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THE TERGAL GLAND OF THE MALE COCKROACH, SUPELLA SUPELLECTILIUM

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TWO FIGURES

The tergal or dorsal glands of some male cockroaches have been used in blattoid systematics (Hebard, '17; Ramme, '23; Rehn, '31). After considering the various diagnostic features of cockroaches, Hebard ('17) concluded that the most important was ". . . the superlative value in many genera of the Pseudomopinae of the form and specialization of the median and dorsal abdominal segments in the male sex. In a number of species of *Parcoblatta* the specialization of the male glands proves, by far, the most valuable character for separating the males." These glands are also of interest to the physiologist because in some species, e.g., *Blattella germanica* (L.), they produce a secretion which is attractive to the female during epigamic behavior (Sikora, '18; Wille, '20; Roth and Willis, '52). The males of the brown-banded cockroach *Supella supellectilium* (Serv.) possess a very distinctive tergal gland (fig. 1 C) and observations on the behavior of this species revealed that the function of this structure is similar to that of the dorsal glands of male *B. germanica*. Like the German cockroach, the courting behavior of male *Supella* consists in raising his wings and tegmina to about an angle of 90° and strongly arching his abdomen dorsad, thereby exposing the exterior portion of the tergal gland to the female. The sexually-active female feeds on the male's glandular secretion just prior to copulation. Males have also been seen to feed on the tergal gland secretion of other courting males.

The present paper describes the male tergal gland of *Supella*. The structure was studied in whole mounts by boiling the abdomen in KOH and mounting in balsam. Histological sections were also prepared; the abdomens of newly-emerged and old males were fixed in Bouin's or Lavdowsky's mixture, paraffin sectioned at about 6 μ and stained with Harris' haematoxylin and eosin, iron haematoxylin, or Mallory's triple.

Hebard ('17) gives a brief description of the external appearance of this gland and states that it is ". . . a circular, deeply depressed area, mesad on the sixth segment, which is bounded by a slightly raised and rounded ridge and has its floor heavily clothed with agglutinated hairs directed mesocephalad, thus forming a low, sub-conical tuft, . . ."

Rehn ('47) pointed out the fact that the gland in *Supella* is located in the middle of the 7th abdominal tergite, and not the 6th as stated by Hebard. Because most of the structure is not covered by the preceding tergite and because the setae associated with the gland are massed together and darkly pigmented, the organ is readily seen when the insect's wings are raised or removed (fig. 1 C). The organ is surrounded by a circular ridge (fig. 1 C, *d*) within which is a depression or pit. The cuticular floor of the fossa rises toward the median line and forms a mound. Arising from the mound are numerous stout setae (figs. 1 A, C; 2 A, B, *b*), many of which are strongly curved at their tips. This principal mass of setae (mound brushes) is divided into two equal groups and the setae themselves are recumbent with the extremities of most of them directed anteriorly; some of the outer setae point antero-medially or medially. The setae are glossy because of the secretion which covers them (fig. 1 C). Anterior to these two major setal brushes are two separate patches of smaller hairs which lie in the anterior portion of the tergal pit (fig. 1 A, *a*). These tapering setae are either straight or have slightly curved tips and their apexes are directed posteriorly toward the mound setal brushes; the two small groups of setae are sometimes covered in part by the over-

lapping posterior margin of the 6th tergite. Karny's ('25) drawing (after Shelford) of the tergal gland of *supellectilium* is incorrect in that it shows the setae arising from the inner wall of the circular ridge and all of the hairs are directed toward the center of the pit.

When the adult male has just emerged from the last nymphal skin the mound setae are golden-brown and are recumbent and massed together, as in the old male, though no secretion is present. Thus the recumbent position of the setae is the normal one (i.e., the hairs are not erect) and their agglutinated appearance is not due to the presence of the secretion alone. Also in the newly-emerged male the abdomen is extended and swollen and the pit has not yet been formed, i.e., the mound on which are located the setal brushes has not yet sunken into a depression. About 20 minutes after emergence the male's abdomen contracts, the fossa is formed and the glandular area assumes the appearance characteristic of older insects.

