THE HINDGUT ULTRASTRUCTURE, AND EXCRETORY PRODUCTS OF LARVAE OF THE IMPORTED FIRE ANT, 
Solenopsis invicta Buren *
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SUMMARY

The ultrastructure and excretions of the hindgut of larvae of the imported fire ant, Solenopsis invicta Buren, is described. The anterior or base of the hindgut is closed and rooted (via the "dome") in the posterior wall of the midgut, and is composed of basal cells of both the malpighian tubules and the small intestine (ileo-colon). The ileo-colon opens via a rectal valve into the rectum and transfers uric acid (white excretion) secreted by the malpighian tubules, into the rectum. The thin walled rectal epithelium has three rectal pads composed of large, cuboidal cells. The excretory product of larvae consists of 2 components, a white precipitate composed of uric acid and a clear liquid consisting of water and salts. Ultrastructural and observational studies suggest that the rectal pads and malpighian tubules secrete the clear fluid from the hemolymph. Results of experiments with the waste products indicate that larval excretions are not ingested by other members of the colony except adults which under water stress do consume some of the clear liquid. The adults do participate in the removal of the excretory products from the brood chamber.

RESUME

L'ultrastructure de l'intestin postérieur et les matériaux excrétés chez la larve de la « Fourmi de feu » Solenopsis invicta Buren

Nous décrivons dans cet article l'ultrastructure et la fonction de l'intestin postérieur chez la « fourmi de feu » Solenopsis invicta Buren. La base de l'intestin postérieur est fermée et insérée (par le "dôme") dans la paroi postérieure de l'intestin moyen ; elle est composée de cellules basales provenant à la fois des quatre tubes malpighiens et de

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l'intestin postérieur (ileo-colon). L'ileo-colon débouche, grâce à une valve rectale, dans le rectum, et y déverse de l'acide urique (excrétion blanchâtre) sécrété par les tubes maliphiqiens. L'épithélium rectal à paroi mince possède trois papilles rectales composées de grosses cellules cuboides. Les matériaux excrétés par la larve consistent en deux éléments: un précipité blanc composé d'acide urique et un liquide clair composé d'eau et de sels. Les observations ultrastructurales suggèrent que les papilles rectales et les tubes maliphiqiens sécrètent le liquide clair à partir de l'hémolymphe; les résultats d'expériences menées sur les excréments indiquent par ailleurs que les excréptions larvaires ne sont pas ingérées par les autres membres de la colonie, à l'exception des adultes qui mangent du liquide clair en cas de déficit en eau. Les adultes transportent les matériaux excrétés hors du nid.

INTRODUCTION

A control measure for the imported fire ant Solenopsis invicta Buren, a serious pest in the southeastern United States, may involve the use of food baits which are fed directly to the larvae (PETRALIA and VINSON, 1978). The success of this idea will require an adequate knowledge of the biology of the larvae, particularly nutrient cycling and the fate of various components in the food. To this end, the feeding behavior (PETRALIA and VINSON, 1978), external (PETRALIA and VINSON, 1979), and internal anatomy (PETRALIA and VINSON, 1980) of larvae have been described.

It is important to determine the excretory products of larvae and how these products are handled by adult workers. O'NEAL and MARKIN (1973) report that the excreta of the larvae consist of 2 separate fractions, a white precipitate and a clear watery excretion. They suggest that workers ingest the white precipitate and discard the clear excretion. This, in turn suggests that the white excretory product may contain nutrients recycled in the colony. In support of this, amino acids have been found in the excreta of larvae of other ants (MASCHWITZ, 1966; WÜST, 1973). However, no chemical analysis has been done on the excretion of imported fire ant larvae.

BONAVITTA, COUGOURDAN and POVEDA (1972) report that the midgut may connect to the hindgut via a "filtering organ" which allows excess water to pass directly from the midgut into the hindgut to eventually be ingested again by the adult workers (LE MASNE, 1953) but ATHIAS-HENRIOT (1947) suggests that excess water might be removed from the hemolymph via the rectum.

Although the general anatomy of the hindgut of the larvae of fire ants has been described (PETRALIA and VINSON, 1980) as well as that of other ants (PÉREZ, 1902; ATHIAS-HENRIOT, 1947; LAPPAO, 1958; NITSCHMANN, 1959; BONAVITTA-COUGOURDAN and POVEDA, 1972), no ultrastructural examination has been reported.

We report on the ultrastructure and physiology of the larval hindgut,