Fine Structure and Function of the Sensory Pegs on the Scorpion Pectine

Along the distal part of one side of each lamella of the pectine of the scorpion *Leiurus quinquestriatus* is a field of some 400 sensory pegs. Each peg (Figure 1) is blunt-ended, about 2 μ in diameter and 2 μ long, mounted on a cylindrical base 5 μ in diameter inserted into a pit in the cuticle. The pegs have a thin cuticular covering and are not hinged in any way at their junction with the body cuticle. Under the electron microscope each peg is seen to contain a cylindrical membrane possibly composed of cuticular material. This is concentric with the peg and has a dome-shaped upper end which bears inwardly-directed pleats, usually eight in number (Figure 2). This structure lies in the centre of the peg base and is surrounded by cytoplasmic material without any apparent fine stucture. Pressure from any direction upon the narrower portion of the peg will cause deformation of the pleated arrangement. Thus, this fits well with HOFFMAN's[1] supposition from his electro-physiological findings that the pegs are mechanoreceptors sensitive to deformation. Further, to each pleat is attached a fibre which in cross section can be seen to contain nine fibrils arranged round its periphery. Through these, displacement of the pleats may be conveyed to the sensory cells deeper in the lamella (a complete description of the sensory system will be published elsewhere).

Fig. 1. Electron micrograph of median section through a sensory peg. Scale = 1 μ.

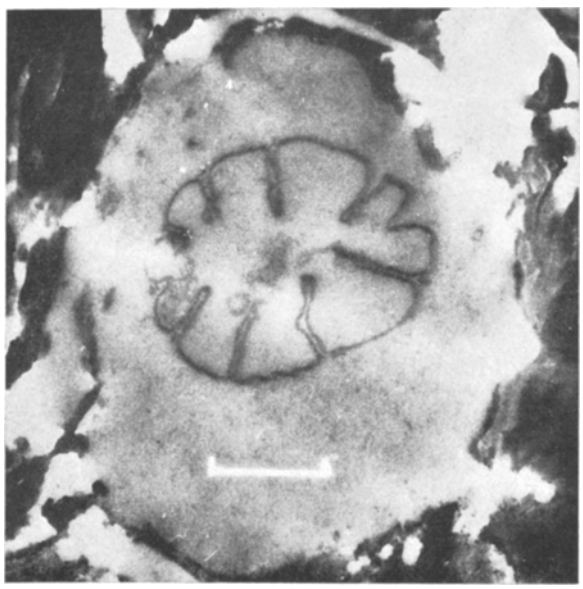

Fig. 2. Electron micrograph of cross section of peg base showing pleated membrane. Scale = 1 μ.

The electrophysiological findings coupled with the morphology of the pegs suggests that the function of the sensory field may be that of sensing the particle size of the substratum. ABUSHAMA[2] has shown that both males and females of this species are unable to distinguish surfaces composed of particles of 0.5 mm diameter from a smooth surface, but that they avoid surfaces made up of larger particles, preferring a smooth surface. Painting the pectines with varnish rendered the scorpions insensitive to the substratum, indicating that they were essential for this discrimination.

Any one sensory field is approximately 0.5 mm in length and 0.05 mm broad along most of its length. If the substratum were made up of uniform spheres of 0.5 mm diameter, such a field could be stimulated at its two ends if it were placed lengthwise across two adjacent spheres. With larger particles, however, the field would be expected to be stimulated in one part only of its length, since if held horizontal it would not be long enough to bridge the gap between spheres. On a smooth surface the proportion of the pegs stimulated would approach 100%. Thus, distinction between particle size could be based on the proportion of the pegs stimulated.

Substratum selection is important during courtship when the male deposits his spermatophore and leads the female to it[3]. The male selects the place very carefully and prefers if possible a solid surface. Removal of the pectines brings courtship to a halt. In the past it has been argued that the presence of pectines on both sexes vitiates the theory that they are of importance in this apparently uniquely masculine role. However, choice of substratum clearly is of importance at other times[2]; both sexes show the same preferences. Thus the presence of pectines bearing these sense organs, in both sexes is no obstacle but support for the theory that they are used to detect the form of the substratum as electrophysiological and electromicroscopic evidence suggests.

Zusammenfassung. Elektronenmikroskopische Untersuchungen der Sensillen auf dem kammförmigen Organ des Skorpions *Leiurus quinquestriatus* zeigen einen Bau, welcher einer Reaktion auf mechanische Deformierungen besonders angepasst scheint. Die Funktion dieser Sinnesorgane wäre die Erkennung der Partikelbeschaffenheit des Untergrunds.

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[2] F. T. ABUSHAMA, Anim. Behav. *12*, 140 (1964).
[3] A. ALEXANDER, Proc. zool. Soc. *133*, 145 (1959).