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A NEW TARSAL GLAND OF THE BROWN DOG TICK, *Rhipicephalus sanguineus* (LATREILLE), 1804 (ACARINA: IXODIDAE)*

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ABSTRACT

Y. S. Chow, S. H. Lin and J. S. Su (1972) *A New Tarsal Gland of the Brown Dog Tick, Rhipicephalus sanguineus (Latreille), 1804 (Acarina: Ixodidae)*, Bull. Inst. Zool., Academia Sinica. **11**(2): 35-39. A large ectogland has been located beneath the Haller's organ of tarsus I. This ectogland consists of two lobules, each is composed of cubodial cells and a central glandular duct. It excretes lipid substance that is similar to the substance outside the empodium and exocuticle. Tarsus II, III, and IV of adults and nymphal stages also have similar organs.

The brown dog tick, *Rhipicephalus sanguineus* (Latreille) is frequently found on dogs and occasionally on cattle in Taiwan. It is a major vector of piroplasmosis, paralysis, anaplasmosis, and many other diseases[1,5,12]. Many authors believe that ticks used their first pair of legs as an insect antennae, so, the structures within the tarsus I have been studied in detail[4,7]. The present report describes a new glandular organ in the tarsus of the brown dog ticks.

MATERIALS AND METHODS

Adult *Rhipicephalus sanguineus* were fed in a polyethylene Mason jar fastened on a rabbit for 10 days. Then the tarsus of the leg was cut with scissors at the coxa segment. The paraffin and frozen sections were prepared according to Humason[8]. Paraffin sections were stained with hematoxylin-eosin, periodic acid-Schiff (PAS), and Ninhydrin-Schiff for general examination. Frozen sections were stained with oil red 0 for the lipids. The Epon technique described by Nathason[10] was adopted. Alternative thick sections for light microscope were approximately 1 μ in thickness and stained with periodic acid-basic fuchsin-methylene blue (PBM) without removing the embedding. The staining procedures are as follows:

1. 2% aq. periodic acid at room temp. for 5 min.
2. Rinse in distilled water.
3. 0.15% basic fuchsin in 50% ethanol at 40°C for 5 min.
4. Rinse in distilled water.
5. Methylene blue-azure II mixture, 40°C for 5 min.
6. Rinse in water.
7. Dry and mount in Permount.

Sections for light microscopy were examined under a Nikon SUR-KE research microscope. For electron microscopy, after stained with uranyl

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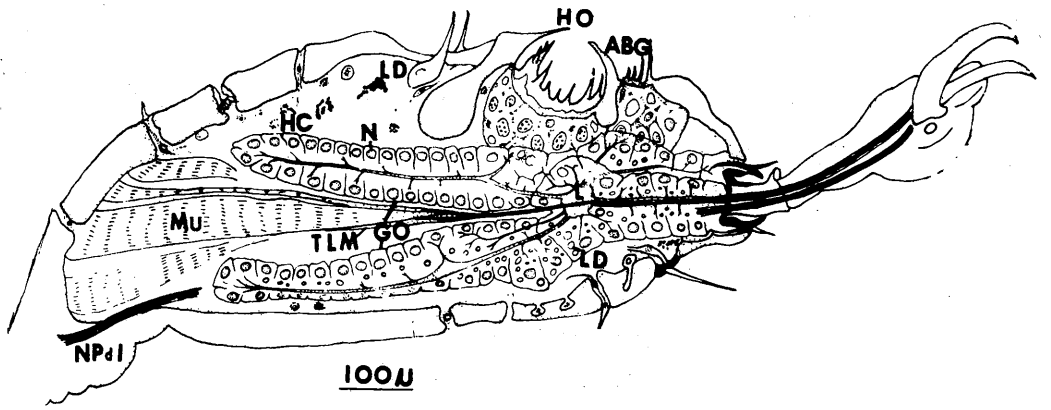

Fig. 1. Lateral drawing of tarsus I showing the Haller's organ (HO), glandular organ (GO), and the lumen canal (L). MU: muscle; LD: lipid droplet; HC: hemocyte; NPd_1: nerve of pedal I; ABG: anterior bristle group; TLM: tendon and tonofibrillae of levator muscle.

