larvae of Aedes communis (De Geer) from various localities in the western United States and other species which illustrated structures not found in Aedes communis were done with sharpened minuten pins under a stereomicroscope. The separated structures were transferred directly from the water in which they were dissected to a slide, where they were first blotted to remove excess water, then covered with a small drop of balsam diluted with xylene. Balsam and cover slip were positioned the next day. Ventral blades, pectinate brushes, setae of the mandibular comb, setae of the mandibular brush, mandibular teeth, and maxillary brushes were sectioned from the mandibles and

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maxillae of eight specimens to provide a better three-dimensional perspective of the parts. Observations and illustrations were made using a compound microscope under 40x, 400x, and 1000x, oil immersion, magnifications.

### Descriptions of the Larval Mouthparts

The mouthparts of the larvae of Aedes communis are described here to clarify and augment Pao and Knight's terminology with information accrued from studying species other than those included in their studies. The mouthparts of this species appear to be representative of the genus Aedes and, hence, will be used to illustrate the generalized form of the mouthparts of that group. The terms used in this study to describe the mouthparts are those of Pao and Knight (1970a), Knight (1971) and Laffoon and Knight (1973), unless otherwise stated.

#### MANDIBLE

The mandible (fig. 1,2,6) rotates on two articular points. The sclerotized base of the mandible has on its lateral third, two thickenings, the preartis (Pea) and the postartis (Poa). The preartis is a small nodular thickening which articulates with the cibarial bar. The postartis is a stout rectangular projection which articulates with the postcoila (Pot). Lateral and anterior to the postartis is the V-shaped suture (VS) to the basal portion of which is inserted the mandibular adductor muscle. Near the preartis is the mandibular ring (MR), which resembles a setal socket with a small unpigmented conical papilla, barely projecting beyond the surface of the mandible. It appears to be the only element of the mouthparts which is uniformly constructed throughout the Culicidae and may be an important sensory receptor.

The lateral surface of the mandible ascends in a smooth arc to a saddlelike indentation, termed here the sella (Se), at the anterior apex of the mandible. Mounted in the sella are two long sigmoid setae and a shorter saw-shaped seta. These are named the mandibular spurs by Pao and Knight (1970a). They appear to be unicellular structures, and it seems inappropriate to refer to them as spurs. We, therefore, designate these here as the sellar setae (SeS). Sellar setae 1 and 2 (SeS<sub>1</sub>, SeS<sub>2</sub>) are slightly more than twice the length of the saw-shaped seta, sellar seta 4 (SeS<sub>4</sub>). These two setae are lined almost their entire posterior lengths with minute bristles. SeS<sub>1</sub> is dilated proximally and is the longest and most dorsal of the three setae. SeS<sub>4</sub> is the most ventral and mesal of the three and is lined with small uniform serrations distally.

It is our belief that what Knight (1971) indicated as a double mandibular spur (MdS<sub>3</sub>) in many of his genera is actually two separate setae and that his MdS<sub>2</sub> is a group of fine setae. We, therefore, are calling the seta adjacent to SeS<sub>1</sub>, SeS<sub>2</sub>. To the group of fine setae designated MdS<sub>2</sub> by Knight, we apply the term sellar hairs 1 (SeH<sub>1</sub>) to avoid confusing these with the more prominent setae and with a second group of hairs, sellar hairs 2 (SeH<sub>2</sub>) situated mesal to the SeH<sub>1</sub> and found in the sella of Uranotaenia sapphirina Osten Sacken.

Descending mesally from the sella, the anterior ridge of the mandible is lined with long stout sigmoid setae, the mandibular comb (MdC). The setae of the mandibular comb (figs. 1, 6c) have on the ventral margin of the base a broad flat translucent flap, termed here the velum (V). This term is subsequently used for all translucent flaps at the base of setae. A few proximal filamentous branches arise from the dorsal margins of some of the lateral mandibular comb setae. The 3-5 lateralmost setae are filamentous with smaller vela and with numerous bilateral branches.

In contrast to this form, the setae of the mandibular comb in the subgenera Aedes, Aedimorphus and Stegomyia lack the vela (fig. 6d) and are straighter than the sigmoid mandibular comb setae of Ochlerotatus.

