

NOTE ON GLANDS PRESENT IN MELIPONINAE  
(HYMENOPTERA, APIDAE) BEES LEGS

Carminda da Cruz-Landim<sup>1</sup>

Regina Lúcia Morelli Silva de Moraes<sup>1</sup>

Heliana Clara Salles<sup>1</sup>

Rejane Daniele Reginato<sup>1</sup>

ABSTRACT. The present paper reports the presence of glandular structures in legs of some stingless bee species. The glands appear as: the epidermis transformation in a glandular epithelium as in basitarsus, an epithelial sac inside the segment as in the femur of queens or in the last tarsomere, as round glandular cells, scattered or forming groupments. The saculiform gland of femur is present only in queens, the other glands are present in males, queens and workers of the studied species, apparently without any type of polymorphism. This occurrence seems indicate that the function of these glands have not to do with the sociality or specific behavior of castes.

KEY WORDS. Hymenoptera, stingless bees, legs, glands

The presence of glandular structures in legs of insects has been reported by several authors (LEUTHOLD 1969; BACCHUS 1979; BILLEN 1984, 1986; WALKER *et al.* 1985). In bees, the presence of glands in legs was first reported by ARNHART (1923) and CHAUVIN (1962) in the last tarsomere of both sexes and castes of *Apis mellifera* Linnaeus, 1758. This tarsal gland is constituted up of a epidermal fold inside the tarsus forming an epithelial sac where the secretion is apparently stored.

Lately CRUZ-LANDIM & CUNHA (1965) confirmed the presence of the tarsal gland in *A. mellifera* and described it to several species of stingless bees (Meliponinae) and for *Bombus atratus* Franklin, 1913 verifying its occurrence in males, workers and queens apparently without any developmental or morphological differences. Recently LENSKY *et al.* (1985) and POUVREAU (1991) described the ultrastructural features of tarsal gland respectively in *A. mellifera* and in seven different species of Bombinae.

The tarsal gland, however, is not the only gland present in bees' tarsus. As a matter of fact two types of glandular structures are present in the basitarsus of these bees as reported by CRUZ-LANDIM & SILVA DE MORAES (1994) for *A. mellifera*, *Melipona quadrifasciata anthidioides* Lepeletier, 1836 and *Scaptotrigona postica* Latreille, 1811 queens and workers: a glandular transformation of the epidermis of the dorsal or outer tegument of the leg segment and isolated round glandular cells provided individually of excretory canaliculus that open throughout the cuticle of the ventral or inner face of the basitarsus.

In this report is registered the presence of glandular cells in other "segments" of the leg of some species Meliponinae of bees.

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1) Departamento de Biologia, Instituto de Biociências, Universidade Estadual Paulista. 13506-900 Rio Claro, São Paulo, Brasil.

## MATERIAL AND METHODS

Legs of males, queens and workers of the species of bees listed below were fixed in fixative of Dietrich and processed for inclusion in JB4 historesin according to the manufacturer recommendations. The legs were then sectioned in 6µm slices, put in slides and stained with hematoxylin and eosin.

The species of bees studied were: *Nannotrigona testaceicornis* (Lepeletier, 1836), *Trigona hypogea* Silvestri, 1902, *Trigona spinipes* (Fabricius, 1793), *Trigona weyrauchi*, *Tetragonisca angustula* (Latreille, 1811), *Scaptotrigona postica* Latreille, 1804, *Plebeia remota* (Holmberg, 1903), *Plebeia* sp., *Schwarziana quadripunctata* (Lepeletier, 1836), *Camargoia nordestina* Moure, 1979, *Oxytrigona taira* (Smith, 1863).

## RESULTS AND DISCUSSION

Glands were found in all segments of legs of both sexes and both female castes of the examined bees (Tab. I).

Table I. Exocrine glands in bee's legs.

