

Functional Interrelationships of the Substructures
of the Mouthparts of Larval MosquitoesClark F. Gardner and Lewis T. Nielsen
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That the mandibular teeth of mosquito larvae serve as masticating agents by grinding food against the serrate plates of the prementum is obvious to casual observation. The precise intercuspsation of the toothed plates and the function of the various specialized groups of setae of the mouthparts, however, are not so evident. In this paper an account of these interrelationships is given. The mouthparts of Aedes communis (De Geer) are illustrative of the relationships found in the substructures of the mouthparts in most species of the family Culicidae. The terminology used to describe the substructures of the mouthparts is that of Gardner, Nielsen and Knight (1973).

Chaudonneret (1962) illustrated the intercuspsation of the mandibles with the prementum, but in his rendition the mandibles are ventral to what appears to be their normal relationship. The occlusal relationship for the mandibular and premental dentition appears to be as follows (fig. 1): ventral tooth 0 (VTO) occludes within the median fossa (MF); ventral tooth 3 (VT₃) intercuspsates between the lateral edges of the ventral (VPP) and the middle premental plates (MPP); ventral tooth 1 (VT₁), which usually has a deep dental notch, intercuspsates with the VPP, its notch interlocking with the teeth of that plate, or possibly with the lateral margin of the MF; ventral tooth 2 (VT₂) occludes between the VPP and MPP; ventral tooth-4 (VT-4) occludes within the DF; and the dorsal teeth (DT) occlude between the MPP and the dorsal premental plate (DPP). In the genus Anopheles the dorsal teeth have exceedingly numerous accessory denticles (AD) which occupy a large area of the mesal portion of the mandible. These occlude with an equally expansive, spinous area occupying the labioepipharynx from the dorsal fossa of the prementum to the salivary orifice. In Group F (Scapularis Group), the Aculeatus Section, and Group G (Fulvus Group) of the genus Aedes, to accommodate the enlarged VT₃ of the mandible, the number of teeth in the VPP is reduced. The premental papillae probably serve as positional indicators in guiding the mandibular teeth into place.

The function of the piliferous process (PP) is to sweep the prementum free of debris by means of its numerous long hairs directed mesally. In Anopheles which has a greatly reduced PP, the premental plates are also greatly reduced in size. In predatory species in which the PP is reduced or absent, their large flat, spiny prementi may not collect much debris owing to the nature of their food.

The ventral blades (VB) and pectinate brushes (PB) are situated so that on adduction of the mandible they will skim the mesal half of the dorsal surface of the maxilla, which bears three rows of setae, the maxillary setal groups 1, 2 and 3 (MxG₁, MxG₂, MxG₃). By this means MxG₃ and MxG₂ are cleansed. MxG₁ is usually situated too far ventrally to be cleaned by the VB's and PB's. The long hairs of the ventromentum

(Laffoon and Knight, 1973), the hair-bearing structure ventral to the mentum or dorsomentum (Laffoon and Knight, 1973), together with the MxG_1 form a sieve-like mesh which seals off the entire ventral portion of the preoral cavity.

The ventral portion of the maxillary brush (MxB) and possibly the apical portion of MxG_1 are the only elements of the mouthparts which appear not to be cleaned by other intrinsic elements of the mouthparts. Mattingly (1969) suggested that the pecten and comb of the abdomen serve to clean the labral brushes or lateral palatal brushes (Laffoon and Knight, 1973). It may be that the pecten and comb clean these two maxillary parts as well. The ventralmost row of setae in the MxB, MxB_1 , are palmate in Aedes thibaulti Dyar and are identical to the palmate comb scales on its abdominal segment VIII. The similarities in these two structures are at least suggestive that a functional relationship exists between them.

The setae of the mandibular brush (MdB) may function as combing agents for the lateral palatal brushes which are situated at the dorsum of the preoral cavity. The setae of the MdB are lined with a row of minute bristles which appear to be well suited for the brushing of complex surfaces. The bristles line the side of the seta closest to the body of the mandible. The lateral palatal brushes in order to be cleaned would be drawn between the MdB and the body of the mandible.

