SYSTEMATICS, MORPHOLOGY AND PHYSIOLOGY

Morphology of the Phytophagous Bug *Platyscytus decempunctatus* (Carvalho) (Heteroptera: Miridae)

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Neotropical Entomology 36(4):510-513 (2007)

Morfologia do Percevejo Fitófago *Platyscytus decempunctatus* (Carvalho) (Heteroptera: Miridae)

RESUMO - *Platyscytus decempunctatus* Carvalho é um mirídeo de pequeno porte que vive durante seu ciclo de vida em plantas de *Solanum cernuum* Vell. (Solanaceae). A morfologia interna de *P. decempunctatus* foi estudada revelando que fêmeas possuem ovário do tipo telotrófico com três ovaríolos no ovário direito e cinco no esquerdo. Nas estruturas reprodutivas dos machos existe uma glândula acessória tubular bem desenvolvida. A fitofagia de *P. decempunctatus* foi confirmada devido a observações de pigmentos de clorofila no intestino de todos os espécimes dissecados. As glândulas salivares em formato tubular e os túbulos de Malpighi também foram discutidos.

PALAVRAS-CHAVE: Ovário, testículo, tubos de Malphigi, glândula salivar, *Solanum cernuum*

ABSTRACT - *Platyscytus decempunctatus* Carvalho is a small mirid living throughout its life cicle plant *Solanum cernuum* Vell. (Solanaceae). The internal morphology of *P. decempunctatus* was studied and found that the female has a telotrophic ovary with three ovarioles in the right ovary and five in the left one. In the male reproductive trait there is a well developed tubular accessory gland. The phytophagous feeding habitat of *P. decempunctatus* was confirmed by the observations of chlorophyll pigments in the gut of all dissected specimens. The tubular salivary glands and the Malpighian tubules were also discussed.

KEY WORDS: Ovary, testicules, Malphigian tubules, salivary gland, *Solanum cernuum*

Platyscytus decempunctatus Carvalho is a small plant-bug (3-4 mm length) with the following diagnostic character: dorsal body surface with orange and black spots; pronotal disc and cuneus without spots or marks; scutellum with two lateral reddish or orange spots; wing membrane with two rounded spots; third antennomer with dark apical mark (Carvalho 1945).

Up to date, the knowledge about *P. decempunctatus* is restricted to its description (Carvalho 1945) and its occurrence on plants of *Solanum cernuum* (Solanaceae) (Ferreira *et al*. 2001). However, nothing is known about its behavior or biological activities. Occurrence of *P. decempunctatus* associated only with plants of *S. cernuum* (Carvalho 1945, 1951; Ferreira *et al*. 2001), suggests that an association between *S. cernuum* and the internal morphology of the mirid may assist in understanding this relationship. Therefore this study describes the salivary glands, midgut, male and female reproductive tracts, and the Malpighian tubules of *P. decempunctatus*.

Materials and Methods

Three adults of *P. decempunctatus* were maintained in Zamboni fixative (Stefanini *et al*. 1967) for 24h. After removal of the wings and legs, the insects were dehydrated in a graded ethanol series. The insects were subsequently embedded in a JB-4 historesin and sections 5µm thick were cut and stained with hematoxylin and eosin. Some specimens were dissected for anatomical analysis of the organs.

Results and Discussion

The salivary glands of *P. decempunctatus* are present in the thorax and show a lengthened tubular shape. The gland wall is lined by a single layer of columnar cells with granular cytoplasm and nucleus with predominance of condensed chromatin (Fig. 1A and B). The salivary glands in Heteroptera are located in the thorax and generally overlapped with the alimentary canal. They encompass a main gland which generally has from two to four lobes connected by one duct to an accessory gland (Schuh & Slater 1995). However the salivary gland of *P. decempunctatus* is a single structure, without lobes and accessories glands. Salivary glands with different lobes and accessory glands produce different substances in these compartments and are found in generalist predator and plant feeding Heteroptera (Milles 1960, Roma *et al*. 2003). Therefore the occurrence of a simple gland

