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Little Cicada of Sugarcane *Mahanarva posticata* (Homoptera: Cercopidae). A Brazilian Agricultural Pest. Morpho-histological Study of Salivary Glands

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Summary Little cicadas are homopteran insect pests of sugarcane plantations. As these insects suck out the sap from the leaf parenchyma, they inoculate a toxic saliva that damages the plant vessels, thus promoting the loss of glucose by the affected plant. The morphological and histological analyses of the salivary glands of the little cicada *Mahanarva posticata*, revealed that these glands are formed by 2 portions: one portion comprises a group of acini and has been denominated as the principal gland; the second portion is filamentous in nature and has been denominated as the accessory gland; it is formed by very long and fine filaments. The acinous portion of the gland can be subdivided into 2 lobes: an anterior lobe formed by 3 lobules (I, II, III), and a posterior lobe formed by lobule IV and the excretory duct. Histologically, the salivary glands showed that the filaments are empty sutructures composed by several internal channels with secretion granules being observed in the cytoplasm of the cells of the secretory filaments. Lobules I and II of the principal gland are characterized by being highly basophilic and for accumulating a large amount of secretion in both the cytoplasm of the cells and inside secretion vesicles. Histochemically, we verified that the secretion produced by these glands is lipidic and protein in nature, with the production of polysaccharides being very low. The differences in stain and appearance of the different regions of the salivary gland lead us to believe that the final glandular product is lipoproteic in nature.
Key words Salivary glands, Little cicada of sugarcane, *Mahanarva posticata*, Ultramorphology, Histology, Histochemistry.

Little cicadas belong to the suborder Homoptera, order Hemiptera (Bertels 1956). The sucking mouthparts of these insects indicate a special organization and, in addition to being intimately associated to the salivary glands, are appropriate to penetrate the vegetal tissues from which the insect sucks the sap (Barnes and Ruppert 1996, Bertels 1956, Gillott 1995, Lara 1979). The salivary glands of the Homoptera are paired structures with ducts that are joined to form a medium salivary duct, which opens inside the pre-oral cavity (Imms 1949, Richards and Davis 1983, Wigglesworth 1974).

The little cicada *Mahanarva posticata* causes serious damages to the plants when sucking the sap, such as the "burnt" leaves often seen in sugarcane plantations. This effect is caused because as the insects suck the sap from the leaf parenchyma, they inoculate a toxic saliva that breaks down the molecular structure of the leaf (Gallo *et al.* 1978, Guagliumi 1972, Nakano 1981). This breakage facilitates the suction of nutrients by the insect and damages the plant vessels, thus promoting the

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loss of glucose by the affected plant (Nakano 1981).

The internal morphology of these insects is almost completely unknown, with the exception of a few works concerning the reproductive organs with the objective of establishing an evolutionary and taxonomical investigation for this group (Nur 1962), and a brief study made by Tsai and Perrier (1996) regarding the morphology of the reproductive and digestive systems.

This work has the objective of performing morphological, histological, and histochemical analyses of the salivary glands of the *M. posticata* through the use of various techniques for histology, histochemistry and Scanning Electron Microscopy (SEM) in order to fill the blanks that exist with regards to the basic internal morphology and physiology of these insects.

Material and methods

Male and female of little cicada *Mahanarva posticata* were collected in the plantations of sugarcane from Miracatu, SP, Brazil. The individuals were maintained in the refrigerator for thermal shock anesthesia and dissected in saline solution.

Ultramorphology-Scanning Electron Microscopy (SEM)

The salivary glands from little cicadas were removed, fixed in Karnovsky for 24 h and dehydrated in a graded 70–100% ethanol and acetone series. The material was processed by criptal point drying, sputtered with gold and examined by Phillips 505 SEM.

Histology and histochemistry

The salivary glands from *M. posticata* were removed and fixed in paraformaldehyde 4%, Bouin's solution and formalin 10%, depending on the technic employed. Dehydration was effected in an alcoholic series (70, 80, 90, 95%) at 15 min intervals. Infiltration was made with JB-4 resin at 4°C in a dark bottle. The specimes were embedded in moulds, at 4°C to retard premature polymerization. The moulds with material were filled and covered with JB-4 resin and polymerization was completed at room temperature in 90 min.

Sectioning was carried out (4 μm) with a dry glass knife. The sections were collected and transferred to a room temperature water bath before being placed on cleaned glass slides. They were air dried before staining with Hematoxylin and Eosin, Bromophenol Blue (for protein detection), PAS/Alcian Blue (for polysaccharids detection) and Nile Blue (for lipids detection). In the Nile Blue technique the sections were submited to the Hematoxylin stain to show the nuclei presence.

Results

Our results revealed that the salivary glands of males and females of *Mahanarva posticata* are paired structures located laterally in the region between the head and the thorax. Two portions compose these structures, a) an acinous portion that was denominated as the principal gland, and b) a filamentous portion that was denominated as the accessory gland (Figs. 1, 2a, c). In the acinous portion we noted the presence of spherical structures that resembled acini. This portion was subdivided into 2 lobes: an anterior lobe composed by 3 lobules (I–III) and a posterior lobe comprising lobule number IV and the excretory duct (Figs. 1, 2a–c, 3a, b). Observations of the lobules' surface of the secretory portion made through scanning electron microscopy (SEM) showed that there are 2 distinct regions, *i.e.*, the acini of lobule I present a highly creased surface, in contrast to the other lobules (II–IV) that show a smoother and more homogeneous surface (Figs. 1, 2b, c, 3a).