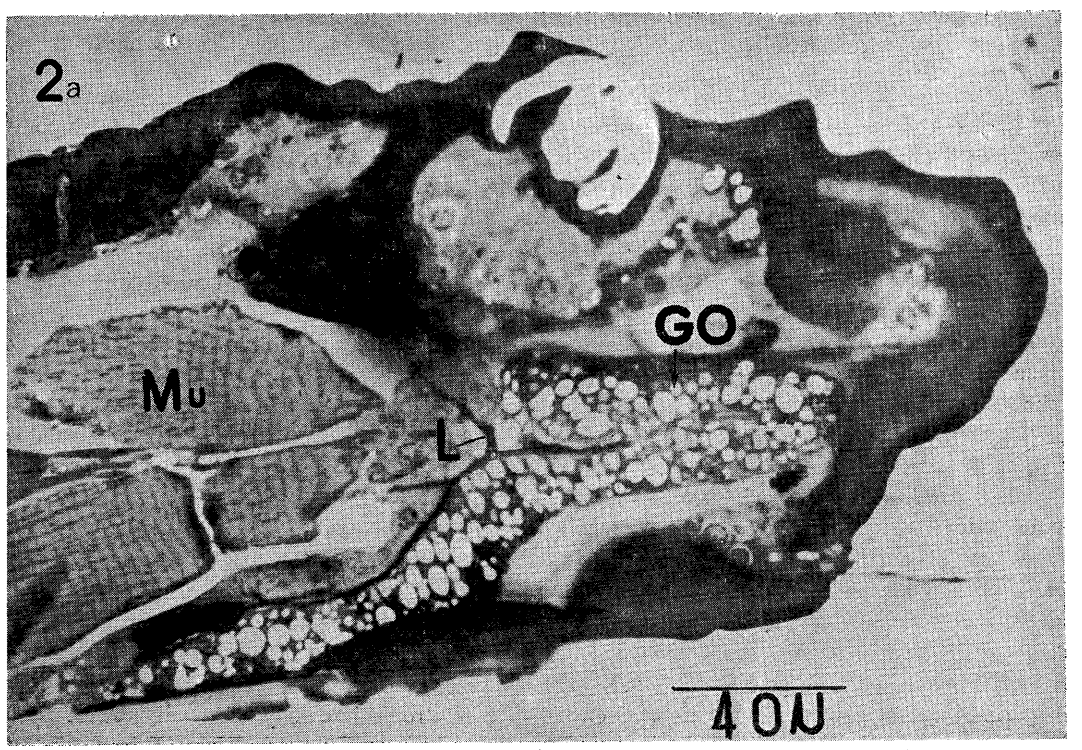

Fig. 2. Photomicrograph of a longitudinal section through tarsus I, showing the highly vacuolized glandular organ (GO). MU: muscle; L: lumen. Epon section, (PBM).

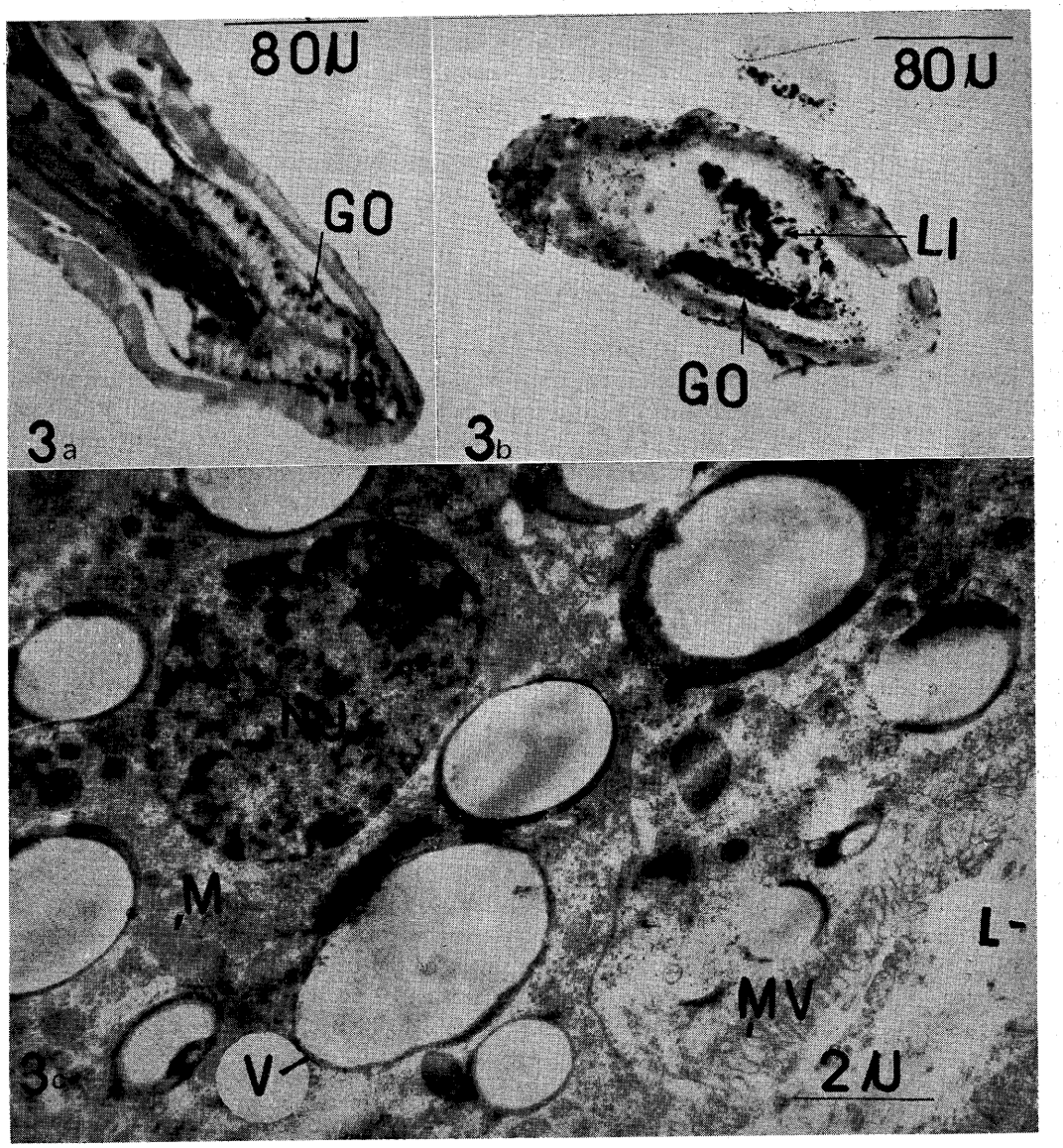

Fig. 3. Photomicrographs of the glandular organ.

