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CUTICULAR STRUCTURES ON THE LABIUM OF THE LARVA OF *CROCOTHEMIS SERVILIA* (DRURY) (ANISOPTERA: LIBELLULIDAE)

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The various types of sensilla occurring on the labium are described with the help of scanning electron microscopy. In addition to bristles and spines, various sensilla trichoidea are located on the ligula and the palps. The palps also contain sensilla basiconica, a row of papillae and simple pits. The possible functional roles played by these types of sensillum in the life of *C. servilia* are discussed.

INTRODUCTION

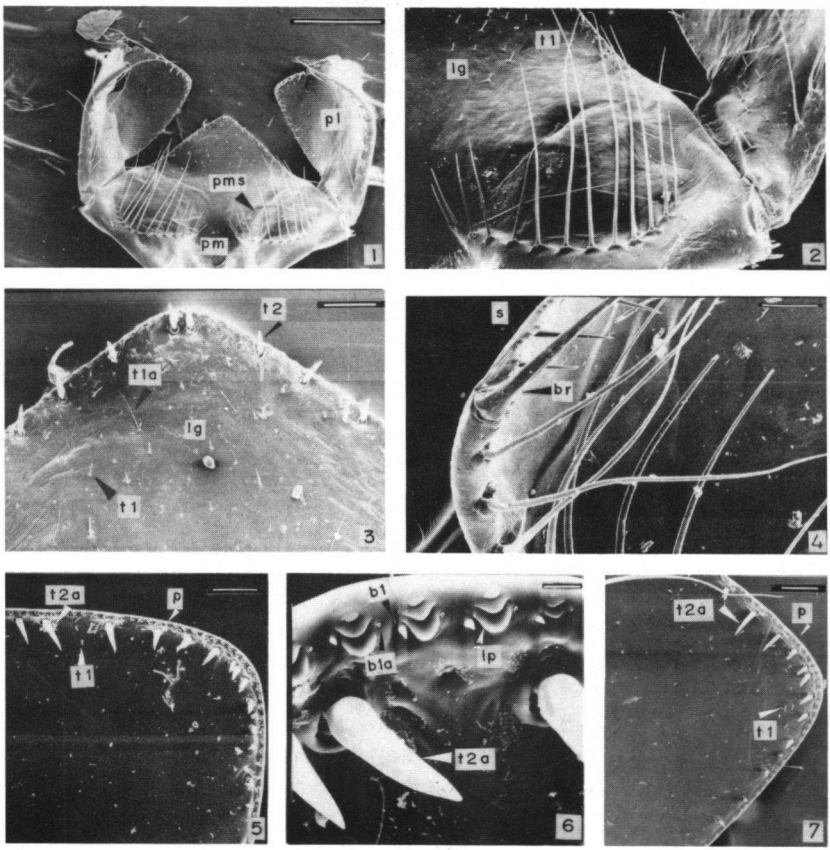
Scanning electron microscopy of the cuticular structures found on the appendages and body surface of aquatic insects has extended our knowledge of the structure of a number of types of sensillum (GOUTEAUX, 1977; SLIFER, 1977; DAHL, 1978; LEE & CRAIG, 1983; KAPOOR, 1985a, 1985b; WOLFE & ZIMMERMAN, 1984). The present study describes the external sensory receptors on the labium of the larval *Crocothemis servilia*. The labium is considered to be a very important structure in odonate larvae. It is folded upon itself and tucked beneath the head ventrally. It is used to capture prey organisms by thrusting it forward. Therefore, a scanning electron microscopic examination of the various types of sensillum present on it is likely to provide a basis for understanding the relationship between the morphology of the larvae and their significant role as predators. Furthermore, as the bristles and other structures on the labium are extensively used in differentiating genera and species in the larval stage, a detailed knowledge of labial structures is likely to be important from a taxonomic point of view.

MATERIAL AND METHODS

Crocothemis servilia inhabits the ponds of Shillong and its neighbouring areas (lat. 25° 34'N; long. 90° 52'E) in the north-eastern region of India. Larvae were collected from Ward lake, a perennial lentic water body in Shillong, from the marginal weed beds. The labium was fixed in 2.5% glutaraldehyde in 0.1 M sodium cacodylate buffer for 2-4 hours. This was followed by washing in buffer, post-fixation in 1% osmium tetroxide, dehydration in graded concentrations of acetone and drying (WOOLLEY & VOSSBRINCK, 1977). It was secured to brass stubs by an electro-conductive paint, 'Dotite'. This was followed by coating with a thin layer of gold in a Fine Coat Ion Sputter JFC 1100. They were examined in a JSM-35 scanning electron microscope operated at 15 KV.