The filamentous portion of the salivary gland is composed by structures that resemble very long and fine filaments that end in a blind edge (Figs. 1, 2a, 3c) and are then inserted into the medi-

Table 1. Histochemistry results of little cicada *Mahanarva posticata* salivary glands

Test applied	Lobule I	Lobule II	Lobule III	Lobule IV	Filament cells
Bromophenol blue	+++	+++	++	++	+++
Nile blue	+++	+++	+++	+++	+++
PAS/Alcian blue	++	+	+	−	−

+++ strong positivity, ++ intermediate positivity, + weak positivity, − negative.

an portion of the main gland, between lobules III and IV, surrounding the acini (Figs. 1, 2a, c, 3a). The filaments can reach a length of 3 to 4 mm.

The region comprised by the acini is located near the head, while the filamentous region flanks the digestive tract in direction to the posterior end of the animal's body.

Histology of accessory glands (filamentous portion)

The filaments of the accessory glands appear as empty structures composed by several internal channels (Fig. 7). The cells of these filaments possess large nuclei, which are extremely elongated and ramified showing an accumulation of condensed chromatin inside them (Fig. 7a–d).

A cuticle envelops the interior part of the internal channel and separates the epithelium from the secretion; it probably functions as a protection barrier for the epithelium against the action of the secretion running inside it (Figs. 4a, 7a).

The secretion of the filaments was also observed in the cytoplasm of the secretory cells and is characterized by its granular appearance (Fig. 7a).

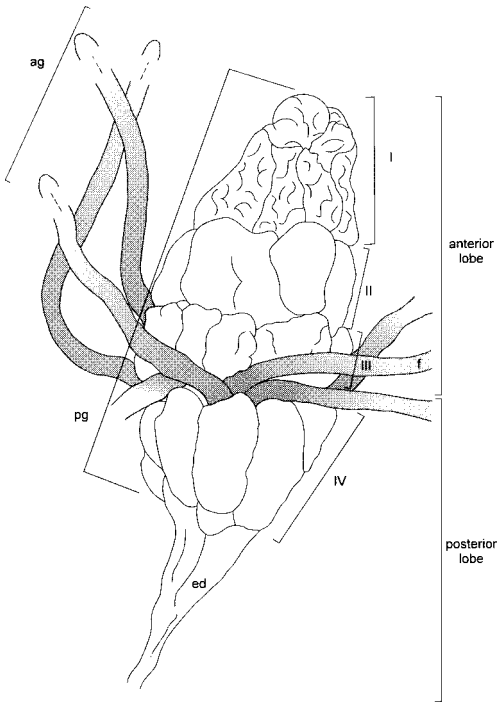

Fig. 1. Salivary gland of little cicada *Mahanarva posticata*. The anterior lobe (lobules I, II and III) and posterior one (lobule IV and excretor duct (ed) both constitutes the principal gland (pg) and filaments (f) constitute the accessory one (ag).

The filaments that compose the accessory glands open and release their secretion into a common collecting duct that runs through the gland longitudinally, penetrating all the lobules (Fig. 6). This duct also collects the secretion produced by the principal gland and sends it to the excretory duct.

Histology of principal gland (acinous portion)

The acinous portion of the salivary gland of *M. posticata* is a morphologically complex structure that presented several distinct regions (Fig. 4a–d). Its cells are arranged in groups forming acini, which are joined forming the lobules and lobes (Fig. 4a).

Anterior lobe

Lobule I This lobule is located at the apex of the salivary gland, being characterized by an

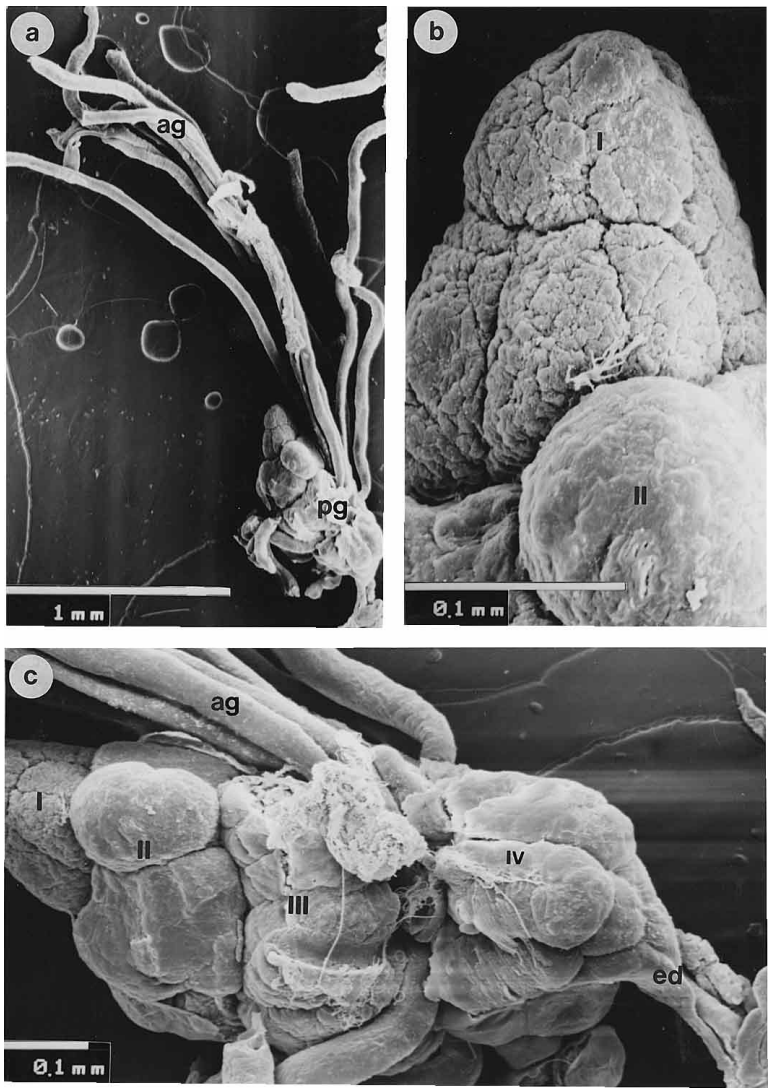

Fig. 2. Scanning electron microscopy (SEM) of little cicada *Mahanarva posticata* salivary glands. a) General view of the gland. pg=principal gland, ag=accessory gland. Bar=1 mm. b) Acines of lobules I and II, showing the surface differences. Bar=0.1 mm. c) Detail of principal gland with I, II, III and IV lobules and excretor duct (ed). ag=accessory gland. Bar=0.1 mm.