A short distance mesal to the mandibular comb is a long curved spine situated dorsally and a short straight spine dorsal to its base. These are the dorsal spines (DS). The long dorsal spine is here designated dorsal spine 1 (DS<sub>1</sub>) and the short one, dorsal spine 2 (DS<sub>2</sub>). Continuing mesally, the ridge terminates in a cluster of heavily sclerotized projections resembling the human hand. The resemblance is best observed from the anterior or posterior view (fig. 6g). The thumb of the hand is situated near the dorsal crest of the ridge, while the four fingers spread ventrally. The thumb is here called the ventral tooth-4 (VT-4). It is homologous with the VT-1 in Knight (1971) and with the mesal DS in Pao and Knight (1970a). The index finger is ventral tooth 0 (VT<sub>0</sub>). The little finger is ventralmost and is ventral tooth 3 (VT<sub>3</sub>). In between VT<sub>0</sub> and VT<sub>3</sub> are ventral teeth 1 and 2 (VT<sub>1</sub> and VT<sub>2</sub>). Mesal to VT-4 is a small projection called here ventral tooth-1 (VT-1). In some species of Aedes, conspicuous in the taeniorhynchus group, there is an additional, curved projection, which is here called ventral tooth-2 (VT-2), at the base of VT-4. There is also a small projection, ventral tooth-3 (VT-3), in between VT-2 and VT-4 known only in some species of the Atra Section of the genus Uranotaenia. The anterior surface of VT<sub>1</sub> is deeply notched. On the posterior surface of VT<sub>2</sub> and sometimes on VT<sub>1</sub> are small tubercles, termed here subdental tubercle 2 and 1 (ST<sub>2</sub> and ST<sub>1</sub>), respectively. ST<sub>2</sub> is seen in various insignificant degrees of development in Aedes, but is conspicuously enlarged in the genus Orthopodomyia, where it is as large as VT<sub>2</sub> itself.

Posterior to VT-4 on the dorsal surface are two more sclerotized projections, the dorsal teeth (DT). The anterior dorsal tooth (ADT) is the simpler of the two. It is usually trifold in A. communis. The posterior dorsal tooth (PDT) has one large cusp and a series of 3-6 gradually diminishing cusps. Closely associated with the base of the posterior dorsal tooth is another series of 5-12 sharp projections, the accessory denticles (AD). The accessory denticles traverse the mesal margin of the mandible just below the ventral teeth and terminate near the base of VT<sub>3</sub>.

Lateral to VT<sub>3</sub> is a sawlike appendage, the ventral blade (VB), which is designated here as ventral blade 1 (VB<sub>1</sub>). VB<sub>1</sub> has a dilated base which constricts into a narrow neck, and then broadens to its greatest breadth at its proximal third. From here it tapers evenly to the tip. Its posterior margin is lined with 50-75 somewhat irregular serrations. Lining the middle third of the anterodorsal margin are from 7-12 small uniform serrations. Arising lateral to the VB<sub>1</sub> and overlapping it ventrally is a smaller appendage, termed here ventral blade 2 (VB<sub>2</sub>).

It is approximately one half the length of  $VB_1$ , and is armed with 12-20 long, sharp, often bifid serrations on its posterior margin and with 3-7 shorter serrations on its anterior margin.

Posterior to the ventral blade is a series of from 5-9 fringed hairs, constituting the pectinate brush (PB). From the anteriormost hair, which is approximately equal in length to  $VB_1$ , the hairs diminish in size proceeding posteriorly. The first hair,  $PB_1$  (fig. 6f) is fringed on both its anterior and posterior margins. Long filaments, longer than those of the  $VB_2$ , often bifid or trifid, line its posterior margin. The anterior fringe is shorter. The succeeding hairs appear to be fringed only on their posterior margins. The base of all pectinate brush hairs has a velum which overlaps the base of its adjacent anterior hair. The velum is lacking on the hairs of the pectinate brush in the subgenera Aedes, Aedimorphus and Stegomyia.

The pectinate brush and ventral blade arise from a comma-shaped, membranous area. A semicircular sclerotized arm separates the bases of the ventral blade from the pectinate brush.  $VB_1$  articulates with the apex of the sclerotized arm. The anterior and lateral margins of this membranous area are demarcated by infoldings of the integument.