Sagittal and cross sections of the glandular area show that the centrally placed mound is slightly convex at its posterior region and steeply convex (almost triangular) at the anterior region (fig. 2 C–G). The glandular cells are modified hypodermal cells and lie, together with the epidermal cells, against the endocuticle (fig. 2 A, *c*). No tubules were seen leading from the gland cells through the cuticle to the exterior. The large setae which make up the brushes on the mound are hollow but apparently are not open at their tips.

One interesting anomalous specimen was found which had in addition to the normal gland on the 7th segment, a partial duplication of a gland on the 6th (fig. 1 B). The duplicated portion was about half the normal size and consisted chiefly of only one brush (the right half) of setae (fig. 1 B, *c*). However, a small number of setae representing the left half of the mound was present and could be distinguished by the direction in which the majority of hairs were oriented; only one patch of small setae anterior to the main group was present.

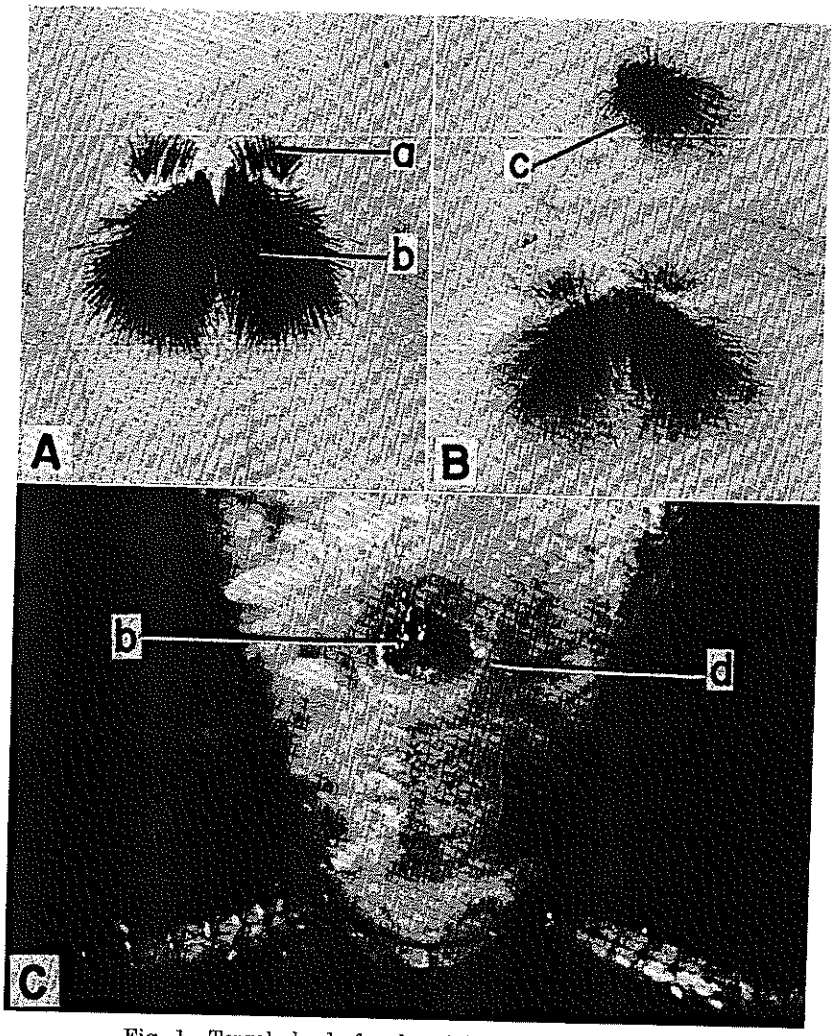

Fig. 1 Tergal gland of males of *Supella supellectilium*.