Species	Coxa			Trocanter			Femur			Tibia			Basitarsus			Tarsomeres			Last tarsomere				
	M	W	Q	M	W	Q	M	W	Q	M	W	Q	M	W	Q	M	W	Q	M	W	Q		
<i>N. testaceicornis</i>	-	-	-	u	-	-	u	u	-	u	-	-	eu	-	0	0	0	s	s	s	-	-	-
<i>T. hypogea</i>	-	-	-	u	-	-	u	-	-	u	-	-	-	-	0	0	0	s	s	-	-	-	-
<i>T. spinipes</i>	-	u	-	-	-	u	u	u	us	-	u	u	-	-	-	-	-	s	s	s	-	-	-
<i>T. truculenta</i>	-	-	-	u	-	-	u	-	-	u	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>T. weyrauchi</i>	-	u	-	-	-	-	u	-	-	u	-	-	eu	-	0	0	0	-	s	-	-	-	-
<i>T. angustula</i>	-	u	-	-	u	-	-	u	us	-	u	u	-	eu	eu	0	0	0	-	s	s	-	-
<i>S. postica</i>	-	u	-	u	-	u	u	u	u	u	u	u	-	-	eu	0	0	0	s	s	s	-	-
<i>P. remota</i>	-	-	-	u	-	u	u	u	us	u	u	u	-	-	-	-	-	-	s	s	s	-	-
<i>P. droryana</i>	-	u	-	u	-	-	u	-	u	-	u	-	-	-	-	-	-	-	-	-	-	-	-
<i>Plebeia</i> sp.	-	u	u	-	u	-	-	u	us	-	u	u	-	-	-	-	-	-	-	s	s	-	-
<i>S. quadripunctata</i>	-	u	u	-	-	u	-	u	us	-	u	u	-	-	0	0	0	-	s	s	-	-	-
<i>C. nordestina</i>	-	-	-	-	-	-	-	u	-	-	u	-	-	-	-	-	-	-	-	-	-	-	-
<i>O. taira</i>	-	-	-	-	-	-	-	u	-	-	u	-	-	-	-	-	-	-	-	s	-	-	-

(e) Epithelial gland, (u) unicellular gland, (s) saculiform gland, (-) not observed, (0) ausent, (M) male, (W) worker, (Q) queen.

These glands are of two different types according to the morphological arrangement of the secretory cells and the way of secretion delivery. Some glandular cells arrange forming an epithelium while others appear as round cells provided individually of an excretor canaliculus. These two arrangements correspond respectively to class I (epithelial glands) and III (unicellular glands) insect glandular cells according to the classification of NOIROT & QUENNEDEY (1974).

The epithelial glands may be constituted uniquely by a thickening of the epidermis or by a sac of epithelial cells while the unicellular gland may have its units isolated or forming groupments.

The table I shows a survey of the glands occurrence and of their morphological features in the species studied and the figure 1 shows the location of the glands.

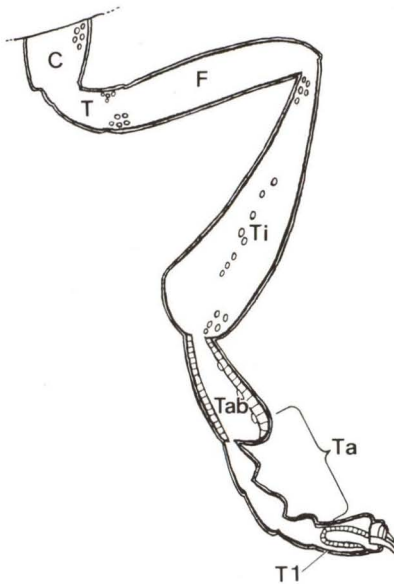


Fig. 1. Schematic representation of a bee leg showing the location of the glands. (C) Coxa, (T) trochanter, (F) femur, (Ti) tibia, (Ta) tarsus, (Tab) basitarsus, (Ts) last tarsomere.

As the segments of the legs are small and generally very sclerotized they are difficult to embedded and section. Because of this it was impossible to verify the glands in all sexes and castes of the studied species, however, the pattern seen in table I indicates that all glands are probably present in males, workers and queens with exception of the femoral saculiform gland that seems characteristic of queens. Also, it seems clear that the three median tarsomeres do not present any glandular cell, being glands present only in the basitarsus and in the distal tarsomere (Fig. 1).

Since NOIROT & QUENNEDEY (1974) classified the tegumentar gland cells of insects in three different classes, in this report the epithelial glands that form a sac was numbered as IV. This is the case of femoral glands present in queens and the tarsal gland present in the distal tarsomere. The saculiform gland in the distal tarsomere is made up of a fold of the epidermis that constitutes a bag (Fig. 2F) of cubic to cilindric epithelial cells in the interior of the tarsomere. The lumen of the bag is invested by a thin cuticle and serve as reservoir to the secretion. The bag opens ventrally in the base of the arolium. In the femur the bag is formed by a fold of the epidermis that covers the apodeme where the femoral muscles are inserted, as seen in figure 3A-C. It is also formed by cubic or cilindric epithelial cells. The opening of this sac could not be found in the sections or through external examination. Glands with these features were before found in *Centris* males by STORT & CRUZ-LANDIM (1965).