accumulation of secreroty vesicles inside its cells (Fig. 4a, b). These vesicles possess varying sizes and morphologies, suggesting that smaller secretory vesicles might be fusing in order to form larger ones (Fig. 4a). We observed the existence of intracellular canaliculi that run through this region collecting the secretion, as well as the existence of a cuticle that envelops this region internally (Fig. 4a, b).

We observed 2 different kinds of secretions in the cells of lobule I, 1) a granular secretion distributed throughout the cytoplasm and 2) another secretion characterized by being clearer and more fluid, which is contained in vesicles that do not appear granular in any way (Fig. 4a, b). The cells of this lobule also presented cells with large nuclei that are extremely elongated and ramified (Fig. 4b).

Lobule II This lobule was characterized by being the most basophilic of all; however, its histological characteristics and the secretion it contains are very similar to the ones described for lob-

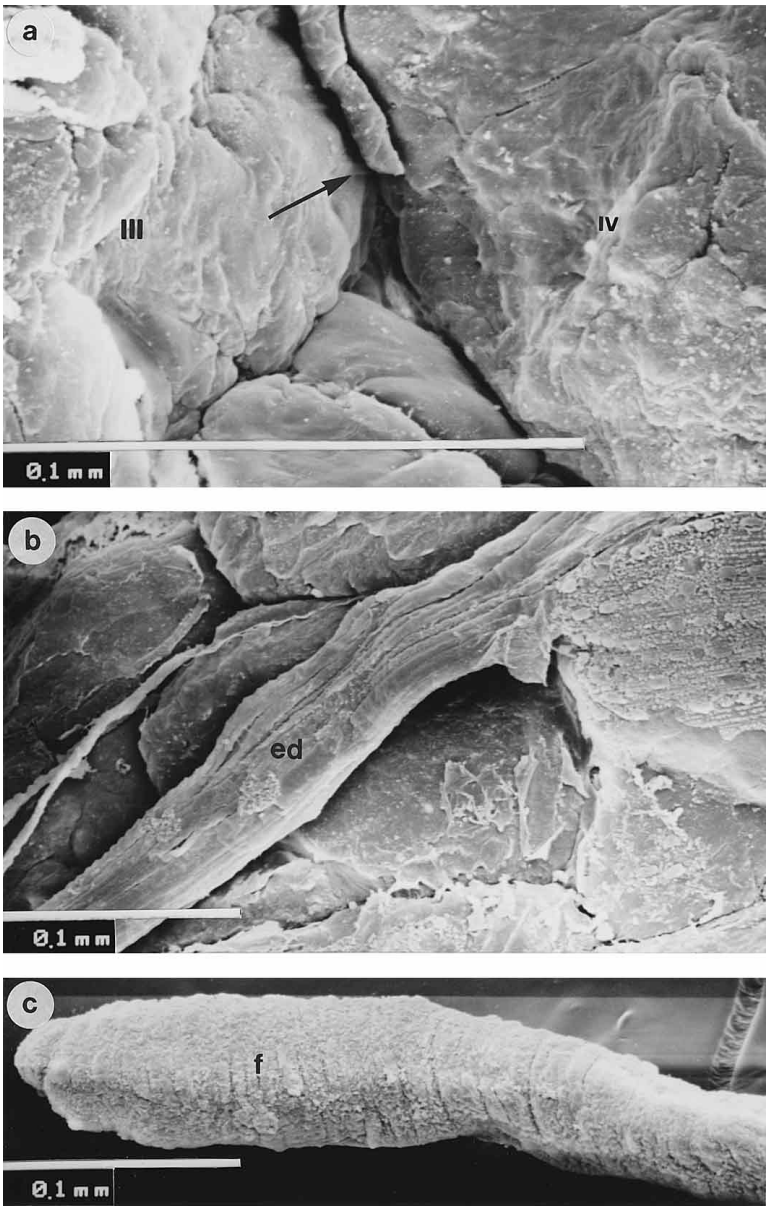

Fig. 3. Scanning electron microscopy (SEM) of little cicada *Mahanarva posticata* salivary glands. a) Surface of lobules III and IV. Arrow=filaments insertion region. Bar=0.1 mm. b) Excretor duct detail (ed). Bar=0.1 mm. c) Terminal end of filament (f). Bar=0.1 mm.

ule I (Fig. 4a, c). Inside the cytoplasm we also noted the presence of canaliculi, which probably collect and send the secretion to the common excretory duct (Fig. 4c). Nuclei with the same characteristics described previously were also observed in the cells of this lobule (Fig. 4c).

Lobule III The histological analysis showed that this lobule presents a lesser intensity in staining, which might indicate that this region produces a lesser amount of secretion, or that the secretion is of a different kind than the one produced in lobules I and II (Fig. 4a, d).