A Brush-like groups of setae of the normal gland on the 7th tergite. × 48.

B Anomalous specimen showing the normal gland on the 7th tergite and a partly duplicated gland on the 6th. × 48.

C Dorsal view of the posterior part of the abdomen (wings removed) showing the gland on the 7th tergite. Note the agglutinated appearance of the setae. × 20.

(a = setae of anterior brush; b = setae of mound brush arising from the mound in the center of the fossa; c = duplicated brush of setae on the 6th tergite; d = circular ridge which surrounds the mound and setae. A and B were treated with KOH and mounted in balsam. C was an untreated specimen.)

The writer has examined museum specimens of males of *Supella hottentotta* (Sauss.) and *S. abbotti* Rehn, both of which have tergal glands similar in external appearance to those in *supellectilium;* this was pointed out by Rehn ('47) who stated that the tergal gland structure of *S. abbotti* is "... essentially as in *S. hottentotta* and *supellectilium,* transverse, bifossulate with the lateral rims arcuate and appreciably converging both cephalad and caudad, the mediolongitudinal division but moderately elevated and the lining hairs adpressed; ..." Thus the males of the above three species of the subgenus *Supella* possess tergal glands as does *Supella chapini* Rehn of the subgenus *Mombuttia.* Males of *Supella gemma* Rehn and *S. mirabilis* Shelford both of the subgenus *Nemosupella* lack the tergal glandular specializations (Rehn, '47).

Externally the tergal gland of *S. supellectilium* resembles at least superficially those found in the males of *Ectobius* (see Ramme, '23; Rehn, '31). In section the structure looks like that described in *E. lapponicus* (Linn.) (see Koncek, '24). The dorsal glands which open on the 7th abdominal segment of *Phyllodromica (=Aphlebia) bivittata* (Brullé), and on the 7th and 8th tergites of *B. germanica* differ from those in *Supella.* In *P. bivittata* the gland consists of two yellowish sacs about 1.5 mm long which extend backwards under the cuticle, to the anterior margin of the 6th abdominal tergite. These sacs are filled with long yellowish setae of varying lengths which protrude from the gland openings like a thick brush (Krauss, 1890). The tergal glands of adult males of *B. germanica* consist of two double pouches, one opening on the 7th and the other on the 8th abdominal tergites. There are no external setae associated with this organ. The glandular cells are elongated and have a tubule arising near the nucleus, leading to the lumen of the pouch (Oettinger, '06; Wille, '20; Koncek, '24).

The tergal gland of *S. supellectilium* is analogous to the metasternal gland of the striped meadow cricket *Oecanthus fasciatus* Fitch described by Hancock ('05). The morpho-

logical resemblance is particularly striking because of the presence of setal brushes in both species. One of the functions of the metasternal glandular secretion of the male *Oecanthus* is to allure the female into a position whereby mating can occur (Hancock, '05; Houghton, '09; Jensen, '09; Gurney, '47) a function similar to that of the tergal glands of *S. supellectilium* (and probably the other species of *Supella* which possess similar structures) and *B. germanica.*