Posterior to the teeth is a pilose projection, the membranous process of Shalaby (1956) and Pao and Knight (1970a). The process in all cases, however, is well sclerotized and functions as a support for aggregates of hairs apparently used in brushing the premental plates free of debris. Because the term membranous is misleading, and because the abbreviations are confusable with maxillary, mandibular, and labral setae designated 1-, 2-, 3-, 4-, 5-, 6-, 7-MP, we have renamed this structure the piliferous process (PP). The distal third of the piliferous process is bifid. The posterior section is here termed the labula (La), or little lip. The piliferous process bears five groups of hairs, which are designated piliferous process hairs 1-5 ( $PPH_{1,2,3,4,5}$ ). The apices of both the labula and piliferous process proper bear a tuft of hairs each,  $PPH_1$  and  $PPH_2$ , respectively. Upon the convex anterior and ventral surfaces of the piliferous process is a group of hairs,  $PPH_4$ . A single line of hairs extends onto the dorsal surface from the  $PPH_4$  group. Dorsally the piliferous process bears two more groups of hairs.  $PPH_3$  is a group of 7-10 long hairs in a single or double row extending from near  $PPH_1$  to the middle of the piliferous process.  $PPH_5$  is a single irregular row of 7-12 long hairs beginning at the base of the piliferous process and proceeding onto the body of the mandible. In some species of Aedes, but not in A. communis, there are at the base of the piliferous process, posteriorly, some minute tubercles or spines which are called here the piliferous process spines (PPS). In the Aedes varipalpus complex of species, there is a spine on the posterior border of the labula, which is called here the labular spine (LaS).

Posterior to the piliferous process is a large, heavily sclerotized rectangular or triangular keel extending from the base of the piliferous process to the mesal arm of the arcuate suture (AS). The tendon of the mandibular adductor muscle attaches to the mesal apex of this keel, the mandibular apodeme (MdAp). The arcuate suture is lateral to the mandibular apodeme on the dorsal surface. The mesal arm of the suture ascends anteriorly from the base of the mandible to near the  $PPH_5$  group of hairs, curves back

posteriorly and courses nearly parallel with the base of the mandible to the preartis. Lining the apex and lateral arm of this suture are 5-7 long flat hairs, the mandibular hair group 2 (MdH<sub>2</sub>). These hairs have sparse, minute branches and simple tips. They extend posteriorly to an angular curve where the arcuate suture begins to parallel the base of the mandible. Near the last hair of MdH<sub>2</sub> is a more lateral group of 10-17 similar hairs, the MdH<sub>1</sub>, which have distinctly tasseled tips.

Descending posteriorly on the dorsal surface from the sella is a series of from 50-70 strong setae, comprising the mandibular brush (MdB), disposed in the shape of a fan. Most of the setae of this brush are long and flat with a pikelike prominence basally (fig. 6e). Distal to the pike the setae parallel the dorsal surface of the mandible. The internal (ventral) margin of the hair is lined with an almost imperceptible fringe similar to those of SeS<sub>1</sub> and SeS<sub>2</sub>. The brush terminates posteriorly near the arch of the arcuate suture.

The entire dorsal surface of the mandible lateral to the mandibular brush is weakly sclerotized except for narrow flanges around the margins. On the anterior and lateral flanges and on the ventral surface lateral to the postartis are a number of short stout spines. This is the spinose area (SpA). On the ventral surface of the mandible near the anterolateral margin is a minute ring from which arise two, or sometimes only one, short, delicate setae, the ring based seta (O-MP). In most anophelines and many stegomyians (Aedes) these setae are long and dendritic.

#### MAXILLA

The maxilla (figs. 3 and 4) consists of three parts, the maxillary body, the palp (P) and the palpifer (Pf). The ventral surface of the maxilla is a broad sclerotized sheet extending from an apical tuft of setae, the maxillary brush (MxB) to a slender basal extension, the entoparartis (E). Mesal to the entoparartis is a notch, termed here the basal notch (BN). The sheet wraps around the lateral portion of the maxilla forming a narrow flange, which bears about ten short spines. Mesally the sheet terminates at a group of strong hairs, termed here maxillary group of hairs 1 (MxG<sub>1</sub>)

The dorsal surface of the maxilla is divided into a lateral and a mesal half by the maxillary suture (MxS) from which an internal band extends from the base of the maxillary brush to the base of the maxilla. The maxillary suture has previously been referred to by Salem (1931) as the chitinous ridge. This designation is misleading inasmuch as no pronounced external ridge is present and all of the exoskeleton contains chitin. Hence, we have redesignated this structure as the maxillary suture. From the basal notch mesally a sclerotized band wraps around the base of the maxilla to merge with the maxillary suture. Where the maxillary suture and the base of the maxilla merge, there is a rectangular expansion to which the maxillary muscles, the depressors of the maxillae and the retractors of the maxillae of Christophers (1960), may attach.