In the central region of the acini of this lobule we noted the presence of large, elongated, and highly ramified nuclei that are characterized by the large amount of heterochromatin they contain

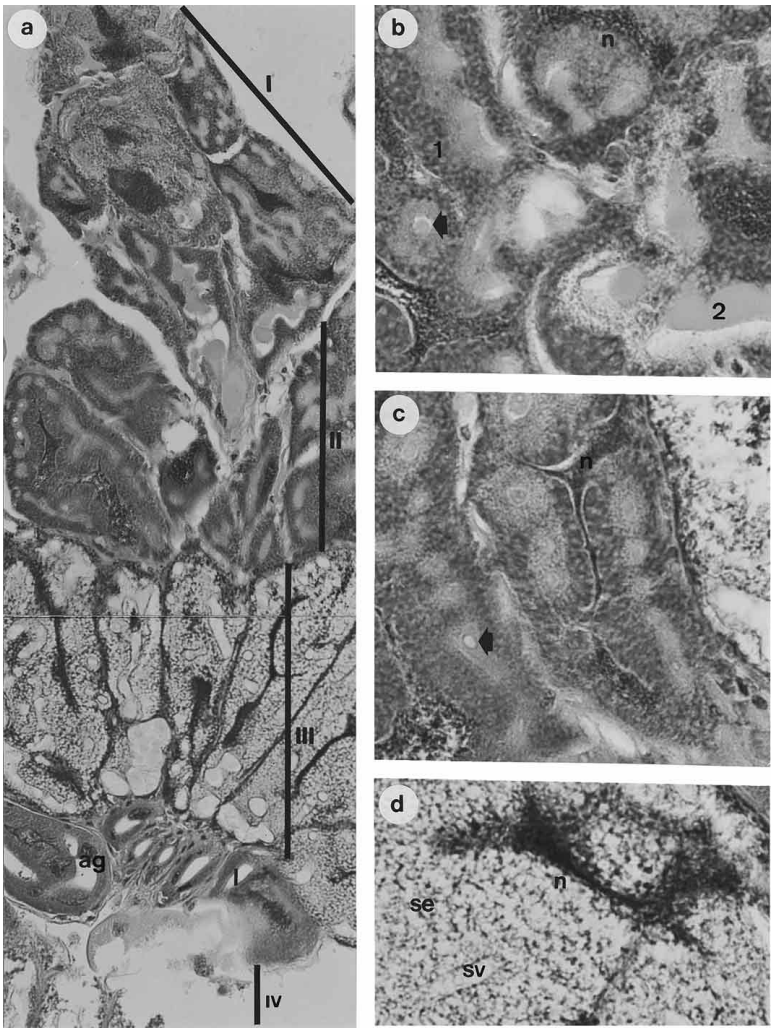

Fig. 4. Histological section of *Mahanarva posticata* salivary gland, stained with Hematoxylin and Eosin. a) General view of I, II, III and IV lobules of principal gland. ag=accessory glands, l=lumen. Magnification=111×. b) Detail of lobule I showing different secretions. 1=secretion with little granulation and weak stained, 2=fluid secretion into vesicles, n=nucleus, arrow=canaliculi. Magnification=278×. c) Lobule II detail showing intracell canaliculi (arrow). n=nucleus. Magnification=278×. d) Detail of lobule III. se=secretion, sv=secretion vesicle, n=nucleus. Magnification=278×.

(Fig. 4d). In this portion, the presence of a fluid secretion contained in vesicles can also be noted, as well as a granular secretion that is basophilic and more disperse located throughout the cytoplasm (Fig. 4d).

Posterior lobe

Lobule IV This lobule is found located immediately bellow the point of insertion of the accessory glands, keeping a close contact with them, in the same way as lobule III. This lobule was characterized by a weak staining and little accumulation of cytoplasmic secretion (Fig. 4a). This fact indicates that there might be a lesser production of secretion in this region when compared to the other lobules.

