6 - Protecting the eggs (gené's organ)

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On ticks’ life cycle, the oviposition phase has extreme importance because it is a considerable moment of vulnerability for females, when their future descendants are placed on the ground and will need an appropriate environment for its development until the larvae hatch. Therefore, that phase of females’ greater vulnerability should be considered and it becomes, consequently, very useful to apply control strategies, once the malfunction of organs involved in this process may result in the offspring non-viability (Booth; Beadle; Hart, 1984; Booth et al., 1989; Oliveira et al. 2005).

Ticks are the only arthropods that have Gené’s organ, which is a specialized exocrine glands group that synthesizes and releases substances that waterproof the eggs. These substances have lipid origin (waxes) and promote...
protection against desiccation, predation and contamination by pathogens, also may even inhibit the absorption of substances that may be present in the environment, such as pesticides. The wax produced by the Gené’s organ also assists in the eggs aggregation process, typical behavior observed in ticks, which it allows the eggs mass to remain united (Less; Beament, 1948; Cherry, 1976; Nelson; Sukkestad, 1970; Howard; Blomquist, 1982).

Some compounds synthesized by the gland cells of the Gené’s organ can act as pheromones and kiromoniums, also known as semi chemicals, substances that can contribute guiding ticks’ behavior, orienting activities such as aggregation in the environment, search for food, copulation and other vital activities (Howard; Blomquist, 1982; Sonenshine, 1991).

For better understand the composition of the waxes released on ticks’ eggs, some studies have analyzed those waxes through different methods, such as: bright field microscopy, transmission electron microscopy (Booth, 1989) and chromatography (Booth, 1992), however, there is still a need for more complex studies that may provide further understanding about where those substances are synthetized and in which cell types these processes occur (Booth, 1992).

According to Arrieta, Leskiw and Kaufma (2006), the wax produced by the *Amblyomma africano hebraeum* Koch Gené’s organ would inhibit *Escherichia coli* and *Serratia marcescens* (Gram-negative bacteria) growth, what reinforced the wax potential to protect the eggs against microorganisms’ infections that could possibly be present in the microenvironment. Lima-Netto et al. (2012), in studies evaluating the *Amblyomma cajennense* s. l. Gené’s organ antiviral potential against influenza and picornavirus, also found out that the secretion would inhibit both microorganisms’ growth.
The morphology of the Gené’s organ of several species of ticks, specifically, has been previously established by different authors who had used scanning electron microscopy (SEM) techniques. Among the species studied were: *R. (B) microplus* (Booth; Beadle; Hart, 1984), *Dermacentor reticulatus* (Schöl et al., 2001), *Hyalomma (Hyalomma) dromedarii* (El Shoura, 1987) and *Haemaphysalis longicornis* (Kakuda; Mōris; Shiraishi, 1992). However, *Rhipicephalus sanguineus* s. l. studies are more recent and have been developed.

The ultramorphological analysis, using SEM, showed that the Gené’s organ of *R. sanguineus* s. l. tick females, with six feeding days, would be composed of a set of tubular glands (often called tentacles), which would have their free extremities bifurcated and ending up blind (Figure 23 A). These glands outer surface would have a smooth and homogeneous appearance, which corroborate the data already found for the other species studied by Lees; Beament (1948), Booth; Beadle; Hart, 1984, El Shoura (1987; 1988).

The histology of the Gené’s organ of *R. sanguineus* s. l. females (Figure 23 B) in vitellogenesis stage (when they are in oviposition phase), showed that the tubular glands are composed of a secretory epithelium with cylindrical cells (typical secretory cell morphology), making a simple cylindrical epithelium, supported on a clear basement membrane and forming a tubular lumen in the gland center. The glands’ secretory cells show cytoplasm with granules resulting from the release of the synthetized product, stored in the cytoplasm until the moment of its use. The studies also revealed that the secretion nature is lipid or polysaccharide.

For the secretion release into the glands’ lumen, the apical portion of each cells undergoes a constriction and separates the apical portion of the cell basal portion,
released first into the glandular lumen, classifying the secretion release in these glands as merocrine type. The histological data found for *R. sanguineus* s. l. species, corroborate those found by Till (1961) for *R. appendiculatus*, by Kakuda Mōris and Shiraishi (1992) for *Haemaphysalis longicornis* and *R. (B.) microplus* by Booth (1992). The latter author also made it clear that the tubular glands of the Gené’s organ would be present in larger quantities and more developed in the eggs laying phase.

The histochemical composition of the secretion synthesized and released by the *R. sanguineus* s. l. Gené’s organ cells, besides the strong lipid positivity (Figure 23 G-H), would react with the weak positivity to polysaccharide elements (Figure 23 C-D), as well as calcium (Figure 23 E-F), but these elements exact function still needs to be clarified.
Figure 23 – Scanning electron microscopy (A) and histological (B) sections of the Gené’s organ of *R. sanguineus* s. l. females. Reaction by PAS (Periodic Acid-Schiff) (McManus, 1946) and counter-staining with methyl green (C-D). Von Kossa staining (E-F). Imidazole osmium technique (G-H). `tg =` tubular glands; `cl =` cell limit; `bm =` basal membrane; `lu =` lumen; `n =` núcleo.

Bars: (A) 500 mm (B-F) 50 mm (G-H) 40 mm.