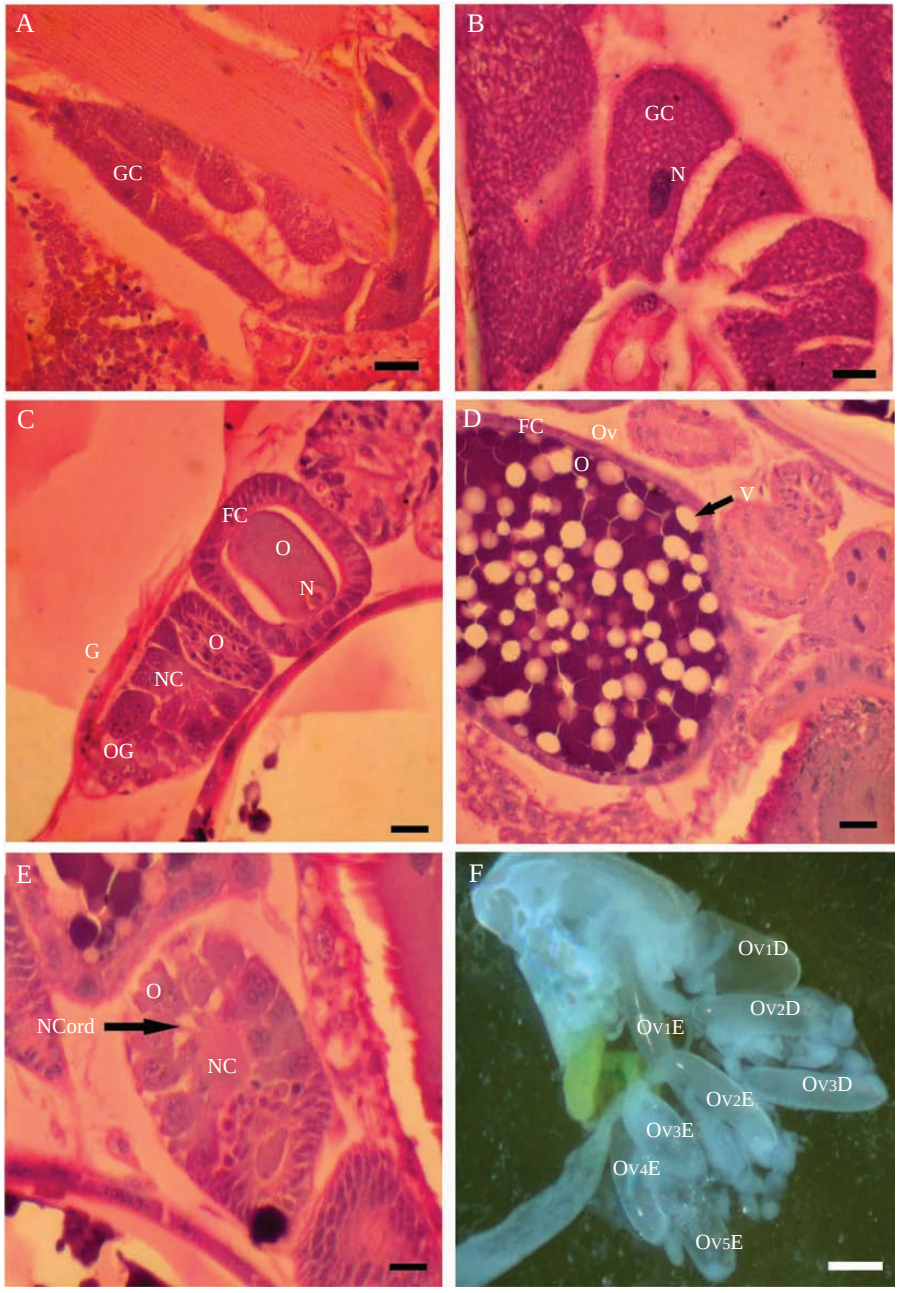

Fig. 1. A – salivary gland with granular cytoplasm (GC). Bar = 10 μm; B – Salivary gland with granular cytoplasm (GC) and nucleus (N) with condensed chromatin. Bar = 5 μm. C - Ovary of *P. decempunctatus* showing the characteristic structures of Heteroptera: germarium area (G), oogonia (OG), nurse cells (NC), oocyte (O), columnar follicle cells (FC), nucleus (N). Bar = 20 μm. D – The vitellarium, showing the ovariole (Ov) with oocytes (O), yolk (V) and flattened follicle cells (FC). Bar = 20 μm. E - Ovary showing the nurse cords (NCord), oocytes (O) and nurse cells (NC). Bar = 20 μm. F – Female reproductive tract of *P. decempunctatus* showing the two ovaries: right ovary with three ovarioles (Ov1D, Ov2D, Ov3D) and left ovary with five ovarioles (Ov1E, Ov2E, Ov3E, Ov4E and Ov5E). Bar = 0.1 mm.

structure in *P. decempunctatus* may be due to its use of unique food resource.