a. Longitudinal section through tarsus III of adult male, showing that other legs also have this glandular organ (GO). Hematoxylin-eosin. (Paraffin section).

b. Oil red 0 stain of the lipid materials (LI) within the glandular organ. (GO) Frozen section.

c. Electron micrograph of the glandular organ showing that the vacuole (V) are enclosed within a ring-like chitin materials. M: mitochondria; V: vacuole; NU: nucleus; MV: microvilli; and L: lumen.

acetate and lead citrate[10], sections were examined in a Hitachi-11-A electron microscope at an accelerating voltage of 50 KV. Micrographs were made in Fugi photographic plates.

RESULTS AND DISCUSSION

The results obtained from the paraffin, frozen and Epon sections are summarized in Table I. The drawing and selected photomicrographs of the glandular organ from satisfactory sections are presented in Fig. 1 to Fig. 3.

The ectogland of the tarsus is located in the tarsus of each leg. It is a bilobular organ; each finger-like lobule is lined with a single layer of cubodial, and fat-containing cells. The cytoplasm of each glandular cell contains many mitochondria, vacuoles, and droplike structures (Fig. 3 c). In frozen section, these vacuoles (Fig. 3 b) show a deep red color when stained with oil red 0. This reaction indicates that vacuoles contain mainly lipid materials. Lipid (Fig. 3 b) exists in such large quantity that it undoubtedly is a lipid-secreting or storing organ. As viewed with hematoxylin-eosin stain (Fig. 3 a), it is similar to the glandular structure of Gene's organ described by Chinery.[8] The electron microscopic studies confirmed our light microscopic studies: Microville and vacuole system do exist in this glandular organ (Fig. 3 c). In insects a similar gland has been described by Tschinkel[13]. In ticks Balashov[1] has pointed out that the anterolateral caeca of the genus *Boophilus* tend to have a secondary division intruding into appendages. The structure described here is not a caeca because it exists only in tarsus not in other segments of the legs. All tarsi of the legs of adults and all nymphal stages have this organ (Fig. 3 a) whereas the anterolateral caeca have only one pair structure[1]. In the frozen sections of whole ticks only Gene's organ, the accessory genital glands, some parts of salivary glands, fat body, and epidermal cells stained with the oil red 0. The cubodial cells (Fig. 3 a and b) examined were organized more orderly than the loose structure of fat body[1] and apparently are the glandular cells.

In the center of each lobule mass, there is a lumen which connects each cell with a small canaliculus (Fig. 3 c). At first, under light microscope, it was thought that this lumen structure (Fig. 2) was a nerve tissue or trachea because these structures stained similarly with the method (PBM) used. However, electron micrographs showed that this lumen structure was neither partially myelinated nor ringed, as in the peripheral nerve axon and trachea of the tick. The exact function of this glandular organ is still not known, some possibilities are: It might relate to the lipophilic nature of the empodium, since their main secretion is lipid and this lipid can be transported outside to the empodium surface through lumen (Fig. 1 and Table I). Since the tendon of the levator muscle is enclosed inside the glandular lumen (Fig. 1), it might produce a lubricant to allow the movement of the tendon. Also it might produce sex phermone[2] because the microvilli and vacuole laden cytoplasm closely resemble the sex phero-

TABLE I

Histological results on the tarsal glandular organ of the brown dog tick

	Nucleus	Vacuole	Lumen	Cytoplasm	Lipid outside the empodium or exocuticle
PAS	—	—	—	light purple	—
Ninhydrin-Schiff	violet	—	light purple	—	purple
Oil red 0	—	red	—	—	red
Hematoxylin-eosin	blue	—	—	pink to light red	
PMB	Purple	—	dark blue	light purple	blue

mone gland of the cabbage looper (*Trichoplusia ni*) and the fruit fly (*Dacus tryoni*) as described by Miller *et al.*[9] and Fletcher[6] respectively. Moreover, there are four pairs of these organs in each individual tick, thus the quantity of the secreted materials is probably enough to function as pheromone.

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狗褐蝨 Rhipicephalus sanguineus 之新跗節腺體

周延鑫　林勝華　蘇加祥

在前足之跗節內有一强大之外管腺體。此器官由二組粒狀腺體細胞之構造及分別管所構成。其主要分泌油脂並可將其分泌物輸送至跗節外之跗間板上。成蟲之第二，三和第四跗節及若蟲之各跗節都有此腺體存在。