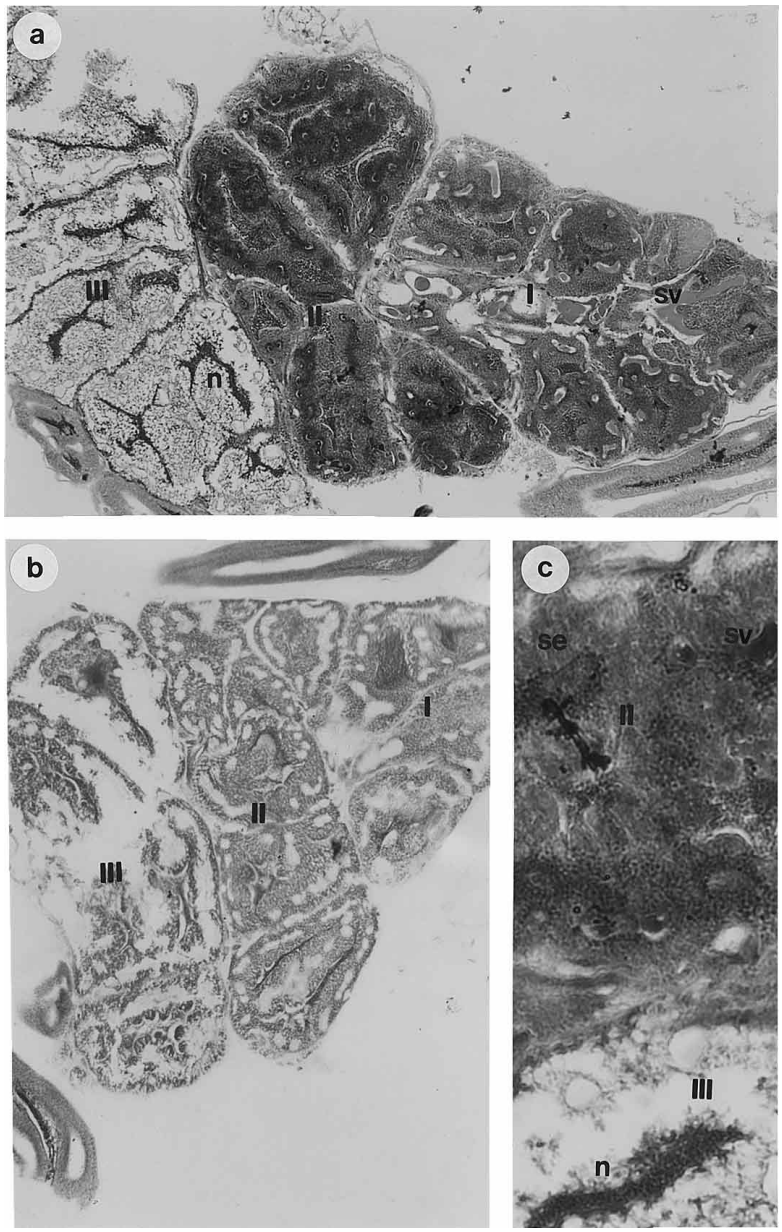

Fig. 5. Histological section of *Mahanarva posticata* salivary gland stained with Bromophenol Blue and Nile Blue. a) General aspect of the principal gland showing staining differences in I, II and III lobules, stained with Bromophenol Blue. sv=secretion vesicle, n=nucleus. Magnification=88×. b) Histological section of *Mahanarva posticata* salivary gland stained with Nile Blue.—Principal gland. Lobules I, II and III details. Magnification=88×. c) Lobules II and III detail, stained with Bromophenol Blue. se=secretion, sv=secretion vesicle, n=nucleus. Magnification=136×.

Histochemistry

Bromophenol blue (protein detection)

Accessory glands (filamentous portion) The accessory glands appeared highly positive to this test, indicating the presence of cells that produce a secretion with a high amount of proteins.

The epithelial cells that constitute the secretory filaments presented a secretion characterized

by a fine positive granulation, which was distributed throughout the cell's cytoplasm (Fig. 7b). In this portion we also observed strongly stained nuclei due to the presence of acidic proteins inside them (Fig. 7b).

Principal gland (acinous portion) The principal gland presented different degrees of staining; however, all the lobules, including the granules and the secretory vesicles, appeared strongly positive, indicating a high degree of proteins in the secretion produced (Fig. 5a, c).

This technique confirmed the presence of 2 types of secretion (strongly positive) in lobule I: one of them is more fluid and is contained inside secretion vesicles and the other shows granular characteristics and is distributed throughout the cytoplasm of the secretory cells (Fig. 5a).

Lobule II also presented an accumulation of a proteic secretion in the form of vesicles that possess a more fluid secretion, as was seen in the cells of lobule I (Fig. 5a, c). This lobule appeared more positive to this test than the other lobules. The many secretion vesicles that are found in this lobule also reacted strongly positive to this test, although more positive than the vesicles found in lobule I. The differences in staining of the secretion might be due to the maturation stage in which the secretion is or to its own composition.

Lobules III and IV appeared less stained; nevertheless, in these lobules we evidenced an irregular nuclear morphology (Fig. 5a, c).

Nile blue (lipids detection)

Accessory glands (filamentous portion) The filaments reacted positively to this test, with the secretion appearing highly lipidic in nature. This secretion was distributed throughout the cells' cytoplasm and was characterized by a fine granulation (Fig. 7c).

Principal gland (acinous portion) In the principal gland, the granular secretion that is found in the cells' cytoplasm was positive to this test; however, the secretion found in the lumen of the acini and inside the large secretion vesicles of lobules I and II was not stained (Fig. 5b).

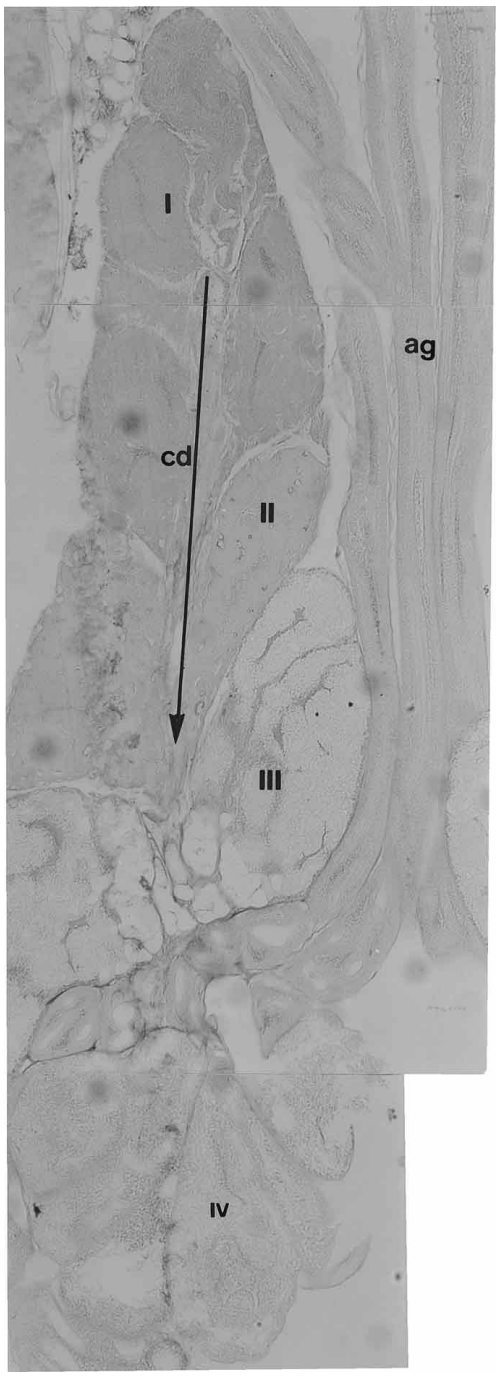

Fig. 6. Histological section of *Mahanarva posticata* salivary gland stained with PAS/Alcian Blue, showing lobules I, II, III and IV of principal gland. ag=accessory glands, cd=comum colector duct running longitudinally into salivary gland. Magnification=87×.