The *P. decempunctatus* ovaries are asymmetric (the right ovarian have three ovarioles and the left five ones) (Fig. 1F); they are joined in the distal portion by the terminal filament, forming a pair of compact structures. In Heteroptera the number ovarioles of each ovary varies from two to 17 (Schuh & Slater 1995, Simiczyjew *et al*. 1998, Lemos *et al*. 2005). The ovarioles of *P. decempunctatus* are meroistic telotrophic with a short germarium preceeding the tropharium. The tropharium has a nutritive cord that connects with oocytes in different developmental stages (Fig. 1E and F). During

the oocyte maturation, the follicular cells become flattened and the yolk accumulates within the oocyte (Fig. 1C and D). The ovary of *P. decempunctatus* is similar to that of other Heteroptera (Bunning 1994, Simiczyjew *et al*. 1998, Lemos *et al*. 2005).

The testis of *P. decempunctatus* are compact and isolated structures with seven follicles lined by a thin tunica propria (Fig. 2C). The number of testicular follicles varies from four to six. It is different from those found in Pentatomidae (Lemos *et al*. 2005), but similar to Triatominae (Gonçalves *et al*. 1987), indicating that the number of testicular follicles may vary among Heteroptera families. The testicular follicles have the following regions: the growth zone, where the spermatogonia increases allowing occurrence of mitoses