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PLATE 1

EXPLANATION OF FIGURES

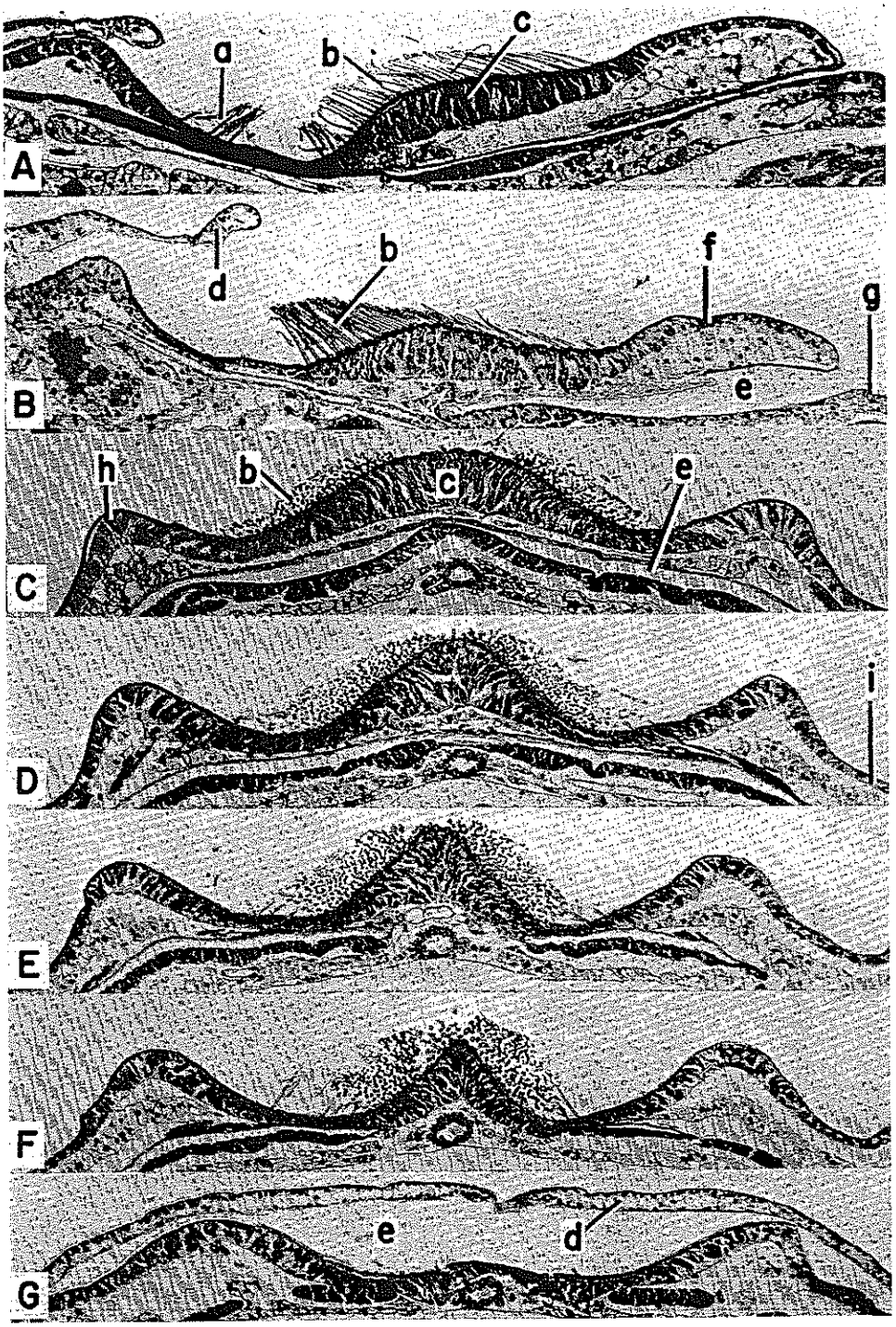
2 Histological sections through various regions of the tergal gland of males of *Supella supellectilium*. × 97.

A Sagittal section through about the middle of the left half of the mound.

B Sagittal section near the mid-line of the mound. (Note the absence of setae of the anterior brush.)

C–G Cross sections starting near the posterior margin of the gland (C) and progressing anteriorly. Note the triangular appearance of the mound near the anterior margin (F). In G the section passes through the region of the anterior brushes.

(a = setae of anterior brush; b = setae of mound brush; c = gland cells; d = 6th tergite; e = intertergal space; f = 7th tergite; g = 8th tergite; h = ridge; i = epidermis. C stained with Mallory's; all other sections stained with Harris' haematoxylin and eosin.)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