This test showed clearly that lobules III and IV produce a secretion that contains more lipids than proteins or polysaccharides, since they appeared more strongly stained by this technique than

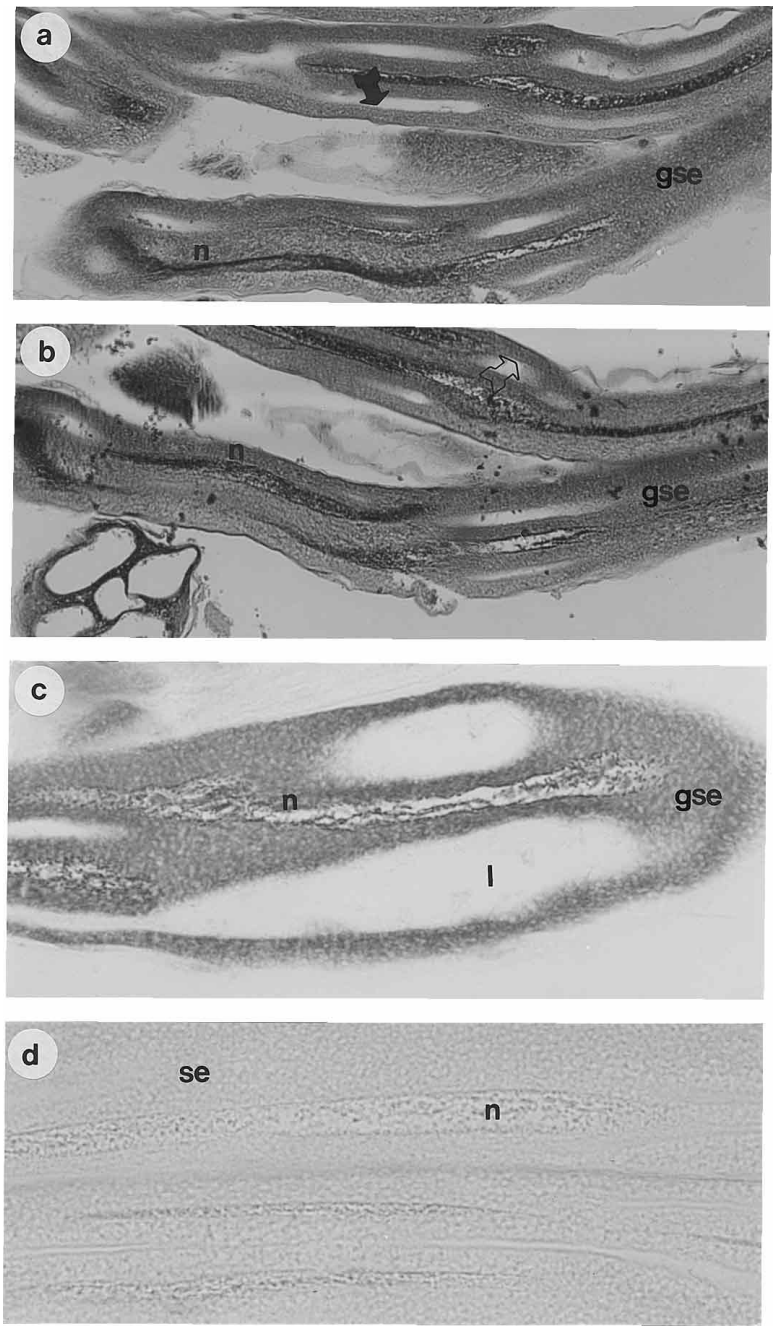

Fig. 7. Histological section of *Mahanarva posticata* accessory glands. a) Longitudinal section through the filament. arrow=cuticle, n=nucleus, gse=granular secretion. Magnification=142×. b) Filament longitudinal section of *Mahanarva posticata* accessory glands, stained with Bromophenol Blue. gse=granular secretion, n=nucleus, arrow=cuticle. Magnification=142×. c) Filament longitudinal section of *Mahanarva posticata* accessory glands, stained with Nile Blue. gse=granular secretion, l=lumen, n=nucleus. Magnification=355×. d) Filament longitudinal section of *Mahanarva posticata* accessory glands, stained with PAS/Alcian Blue. se=secretion, n=nucleus. Magnification=355×.

by the other applied (Fig. 5b).

PAS/Alcin blue (polysaccharids detection)

In general, the salivary gland of *M. posticata* did not react positively to the test for the detection of polysaccharides. This result suggests that the secretion produced by this gland does contain polysaccharides, but in low concentrations (Fig. 6).

Accessory glands (filamentous portion) The filaments of the accessory glands appeared poorly stained by this technique, although it allowed the observation of a granular secretion in the cells' cytoplasm (Figs. 6, 7d).

Principal gland (acinous portion) Lobules I and II (Fig. 6), although poorly stained, appeared more evident when compared to the rest of the principal gland. In the cytoplasm of the cells of these 2 lobules we verified the presence of a granular secretion that was not concentrated. Lobules III and IV appeared less stained; nevertheless, we observed a granular secretion distributed throughout the cytoplasm of their cells (Fig. 6).

Discussion

The salivary glands of insects are paired structures located in the region between the head and the thorax (Chapman 1998).

In little cicada bug, very little is known about this gland. This bug is an insect that has caught the attention of researchers and sugarcane growers in recent years since it is showing characteristics of an emergent pest. As this insect sucks the sap from the plant, it inoculates toxic substances that cause the yellowing of the leaves, thus hampering the photosynthetic process and reducing the production of sucrose by the affected plant (Guagliumi 1972, Nakano 1981).