Several attempts have been made to homologize the structures of the maxilla of the mosquito with those of the generalized insect maxilla. Pucat (1965) called the entire dorsal half of the maxilla mesal to the maxillary suture the lacinia, and all the rest of the maxilla, the dististipes. The maxilla does appear to be formed by the fusion of two lobes. The mesal lobe is demarcated from the lateral lobe by a line of fusion extending from the basal notch to the apex of  $MxG_1$ . This mesal lobe is continuous with the lacinia basally. In the maxillae of most of the Ochlerotatus the mesal lobe is fused for most of its length with the main lobe of the maxilla ventrally, the line of fusion being evident as a line of lessened sclerotization between the two lobes (dotted lines in fig. 1). In the genus Haemagogus the two lobes are completely unfused ventrally, and the mesal lobe is much more heavily sclerotized than the lateral lobe. Shalaby (1957a), whose interpretations Pao and Knight followed, believed the cardo to comprise the entire basal portion of the maxilla, but there is no basal confluence between the main and the mesal lobes of the maxilla across the maxillary suture dorsally or the basal notch ventrally. The mesal lobe, therefore, appears to be distinct from the main lobe, and thus, the entire basal portion of the maxilla does not appear to be formed from a continuous remnant of the cardo.

For the above reasons the half of the maxilla mesal to the maxillary suture and the line of fusion from the basal notch to the apex of the mesal row of hairs  $MxG_1$  is here called the lacinia (L) following Pucat's terminology. The ventral crescentic sclerite of the lacinia is here referred to as the lacinial sclerite (LS) and the lateral lobe is referred to here as the cardostipes (CS) in belief that the basal portion of the maxilla bearing the entoparartis is the cardo which is fused distally with the stipes.

Located on a hairy prominence on the apical two thirds of the maxilla and lateral to the maxillary suture are two long cylindrical appendages, the dorsal maxillary setae (DMxS). These were also referred to as spurs by Pao and Knight (1970a). These have been redesignated as setae as they, like the sellar setae of the mandible, appear to be unicellular. Each of these setae is supported upon a small pedicle. Lateral and apical to the DMxS the maxilla is membranous and covered with sparse filamentous hairs. Posterior to the DMxS the mandible fits snugly against the maxilla in a slight concavity.

On the dorsal surface of the lacinia are three distinct groups of hairs, the maxillary hair groups ( $MxG_{1,2,3}$ ). The mesalmost row,  $MxG_1$  consists of xiphoid hairs (xh) in the apical portion of the row and branched hairs (bh) near the base of the row. In between the xiphoid and branched hairs are intergradations between the two, having either deep incisions in the hairs or stout branches paralleling the axis of the hair. Most of the hairs on  $MxG_1$  which are not distinctly branched or simple xiphoid are referred to here as incised hairs (ih). Parallel to the maxillary suture and posterior to the  $MxG_1$  is a group of delicate hairs,  $MxG_3$ . Between  $MxG_1$  and  $MxG_3$  is group  $MxG_2$ .  $MxG_2$  is composed of a single row of closely spaced dendritic hairs. The hairs near the base of the maxilla in  $MxG_2$  bifurcate proximally and each of its branches ramify symmetrically. The hairs located nearer the maxillary brush are longer and bifurcate more distally than do the hairs located nearer the base of the maxilla.  $MxG_2$  curves toward the maxillary suture apical to the dorsal maxillary setae, and then curves mesally sharply with two or three rows of dendritic hairs. In between  $MxG_1$  and  $MxG_2$  are sparsely scattered, long incised hairs. The cardolacinial line of Pao and Knight (1970a) is actually the line of bases of the uniformly spaced hairs of  $MxG_2$ .

There are five ring-based setae on the maxilla. These are the mouthpart ring-based setae (3-MP, 4-MP, 5-MP, 6-MP, 7-MP) of Pao and Knight (1970a). Lateral to the base of the maxillary brush are two setae. The larger one, 5-MP, is situated ventrally and is approximately one-half the length of the palp. The other, 4-MP, is situated dorsally, and is about two-fifths the length of 5-MP. Between MxG<sub>2</sub> and MxG<sub>3</sub> on the dorsal surface of the maxilla on a level with the dorsal maxillary setae and the apex of the palp is a filamentous 3-MP. It is approximately equal in length to 5-MP. At the mesodorsal base of the maxillary brush is 7-MP. The 7-MP is a long seta with a filamentous terminal half, and a spinulated proximal half. The 1-MP and 2-MP of Pao and Knight are located on labral sclerites and are not considered in this study.

