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THE STRUCTURE AND FUNCTION OF THE STERNAL GLAND IN *ZOOTERMOPSIS NEVADENSIS* (HAGEN) AND ITS ROLE IN BEHAVIOUR

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There are two components in the transmission of non-catastrophic alarm and food finding in the termites *Zootermopsis nevadensis* (Hagen) *and Nasutitermes corniger* Motschulsky. The first is the side to side « yawing » movements and bumping into other termites. The intensity of this movement is monitored by the intensity of the primary stimulation (cause of alarm or food). This movement alerts other termites to a greater or less extent depending again on the intensity of the primary stimulation. The second component is a directional one and is a trail laid down by the alarmed termites. Alerted animals are recruited by this trail to the site of initial alarm or finding of food. Trail laying is thus an important part of the behaviour of these termites and it has been found previously that the trail is a chemical one consisting of a pheromone produced in the sternal gland of the termites.

It is considered that alarm and food finding are merely the same phenomenon in different intensities as GRABENSBERGER (1933) claimed. It is postulated here that elaborate foraging in the higher termites e. g. *Nasutitermes* has evolved from the more primitive alarm behaviour such as is shown today in *Z. nevadensis* which does nos construct long foraging trails outside its very primitive nest.

To shed light on the functioning of the sternal gland a detailed study of it using classical histology and electron microscopy has been carried out.

The sternal gland of the termite *Zootermopsis nevadensis* (Hagen) is a swelling of the epidermis in the region of the fifth abdominal sternite that secretes a trail-laying pheromone. The gland is three layered. The cells immediately abutting the cuticle are columnar with microvillous borders at their apical ends. Their cytoplasm contains numerous smooth membrane-bound cisternae and bundles of microtubules. The microtubules insert on a pouchlike invagination of the cell membrane and the conjunction is considered to represent a new organelle. At the lateral borders of the columnar cells, septate desmosomes are present. The basal surfaces contain osmiophilic deposits probably

representing glycogen and they interdigitate with the second layer whose cells characteristically show large electron-transparent granules that may contain secretion The third layer is composed of pyramidal cells that lie against the basement membrane. The cuticle above the gland is a fibrous meshwork whose interstices are packed with what way be lipid micelles. At intervals the meshwork is pierced by campaniform sensilla. The central element of the sensillum has a typical 9 + 0 organization at is proximal end and balloons distally. The element is surrounded by a scolopale and by microvilli. The campaniform sensilla are considered to be proprioceptors responding to pressure when the insect lays a tract by pressing its abdomen to the ground. A degres of control over the amount of pheromone deposited is thus possible.

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REFERENCE

GRABENSBERGER (W.), 1933 : Untersuchungen über das zeitgedächtnis der ameisen und termiten. *Z. vergl. physiol. 20,* 1-54.

Intervention de M^me^ NOIROT.

1° Quel fixateur a été utilisé?

2° Quelle est le diamètre des microtubules des cellules columnaires? Ces microtubules sont-ils analogues à ceux décrits récemment par PORTER...?

Réponses de M. STUART.

1° 1% osmium in veronal acetate.

2° Le diamètre des microtubules est 22 mμ.
They seem to be.

Intervention de M. HOWSE.

I would like to ask a question concerning the nature of the rounder camponiform sensilla. I have found such sensilla on the leg of *Zootermopsis* and there is a clear discontinuity in the rim of these organs in the same axis of the leg and the same axis as the bow in the normal oral type of sensillum. I have suggested that these organs will also respond stern forces, but those at right angles to the main axis. Such

sensilla would be well suiter to registering bending movements of the sternum around the sternal gland. I wonder if, in fact, you have the same type of sensillum that I have found?

Réponse de M. STUART.

The sensilla on the fifth abdominal sternite are quite round and show no asymmetry.

Intervention de M. PASTEELS.

Je suis surpris de voir combien la glande sternale de *Zootermopsis* est différente et plus complexe que celle de *Nasutitermes lujae?* Chez *Nasutitermes,* la glande est parfaitement délimitée, sans transition à l'arrière avec l'hypoderme. On n'y trouve que deux types de cellules glandulaires. Les sensilles campaniformes sont situées uniquement à l'arrière de la glande, le long d'une ligne qui se prolonge dans l'hypoderme voisin, bordant l'avant du sternite.

M. NOIROT, qui a examiné de nombreuses espèces pourra peut-être nous dire si chez d'autres Termites primitifs, on rencontre une structure semblable à celle de *Zootermopsis.*

Intervention de M. NOIROT.

(après intervention de M. PASTEELS).

D'après nos recherches histologiques portant sur de nombreuses espèces, la glande sternale paraît avoir une constitution assez variable dans le détail. Chez les Termitidae, on a en général une glande très bien individualisée, avec deux catégories de cellules; chez *Anacanthotermes,* la structure est particulièrement complexe, avec une glande en deux parties; chez *Mastotermes* (où il y a 3 glande, sur les 3e, 4e et 5e sternites), il semble n'y avoir qu'une seule catégorie, etc...
(après réponse de M. STUART qui cite le travail de Bernardini Mosconi).

Chez certains Termitidae, il paraît exister un espace entre la cuticule et l'épithelium (mais s'agit-il d'un artefact de fixation?); parfois même (*Termes*) on voit dans cet espace des granulations fortement sidérophiles qui représentent peut-être une sécrétion.