In the past, sugarcane in Brazil was harvested by hand and the stems were then burnt. Nevertheless, nowadays the burning process is forbidden and the harvest is being done mechanically. In consequence, this process has allowed the survival and proliferation of these insects, since the eggs are not destroyed and have the chance to survive and produce new individuals.

This study presents the first morphological data concerning the salivary glands of the sugarcane little cicada *Mahanarva posticata*. We observed that these glands are paired structures and are located in the region between the head and the thorax of the insect, one at each side. The glands showed an acinous portion (composed by acini) that was denominated as the principal gland, and a filamentous portion that was denominated as the accessory gland. The principal gland was subdivided into anterior and posterior lobes; these lobes were in turn subdivided into lobules I, II and III (anterior lobe) and lobule IV plus an excretory duct (posterior lobe). This description agrees with the one made by Nunes and Camargo-Mathias (2001) for the salivary glands of the little cicada *Mahanarva fimbriolata*. In short way, the salivary gland of *Mahanarva posticata* would be constituted:

Salivary gland
- Acinous portion (Principal gland)
  - Anterior lobe (Lobule I, II, III)
  - Posterior lobe (Lobule IV, Excretor duct)
- Filamentous portion (Accessory glands)
  - Filaments

The morphology of the salivary glands of *M. posticata* is also very similar to the description made by Tsai and Perrier (1996) for the salivary glands of *Dalbulus maidis* and *Graminella nigrifrons* and by Wayadande *et al.* (1997) for the salivary system of *Circulifer tenellus* and *D. maidis*; these species also presented paired glands, with the same location, and subdivided into principal and accessory glands. Anterior and posterior lobes also composed the principal gland in these insects; however, while in *M. posticata* we observed that the anterior lobe was formed by lob-

ules I, II, and III, the anterior lobe of *D. maidis* and *G. nigrifrons* was formed by 2 acini and a spherical appendix. This description differs from our observations in *M. posticata* and the obserrvations of Nunes and Camargo-Mathias (2001) in *M. fimbriolata*, which do not possess this type of appendix. Nevertheless, the division of the lobes into acini can also be confirmed for the salivary glands of *M. posticata*.

The accessory glands of *M. posticata* are constituted by very long and fine filaments, which are inserted into the median portion of the principal gland, between lobules III and IV, all in the same region surrounding the acini. This description was also confirmed in *M. fimbriolata* (Nunes and Camargo-mathias 2001).

Studies made by Tsai and Perrier (1996) concerning the salivary glands of *D. maidis* and *G. nigrifrons* did not reveal the presence of a filamentous portion as we observed in *M. posticata*. Wayadande *et al.* (1997) described in *C. tenellus* the presence of a large accessory gland with multicellular lobes, while in *M. posticata* the accessory glands consist of a group of filaments.

The morphological studies revealed that lobule I of the acinous portion of the salivary gland showed a highly creased surface when compared to lobules II, III, and IV, which appeared smoother and more homogeneous. In contrast, for *M. fimbriolata*, lobules I and III of the anterior lobe and lobule IV of the posterior lobe, presented a more creased surface than lobule II (Nunes and Camargo-Mathias 2001).

The lobules of the salivary glands in Homoptera are generally composed by acini and some authors consider that the variation in number and morphology of the acini among the various species of cicadas is due to age and other physiological factors (Tsai and Perrier 1996). Nevertheless, it is more widely accepted that such variation is probably a characteristic of the genus or species that can sometimes be related to environmental factors.

The salivary glands of *M. posticata* do not possess a reservoir for the storage of the secretion, which was also confirmed for the species *M. fimbriolata* (Nunes and Camargo-Mathias 2001). Thus, it is believed that as the saliva is produced it is immediately released to the exterior or, if it were stored it would be in the form of secretion granules.

Throughout the extension of lobule IV there is an excretory duct that leads the secretions produced by the gland towards the exterior. The diameter of the gland is narrower at the region of the duct, and it widens abruptly in the direction of the acinous portion of the gland. This was also observed in *M. fimbriolata* (Nunes and Camargo-Mathias 2001).

Occupying large extensions in the filaments of the accessory glands and in the acini of the principal gland of *M. posticata*, we found large nuclei, which were extremely elongated and ramified. This observation agrees with Akai (1983) for the salivary glands of some insects. Ramified or polymorphic nuclei have also been described for *Amalo helops megaphyra* (Cruz-Landim 1973), *Spodoptera littoralis* (Sorour 1990) and *Diatrea saccharalis* (Victoriano 1998). The nuclei of the cells of the salivary gland of *M. posticata* are characterized by a large accumulation of heterochromatin in the nucleoplasm, which corroborates with the observation made in the cells of the salivary glands of *Neoponera villosa* (Zara 1995). The size of the nucleus might vary in relation to the metabolism as well as to the amount of DNA contained in the cell. Cells with intense metabolism present large nuclei containing a higher amount of proteins related to DNA transcription; this has been confirmed by biochemical techniques (Alberts *et al.* 1997, Junqueira and Carneiro 2000). The ramifications observed in the nuclei of the cells of the salivary gland of *M. posticata* cause a considerable increase in the nuclear surface and also enhance and facilitate the transport of materials between the nucleus and the cytoplasm for protein synthesis (Akai 1983, Cruz-Landim 1973, Sorour 1990, Victoriano 1998), which must be extremely high in these glands.

An evident and thick cuticle surrounds the lumen of the filaments of the accessory glands of *M. posticata* and *M. fimbriolata* (Nunes and Camargo-Mathias 2001); this observation suggests the need for an efficient system for the protection against autointoxication, or even to prevent the secre-

tion from chemical alterations with products that could come from the haemolymph.