The maxillary brush is composed of assorted setae or hairs. The two most ventral rows of hairs are stoutly pectinate, and are referred to here as MxB<sub>1</sub> and MxB<sub>2</sub>. MxB<sub>1</sub> consists of straight short, pectinate hairs with numerous, long straight teeth on the lateral surface. The teeth basally are at an angle of 45-50° to the long axis of the hair. As they approach the apex of the hair, the serrations become shorter, and they parallel the axis of the hair. Often there are also serrations on the mesal portion of the hair which are smaller and fewer in number than are the lateral serrations. MxB<sub>2</sub> consists of longer hairs with much shorter and fewer serrations than are found in MxB<sub>1</sub>. The serrations on the MxB<sub>2</sub> hairs are mostly those which parallel the axis of the hair shortly after their emergence. This type of serration is referred to as a barb by Belkin (1962). Immediately behind the two ventral rows of pectinate hairs are numerous stout, straight hairs of various lengths. The shafts of these hairs are usually devoid of any branchings except for 2-10 terminal barbs. These hairs are found in nearly all Aedes and are here called barbed hairs (bb), rather than Pao and Knight's branched-tipped simple hairs. Dorsal to the barbed hairs, which constitute the major portion of the brush, are the longest hairs of the brush. Some of these are simple and others have branched tips. These branched hairs are here called brush-tipped hairs (bth), following Belkin (1962).

The palp is a thumb-shaped structure lateral to the body of the maxilla. It measures about three-fifths the distance from the basal notch of the maxilla to the base of the maxillary brush. Its apex is membranous and bears five styloid appendages, the sensoria (S<sub>1,2,3,4,5</sub>). S<sub>1</sub> is the largest. It is supported upon an elevated sclerotized ring, which may be continuous with a sclerotized ring bearing S<sub>2</sub>. S<sub>2</sub> is approximately three-fifths the length of S<sub>1</sub> and is the most dorsally located of the sensoria. The most ventral and mesal of the five is S<sub>5</sub>. S<sub>5</sub> is a small weakly sclerotized peg, sometimes having a notched apex. There is no basal ring supporting S<sub>5</sub>. S<sub>4</sub> is nearly identical to S<sub>2</sub> in size and shape. It is supported on a sclerotized ring near S<sub>5</sub>. Lateral to the base of S<sub>4</sub> is S<sub>3</sub>. S<sub>3</sub> lacks a ringed base and is itself sclerotized only on its proximal third. It is slender, straight, and approximately four-fifths the length of S<sub>1</sub>. S<sub>3</sub> and S<sub>5</sub> are occasionally absent from some Aedes species in the subgenus Ochlerotatus. S<sub>1,2</sub> and 4 have subapically a minute filament directed at nearly right angles to

their long axes. In between the two dorsolateral sensoria,  $S_1$  and  $S_2$ , and the three mesoventral sensoria,  $S_3$ ,  $S_4$ , and  $S_5$ , is a structure resembling a pincushion. In A. communis this structure is situated at the base of a truncate conical structure which completely encloses it within its own chamber except for a tiny opening at the apex. The conical structure is here termed the ampulla (A). It may be that the pincushion-like structure within the dilated base of the ampulla is a chemoreceptive end-organ with access to the aqueous environment through the orifice of the ampulla.

A strong sclerotized band, the maxillary apodeme (MxAp), originates on the dorsal base of the palp. It attaches directly to the base of the mandible (fig. 1) just mesal to the postartis. All other attachments of the palp are membranous.

The palpifer is a triangular sclerite situated between the lateral base of the maxilla, the head capsule, and the palp. Except for a sclerotized rod which courses through its anterior and middle regions and fuses with the postgena of the head capsule near the entoparartis, it is entirely suspended by membrane. Near its mesal angle is a long ring-based seta, 6-MP, which is usually simple in A. communis but is occasionally bifid. 6-MP is equal in length to 5-MP.