The lateral premental plate (LPP) is found in most of the New World tree hole species of Aedes. It rarely occurs in the subgenus Ochlerotatus Lynch-Arribalzaga of Aedes, and when it does, it is usually in the form of a few small spines closely adjacent to the lateral portions of the other premental plates. In two rockhole dwelling species which have been assigned to the subgenus Finlaya Theobald, Aedes epactius Dyar and Knab and Aedes fluviatilis (Lutz), the LPP are huge (fig. 2). No surface appears to occlude with the LPP. Romney (1971) has observed the larvae of A. epactius buried in silt headfirst up to their abdomens, and found pebbles in the contents of their guts. The enormous LPP of A. epactius and A. fluviatilis may serve to protect the lateral recesses of the oral cavity from abrasion by rocky boli ingested with food.

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EXPLANATION OF FIGURES

- Fig. 1 Acclusal relationships of mandibular and premental dentition, as represented by Aedes communis (De Geer). VTO occludes in MF and VT₁, VT₂, and VT₃ occlude in region between MPP and VPP (dotted areas). VT-4 occludes in trough of DF (blackened area). ADT and PDT occlude in region between DPP and MPP (striped area).
- Fig. 2 Prementum of Aedes fluviatilis (Lutz) showing unusual development of the lateral premental plates (LPP).

ABBREVIATIONS

Mandible

ADT	-	anterior dorsal tooth
PDT	-	posterior dorsal tooth
VT(VT ₀ , VT ₁ , VT ₂ , VT ₃ , VT ₄)	-	ventral tooth

Labiohypopharynx

CC	-	central cusps
DF	-	dorsal fossa
DPP	-	dorsal premental plate
DPPa	-	dorsal premental papilla
LPP	-	lateral premental plate
MF	-	median fossa
MPP	-	middle premental plate
MPPa	-	middle premental papilla
VPP	-	ventral premental plate
VPPa	-	ventral premental papilla

FIG. 1

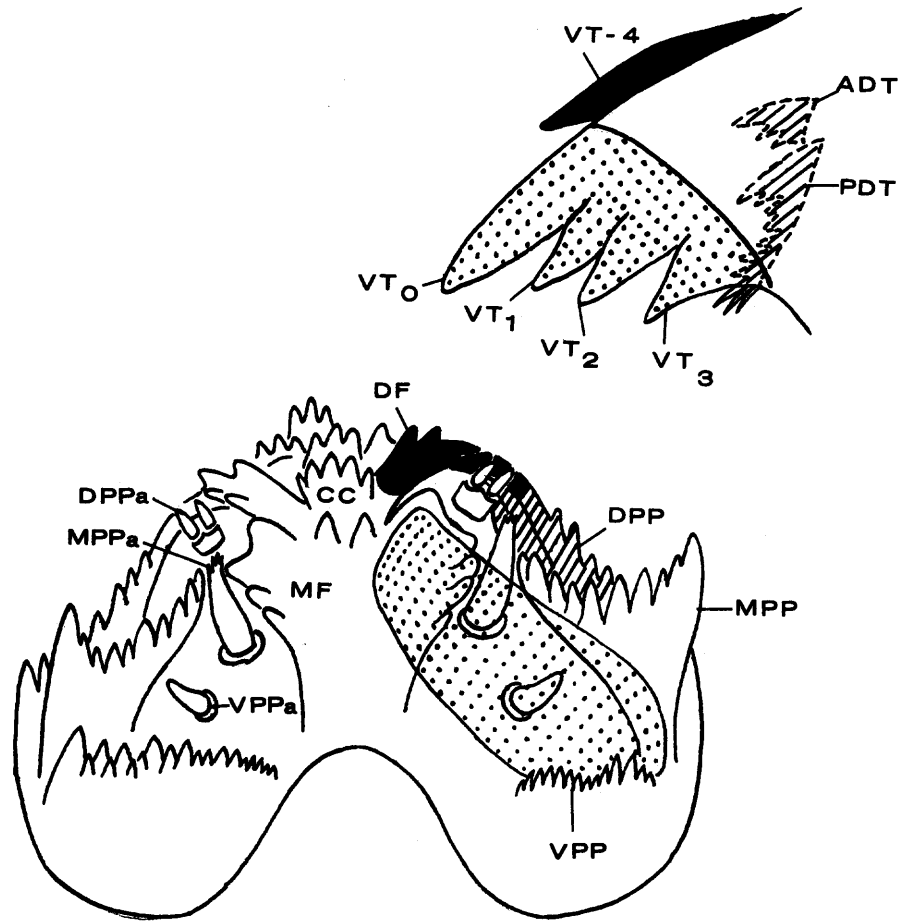


FIG. 2