The histological studies of *M. posticata* confirmed the results obtained for *M. fimbriolata*, in which the secretion produced inside the filaments is characterized by a granulation distributed throughout the cytoplasm of the secretory cells (Nunes and Camargo-Mathias 2001).

Nunes and Camargo-Mathias suggested that the secretion present inside the lumen of the filaments of *M. fimbriolata* is probably not stationary and may undergo constant circular movements. This process was not observed for the secretion present in the filaments of the salivary gland of *M. posticata*.

Our results lead us to believe that the epithelium of the filaments of the accessory gland of *M. posticata* is secretory, since we observed a large amount of secretion granules inside the cytoplasm of its cells, thus corroborating the observations made by Nunes and Camargo-Mathias (2001) for the accessory glands of *M. fimbriolata* and by Wayadande *et al.* (1997) for the accessory glands of *D. maidis*.

For *M. posticata*, as well as for *M. fimbriolata* (Nunes and Camargo-Mathias 2001), it was noted that the filaments of the accessory glands open in a common collecting duct that runs longitudinally throughout the gland. The filaments open precisely between lobules III and IV, liberating the secretion in that place. This duct probably collects the secretions produced by the globular and filamentous portions of the salivary gland and directs them to the excretory duct that will liberate this secretion to the exterior. We did not observe a cuticle enveloping the lumen of this duct.

The histological description of the principal gland of the sugarcane little cicada *M. posticata* corroborate the observations made by Nunes and Camargo-Mathias (2001) in *M. fimbriolata*, since in this insect they also noted the presence of secretion vesicles distributed throughout the acini of the principal gland, as well as secretion granules of varying sizes and morphologies inside the cytoplasm of the cells. The presence of these vesicles might suggest that the smaller secretion vesicles are fusing, thus forming larger vesicles. The existence of canaliculi that run through these acini suggests that the secretion produced by the cells is collected by the canaliculi to be to sent the common collecting duct.

Lobules I and II of the principal gland of *M. posticata* are characterized by an accumulation of vesicles, of varying sizes and morphologies, that contain a fluid secretion. The presence of a granular secretion distributed throughout the cytoplasm of the secretory cells was also noted. The secretion produced by the lobules is strongly basophilic, suggesting that it may be different from the secretion produced by lobules III and IV.

The fact that an accumulation of secretion occurs inside the cells is due to the large-scale production of this secretion and to the absence of a reservoir for the storage of saliva. The presence of granules and vesicles liberating the secretion into intercellular canaliculi in the principal glands of *C. tenellus* and *D. maidis* has been already reported by several authors; however, the connection between these canaliculi to the common duct has not been clarified. The only fact that has been confirmed so far is that the canaliculi are located next to the opening of the common collecting duct (Wayadande *et al.* 1997).

In *M. posticata*, lobules III and IV presented a lesser intensity in coloration, being characterized by small amounts of secretion. In contrast, for *M. fimbriolata* (Nunes and Camargo-Mathias 2001) it was described that these lobules appeared intensely stained and filled with secretion, thus being extremely basophilic. In consequence, after observing the acinous portion of the salivary gland of the sugarcane little cicada *M. posticata*, it might be inferred that the production of secretion is differentiated throughout the gland, *i.e.*, with regards to the amount and composition of this secretion.

The histochemical analysis of the secretion of the salivary gland of *M. posticata* confirmed the results obtained for *M. fimbriolata* (Nunes and Camargo-Mathias 2001) in relation to the secretion produced being highly proteic.

Our results indicate the presence of a granular secretion, less condensed and contained in the cytoplasm of the secretory cells of the accessory glands. Since the accessory glands reacted strongly positive to the tests for proteins, it might be inferred that this portion of the salivary gland is responsible for most of the production of proteic compounds.

The secretion observed in lobule I might be classified into two kinds: a) one is granular and distributed throughout the cytoplasm; b) the other is characterized by being clearer and more homogeneous and is contained inside large secretion vesicles, in which no kind of granulation can be observed and its general appearance suggests that this secretion is more fluid.

Lobule II was characterized by being the most basophilic of all lobules found in the main gland; nevertheless, the secretion it contains appeared very similar to the one described for lobule I. In lobules III and IV, a small amount of secretion was observed, and they were characterized by being the least basophilic of all lobules of the principal gland. This observation might indicate that the production of secretion in these lobules is lower, while in lobules I and II, the secretion is produced in large scale. Nunes and Camargo-Mathias (2001) observed that the lobules III and IV of *M. fimbriolata* were characterized by their strong staining, indicating a large production of secretion in these lobules.

The results obtained for the test for polysaccharides revealed that the production of this kind of compounds is very low in the salivary gland of the little cicada, while there is a high production of lipids and proteins. The acinous and filamentous portions showed the cytoplasm of their cells completely filled with lipid granules; nevertheless, part of the secretion vesicles and the secretion contained inside the lumen of the canaliculi gave a negative reaction to this test. This fact suggests that the secretion might undergo modifications in its chemical nature as it is transported from the site of production to the other regions of the gland until it reaches the exterior. The application of this test clearly showed that most of the secretion produced by lobules III and IV is of lipidic nature.

In consequence, our results suggest that the salivary glands of *M. posticata* produce both lipidic and proteic secretions. This result was expected since in most Homoptera and Hemiptera, the saliva is composed by enzymes that digest the cell wall of plants, thus allowing the penetration of the oral apparatus of these insects in order to suck the sap from the leaves (Imms 1949, Richard and Davis 1983, Wigglesworth 1974). However, these 2 kinds of compounds are not always free in the cytoplasm of the cells and may form lipoproteic complexes in order to form the final secretion of the gland.

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