#### LABIOHYPOPHARYNX

The labiohypopharynx (fig. 5) is a rectangular structure dorsal to the triangular dentate plate, the dorsomentum (Laffoon and Knight 1973), in the midventral portion of the head. Its ventral margin is attached to the base of the dorsomentum, and its dorsolateral corners are attached to the cibarial bars (CB) (Laffoon and Knight 1973). The dorsal attachment is anterior to the ventral attachment. The cibarial bars split into several rami, which encircle the anterodorsal portion of the hypopharynx. The salivary duct opens anteroventrally into the preoral cavity through a salivary orifice (SO) (Chaudonneret 1962) between two of these rami. Dorsal to the salivary orifice is a sclerotized sheet, the chitinous cover (ChC). Laterally on the periphery of the salivary orifice are two flaps which probably regulate the salivary orifice. These are here termed the valves of the salivary orifice (VSO).

A sclerotized corrugated area lies between the salivary orifice and the hypopharyngeal processes (HP). These processes in Ochlerotatus are conical structures with globular bases with a basal fold mesodorsally. These appear to be modified setae. Posteroventrally from the salivary orifice and between the hypopharyngeal processes are a series of small hypopharyngeal spines (HS) (Shalaby 1957d) which are arranged in several clusters. In the middle of the posterolateral margins of the hypopharynx are two sclerotized tubercles, termed here the hypopharyngeal apodemes (HAp), to which the retractor muscles of the labium of Christophers (1960) possibly attach.



The labium of larval mosquitoes has been reduced to a structure composed entirely of prementum (Snodgrass 1959). The prementum (PrM) is a heart-shaped assemblage of toothed plates situated in the mid-ventral region of the hypopharynx. Forming the lateral borders of the prementum are three serrate plates on each side. The most ventral of the three was termed the posterolateral toothed premental plate by Pao and Knight (1970a), but is here called the ventral premental plate (VPP) following Pucat's (1965) designations. On this plate are 10-16 sharp serrations. The middle plate was termed the midlateral toothed premental plate by Pao and Knight (1970a), but is shortened here to middle premental plate (MPP). Its lateralmost tooth is situated near the lateralmost tooth of the ventral plate. There are 7-10 teeth on the middle plate. The dorsal plate, which Pao and Knight termed the anterolateral toothed premental plate, is called here the dorsal premental plate (DPP). There are 4-6 widely spaced teeth on this plate. The lateralmost tooth originates near the lateralmost teeth of the other two plates. Lateral to the ventral premental plate in many Aedes species, although lacking in A. communis, is a nodular expansion bearing a group of spines or hairs, termed here the lateral premental plate (LPP).

The dorsal premental plate is continuous dorsally with a sclerotized arc. The arc is a trough whose concave surface is directed dorsally, and is here termed the dorsal fossa (DF). There are 2-4 prongs on both rims of this fossa. Each dorsal fossa merges mesally with a larger trough, which traverses the middle of the prementum as an overhanging shelf. The two centrally located troughs are here termed the median fossae (MF). They have 4-5 large prongs each, and resemble two moose antlers fused in the middle. Between the two dorsal fossae is a 2-4 cusped prominence, termed here the central cusps (CC). The median fossae and the central cusps are the premental pouches of Pao and Knight (1970a).

On each side between the median fossae and the dorsal premental plate is a membranous area on which are located four ring-based pegs, the premental papillae. To be consistent with the terminology used for the premental plates, these papillae are here termed the ventral (VPPa), middle (MPPa), and dorsal premental papillae (DPPa) rather than the basal, middle, and apical premental papillae, as termed in Pao and Knight (1970a). There are two DPPa situated near the vault of the dorsal fossae. They are seated on a single sclerotized pedicle with a separate socket for each. They are the smallest of the papillae. The MPPa is long, stout, and slightly curved. Its apex is ringed with minute serrations. Its pedicle is situated near the mesal termination of the middle premental plate and is partially concealed beneath the median fossae. The VPPa is situated on a sclerotized pedicle just dorsal to the ventral premental plate.

From a triangular membranous area between the two lobes of the prementum, numerous flattened hairs, the premental hairs (PrH) arise ventrally. The median hairs are broad spatulate hairs with shallow scalloping at their tips, while the more lateral hairs are longer and narrower with deep incisions.

