INNERVATION AS A CRITERION OF HOMOLOGY OF THE ELEMENTS OF THE LARVAL AND PUPAL CHAETOTAXY OF MOSQUITOES

(DIPTERA, CULICIDAE)

The constancy of the chaetotaxy pattern in the different instars of the immature stages throughout the family Culicidae (in the broad sense) suggests that this chaetotaxy is of monophyletic origin and consists of elements that are homologous phylogenetically as well as ontogenetically and in part serially. Attempts to homologize the chaetotaxy have been hampered by the complexity of the pattern and the lack of reliable direct criteria. In the course of recent studies on the mosquitoes of the South Pacific, I have seen several slides of prepupal fourth instar larvae in which nerve connections between the external hairs of the fourth instar and the internal developing hairs of the pupa show very clearly. These connections provide for the first time an absolute criterion of ontogenetic homology of the elements of the mosquito chaetotaxy and demonstrate the sensory nature of the hairs. It is well known that setae and various other cuticular modifications in insects are connected to distal filaments of sensory neurones to form sensilla of different types. Wigglesworth (Q. J. Micros. Sci. (n.s.) 94: 93-112, 1953) showed that the cuticular portions of some sensilla in *Rhodnius* are reformed in successive instars by the identical tormogen and trichogen cells which formed the preceding sensillum and that the new sensillum is innervated by a branch from the distal filament of the original sensory neurone. Owing to this relationship of the sensory filament the sensillum of the older instar remains functional while the new sensillum of the following instar is being formed under the loosened cuticula. In mosquitoes there is a dramatic change in morphology between the fourth instar larva and the pupa but the majority of the sensilla are carried over from the larva to the pupa as shown by the nerve connections. Owing to differential growth of the integument of the pupa the new sensilla come to occupy very different positions from those of the larva but retain the nerve connection by elongation of the original branch of the distal sensory filament. The different sensilla develop at different times and this allows for shifts in position which can be clearly seen in the crossing of filaments from different sensilla. Common innervation thus demonstrates the ontogenetic homology of individual hairs beyond any question from the first instar larva to the pupa. Serial homology and phylogenetic homology of the chaetotaxy, of course, cannot be proved in this manner but the similarity in the pattern on the abdominal segments is strongly suggestive of serial homology, and the constancy of the pattern on all body regions throughout the family likewise probably indicates phylogenetic homology. A reinterpretation of the homology of the larval and pupal chaetotaxy based on innervation is presented in a forthcoming publication on the mosquitoes of the South Pacific (Univ. of California Press).

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