Other glandular epithelium is found in the basitarsus (Fig. 2E) where is the epidermis proper that acquires glandular characteristics as saw by CRUZ-LANDIM & SILVA DE MORAES (1994).



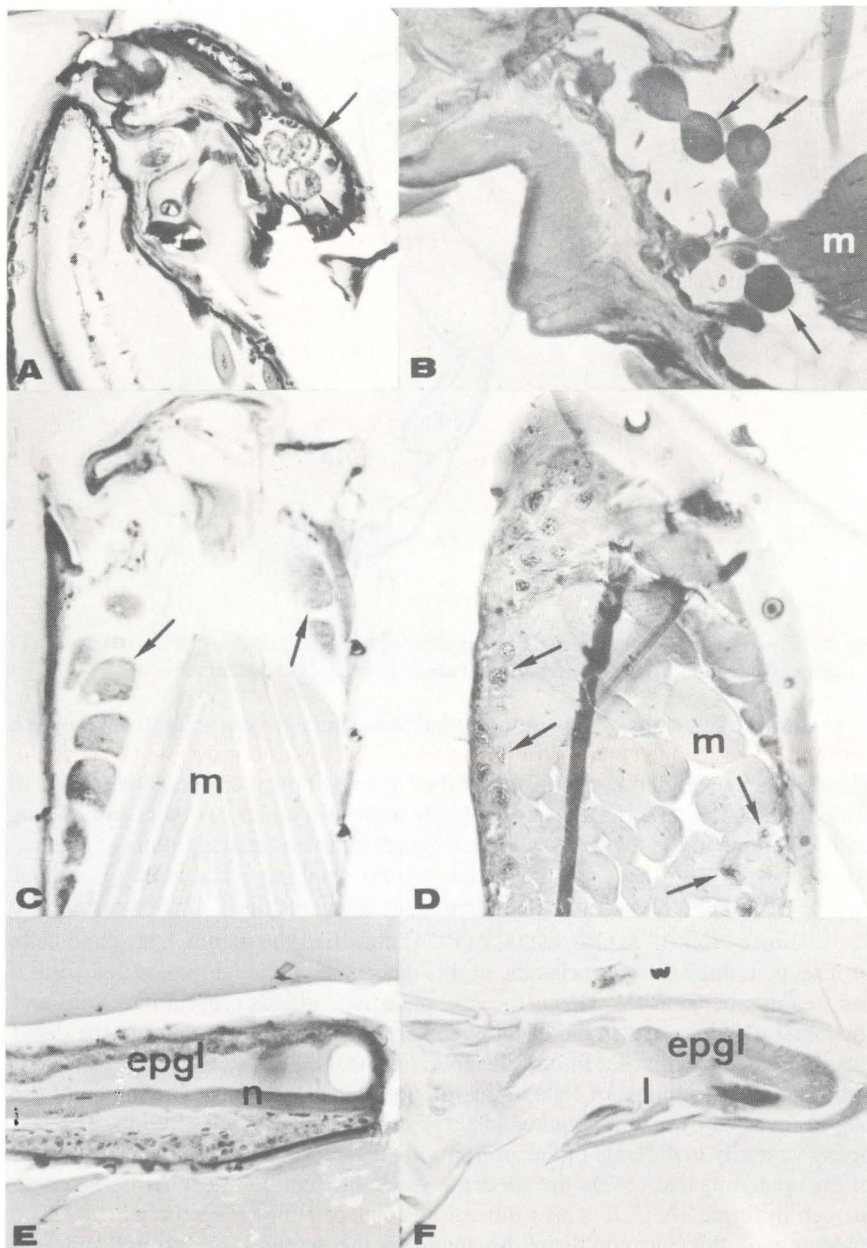


Fig. 2. Glands present in legs. (A) Class III glandular cells (arrows) in trochanter of *T. angustula* worker; (B) some type of gland (arrows) in the femur of *S. postica*; (C-D) class III glandular cells in the tibia of *P. remota*, respectively male and worker; (E-F) epithelial glands (epgl) respectively of the male of *P. remota* basitarsus and last tarsomere of the queen of *S. postica* queen. (m) Muscle, (n) nerve, (l) lumen.