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## ABBREVIATIONS

Mandible

AD	-	accessory denticles
ADT	-	anterior dorsal tooth
AS	-	arcuate suture
DS(DS <sub>1</sub> ,DS <sub>2</sub> )	-	dorsal spine
DT	-	dorsal tooth
La	-	labula
LaS	-	labular spine (not pictured)
MdAp	-	mandibular apodeme
MdB	-	mandibular brush
MdC	-	mandibular comb
MdH(MdH <sub>1</sub> ,MdH <sub>2</sub> )	-	mandibular hairs
O-MP	-	mouthpart ring-based seta
MR	-	mandibular ring
PAP	-	postgenal articular process
PB	-	pectinate brush
Pea	-	preartis
PDT	-	posterior dorsal tooth
Poa	-	postartis
Pot	-	postcoila
PP	-	piliferous process
PPH(PPH <sub>1</sub> ,PPH <sub>2</sub> ,PPH <sub>3</sub> ,PPH <sub>4</sub> , PPH <sub>5</sub> )	-	piliferous process hairs
PPS	-	piliferous process spine (not pictured)
Se	-	sella
SeS(SeS <sub>1</sub> ,SeS <sub>2</sub> ,SeS <sub>4</sub> )	-	seller setae
SeH(SeH <sub>1</sub> ,SeH <sub>2</sub> )	-	seller hairs
SpA	-	spinose area
ST(ST <sub>1</sub> ,ST <sub>2</sub> )	-	subdental tubercle
V	-	velum
VB(VB <sub>1</sub> ,VB <sub>2</sub> )	-	ventral blade
VS	-	V-shaped suture
VT(VT-1,VT-2,VT-3,VT-4,VT-5,VT <sub>0</sub> , VT <sub>0</sub> ,VT <sub>1</sub> ,VT <sub>2</sub> ,VT <sub>3</sub> ,VT <sub>4</sub> )	-	ventral tooth

Maxilla

A	-	ampulla
bb	-	barbed hair
bh	-	branched hairs
BN	-	basal notch
bth	-	brush-tipped hair
CS	-	cardostipes
DMxS	-	dorsal maxillary setae
E	-	entoparartis
ih	-	incised hair
L	-	lacinia

## Abbreviations - continued

Maxilla

LS	-	lacinial sclerite
MP (3-MP, 4-MP, 5-MP, 6-MP, 7-MP)	-	mouthpart ring-based setae
MxAp	-	maxillary apodeme
MxB	-	maxillary brush
MxB (MxB <sub>1</sub> , MxB <sub>2</sub> )	-	maxillary brush ventral hair rows
MxG (MxG <sub>1</sub> , MxG <sub>2</sub> , MxG <sub>3</sub> )	-	maxillary hair groups
MxS	-	maxillary suture
P	-	palp
Pf	-	palpifer
S (S <sub>1</sub> , S <sub>2</sub> , S <sub>3</sub> , S <sub>4</sub> , S <sub>5</sub> )	-	sensoria
xh	-	xiphoid hairs

Labiohypopharynx

CB	-	cibarial bar
CC	-	central cusps
ChC	-	chitinous cover
DF	-	dorsal fossa
DPP	-	dorsal premental plate
DPPa	-	dorsal premental papilla
HAp	-	hypopharyngeal apodeme
HP	-	hypopharyngeal process
HS	-	hypopharyngeal spine
LPP	-	lateral premental plate
MF	-	median fossa
MPP	-	middle premental plate
MPPa	-	middle premental papilla
PrH	-	premental hairs
PrM	-	prementum
SO	-	salivary orifice
VPP	-	ventral premental plate
VPPa	-	ventral premental papilla
VSO	-	valves of salivary orifice

## EXPLANATION OF FIGURES

(all drawings of fourth-instar larva of Aedes communis except as indicated)

- Fig. 1. Ventral surface of mandible.
- Fig. 1a VB's and PB's of mandible.
- Fig. 2. Dorsal surface of mandible.
- Fig. 3. Ventral surface of maxilla.
- Fig. 4. Dorsal surface of maxilla.
- Fig. 5. Anterior view of labium.
- Fig. 6
- a. Mandibular comb (MdC).
  - b. Mandibular comb (MdC) of Aedes cinereus (Meigen).
  - c. Mandibular comb hair.
  - d. Mandibular comb hair of Aedes cinereus.
  - e. Hair from middle of mandibular brush (MdB).
  - f. Pectinate brush (PB) hairs.
  - g. Posterior view of mandibular dentition.
  - h. Apex of maxillary palp, ventral view.