RESULTS

In Odonata, the labium is folded upon itself at about its midlength and turned backward. In *C. servilia*, the labium has well-developed premental setae, which are bristles or sensilla chaetica. The front margin of the prementum is produced into a triangular ligula. The hinged palps are armed with two curved hooks. The palpal margin is beset with bristles and other sensilla (Fig. 1). The premental setae are arranged in a group, somewhat like a bristle-field, each seta emerging from a roughly conical socket. The basal region of both the ligula and the palps bear sensilla trichoidea, designated here as type 1, 28-57 µm long, each with a bulb-shaped socket and a relatively stout basal region tapering sharply towards the apex (Fig. 2). Similar trichoid sensilla, 20-33 µm long are also strewn on the central and apical regions of the ligula. Interspersed among them are a few sensilla trichoidea of type 1a, around 80 µm long. These have similar sockets to those of type 1, but are more slender and whip like (Fig. 3). Sensilla trichoidea designated type 2 are arranged at regular intervals along the front margin of the ligula, forming a definite pattern. They are 33-60 µm long and emerge from circular punctures fringed with collar-like structures. Their tips are relatively blunt (Fig. 3). The proximal outer margin of the palps is beset with a row of long (about 580 µm) bristles with heavily sclerotized bases. A few shorter but sharp-tipped spines can also be seen (Fig. 4). The front and inner margins of the palps contain a row of sensilla trichoidea type 2a, having similar sockets to those of type 2 found on the ligular margin, but with relatively pointed tips. Their length gradually diminishes from about 100 µm in the centre to about 30 µm on the sides. Beyond them, almost along the edge, is a linear row of papillae (Fig. 5). At higher magnification, each type 2a trichoid sensillum can be observed to be associated with a pit about 6 µm in diameter. Each papilla has three lips, diminishing in size from the inner to the outer. On one side of each papilla is a short (3-5 µm) basiconic peg and, on the other side, a still shorter (1-1.5 µm) basiconic peg; these are designated as types 1 and 1a respectively (Fig. 6). Type 1 basiconic pegs are also strewn over the surface of the palps with type 1 sensilla trichoidea (10-23 µm long) interspersed among them (Fig. 7).



Figs 1-7. *Crocothemis servilia*, cuticular structures on larval labium: (1) Labium, general view; (2) Premental setae, magnified; (3) Ligula showing sensilla; (4) Bristles and spines on the outer margin of the palp; (5) Sensilla on the front margin of the palp; (6) ditto, magnified; (7) Surface of the palm with sensilla basiconica and sensilla trichoidea. [lg: ligula; pm: prementum; pms: premental setae; pl: palp; br: bristles; s: spines; p: papillae; l.p: lips of papillae; t 1: sensilla trichoidae, type 1; t 1a: ditto type 1a; t 2: ditto, type 2; t 2a: ditto, type 2a; b1: sensilla basiconica, type 1; b1a: ditto, type 1a. All the bars are 100 μm except those in Figs. 1 and 6, which are 1000 μm and 10 μm resp.]

DISCUSSION

Scanning electron microscopy, because of its large depth of field and high resolving power becomes indispensable for detailed morphology of insect sensilla (SCHMIDT & SMITH, 1987).

Based on the heterogeneity, complexity and abundance of sensilla, the labium appears to be a very important sensory region of the head. This is in keeping

with its functions of capturing and sampling the prey. The basiconic pegs associated with the linear array of papillae on the margins of the palps are likely to be chemoreceptors, as concluded by AMRINE & LEWIS (1978, 1986) for similar sensory structures found in the flea *Cediopsylla simplex*. The ligular and palpal surfaces are clothed in sensilla trichoidea of a few types. These are presumably all mechanoreceptors. However, the longer, more slender ones (type 1a) could also possibly detect the presence of another object without coming into actual contact with it. This would be possible due to a force on the insect caused by the increased drag as it passes an object, or vice verse. Thus any object within 10 to 100 diameters of the insect would be readily detected due to a wave of resistance which would be reflected back against the insect (WOLFE & ZIMMERMAN, 1984). Therefore it appears that *C. servilia,* which is known to be an efficient predator of other insects and fish spawn, could bank upon its array of sensilla to locate and ambush its prey. The premental setae are grouped together in the form of a bristle field, and probably function as proprioceptors in addition to providing useful tactile information to the nymphs (AMRINE & LEWIS, 1978, 1986; SCHMIDT & SMITH, 1987). Thus they are likely to be instrumental in providing feed-back information about the stretching of the palps during prey capture.

The functional significance of the numerous pores on the palps cannot be ascertained at present. AMRINE & LEWIS (1978, 1986) suggested that similar pores found in the flea *Cediopsylla simplex* are openings to epidermal glands which secrete an oily substance. However, their role in aquatic larval stages can only be determined through studies on fine structure, innervation and physiology.

Finally, the occurrence, density and arrangement of the labial sensilla are expected to serve as useful morphotaxonomic characters in species differentiation.

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