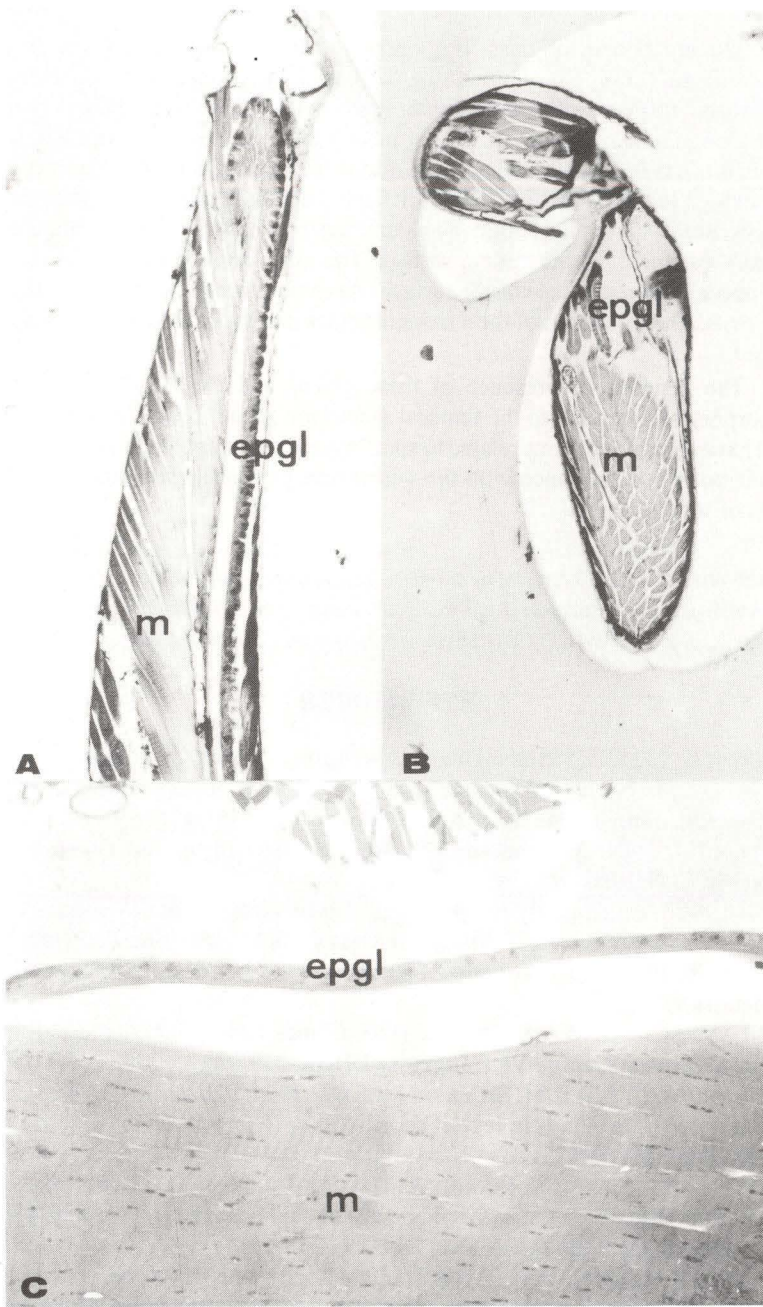


Fig. 3. Saculiforme glands (epgl) of the femur of *Plebeia* sp. queens (A), *T. angustula* (B) and *S. quadripunctata* (C). (m) Muscle.

The unicellular, or class III, glandular cells are most scattered in the legs. They are found forming groupments in the anterior outer coxa, in the posterior end of the trochanter (Figs 1, 2A) and anterior femur (Figs 1, 2B). In tibia they are found sparse along the tegument (Fig. 2C) or among the inner muscle (Fig. 2D). In the basitarsus this type of glandular cells are also present, but they usually are very small and included in the epithelium, being difficult their observation as separated cells. The presence of these glands may be indentified externally by the openings of the excretory canaliculi in the cuticle surface. The pores formed by these openings may appear scattered in the cuticle surface or as a sieve resulting from the grouping of the exits. The formation of the a sieve indicates that the glandular cells inside are grouped.

The generalized presence of these glands and the lack of any type of polymorphism (exception to the femural saculiform gland) seem indicate that they do not have special functions related to sociality or behaviour of the sexes and castes. This vision is in accordance with the widespread presence, of the tarsal gland, in insects of several orders.

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