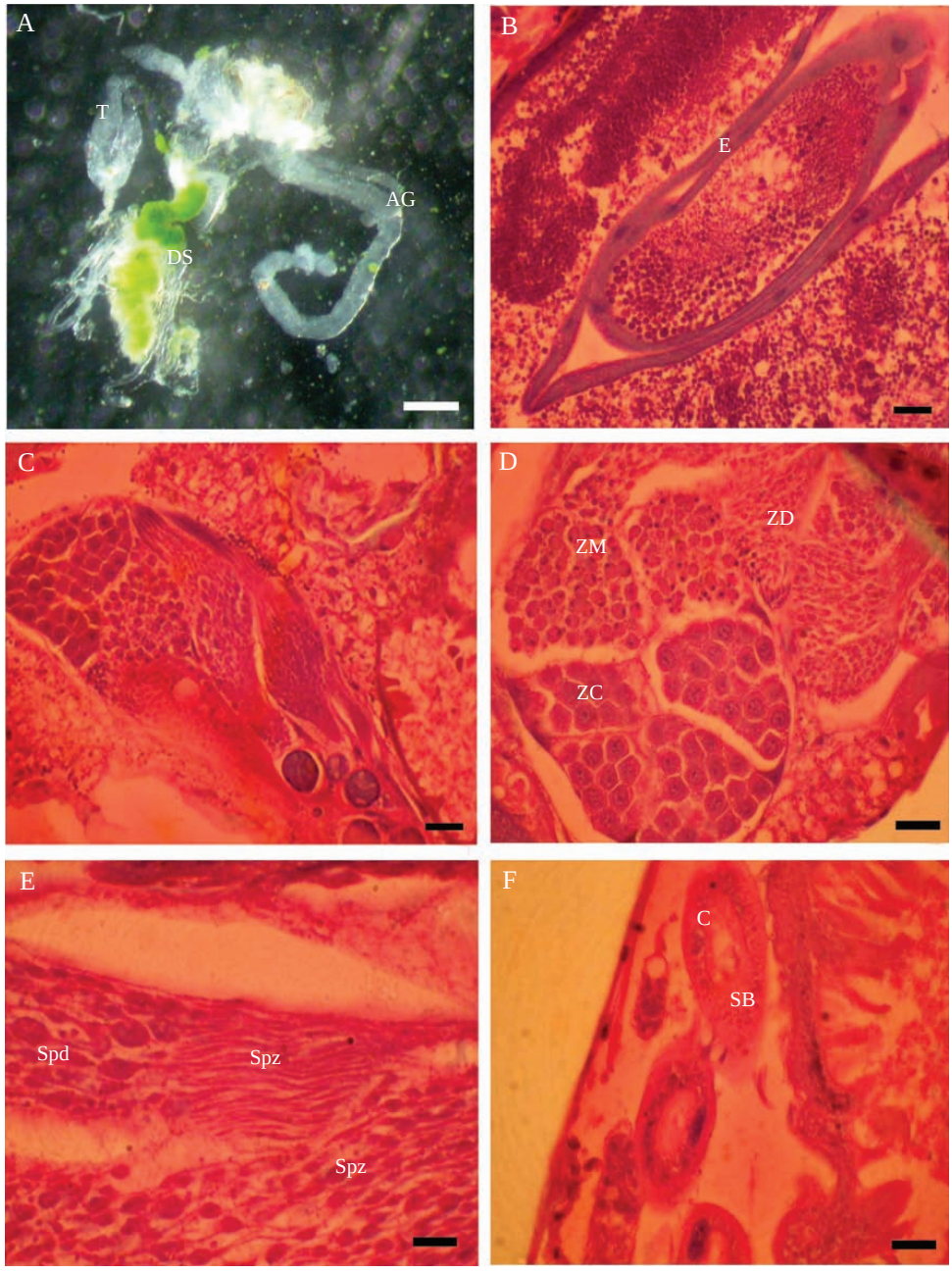

Fig. 2. A – Digestive tract (DS), testes (T), and male accessory gland (AG) of *P. decempunctatus*. Bar = 0.1 mm; B – Male accessory gland showing the flattened epithelium (E). Bar = 20 μm. C - Testis showing its follicles. Bar = 20 μm. D - Testis in transverse section showing the areas and developmental stages of the spermatozoa: growth zone (ZC), maturation and reduction zone (ZM) and differentiation zone (ZD). Bar = 10 μm. E - Testis in transverse section showing the spermatids (Spd) and the spermatozoa (Spz) in different differentiation phases. Bar = 5 μm. F – Malpighian tubules with one layer of cells (C) and with brush border (SB). Bar = 10 μm.

and differentiation into spermatocytes; the maturation zone, where meiosis takes place originating spermatids; and the differentiation zone, where spermatids are extended to form the spermatozoa (Fig. 2D and E). Associated with the male reproductive tract, there is a pair of long tube-like accessory glands lined by a single layer of flattened cells with nucleus containg condensed chromatin (Fig. 2A and 2B). The gland content is characterized by a granular basophillic secretion (Fig. 2B).

The male accessory glands in insects are responsible for spermatophore production and produce some active peptides that stimulate ovary activation after mating, decrease female reception for mating and are bactericide (Kubli *et al*. 2003). The number of male accessory glands varies among insects, but in Heteroptera there are about seven pairs (Barth 1958) contrasting with the single pair found in *P. decempunctatus*. In insects with many pairs of male accessory glands, different glands produce distinct substances. However, the long size of the single accessory gland of *P. decempunctatus* suggests that the production of different substances may occur along the entire length of the gland. Such production in the accessory gland probably ends before the adult stage herein analyzed since the glands are full and their flattened cells are not in secretagogue stage for sure.

The midgut occupies a large part of the abdomen and it is divided into three parts: an enlarged midgut, foremidgut and hindmidgut, separated by a fine and long mid-midgut (Fig. 2B), a putative feature in Hemiptera despite feeding habitats (Billingsley & Downe 1983). The presence of food of intense green coloration in the interior of the midgut (Fig. 2B) provides support for the hypothesis of a phytophagous feeding habit of *P. decempunctatus*. In the transition from the midgut to the hindgut, there are Malpighian tubules with a single epithelium of cubical cells with evident brush border and cytoplasm with clear granules (Fig. 2F) observed in other insects.

Acknowledgments

We thank the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and the Departamento de Biologia Geral, Universidade Federal de Viçosa for allowing this study.

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Received 22/VI/06. Accepted 18/V/06.