

[SHORT COMMUNICATION]

**Ultrastructures of the Primordia of Sternal Glands
in the Second-instar Pupal Stage
of *Frankliniella intonsa* (Thysanoptera: Insecta)**

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Adult males of some thrips have glandular areas that contain sternal glands in their abdominal sternites. This area is generally present in sternites III to VII in thripine thrips but only in sternite VIII in phlaeothripine thrips. The sternal gland in thripine thrips consists of many secretory cells, a cuticular ridge, some secretory ductules and a wide subcuticular space. The secretory cells are characterized by an abundance of mitochondria and numerous apical microvilli (Bode, 1978; Sudo and Tsutsumi, 2002). On the other hand, the gland in a phlaeothripine thrips has many secretory cells and a subcuticular space but lacks a cuticular ridge and a secretory ductule (Sudo and Tsutsumi, 2002). These morphological differences in sternal glands among families may suggest that the sternal glands in thripine thrips and phlaeothripine thrips originated independently. Comparison of the formation processes of sternal glands among families of thrips may thus provide an insight into the origins of sternal glands in thrips. However, there have been no studies on the formation of sternal glands.

We have therefore begun the comparative study on the morphogenesis of sternal glands among thrips. In this report, we describe the primordia of sternal glands in the second-instar pupal stage of a thripine thrips, *Frankliniella intonsa*, based on observations using transmission electron microscopy.

Adult females of *Frankliniella intonsa* were collected from various flowers on the campus of Fukushima University, Fukushima Prefecture, Japan, and were reared individually. Second-instar pupal males, taken from these iso-female lines on the second generation, were used in the present study. They were processed into preparations for transmission electron microscopy by conventional procedures (cf. Sudo and Tsutsumi, 2002).

The primordia of sternal glands form in the second-instar pupal stage in males of *Frankliniella intonsa*. In the early second-instar pupal stage, when the adult cuticle had not been secreted, a layer of epithelial cells was observed (Fig. 1a) in a sagittal section of the region in which the primordium of the sternal gland would be formed in the late second-instar pupal stage. These epithelial cells were of equal height, but some cells in the peripheral region were relatively short in height and broad in width (outermost cells in Fig. 2a). The subcuticular space (ScS in Fig. 1a) between the epithelial cells and pupal cuticle was demonstrated electron dense and appeared to be filled with an exuvial fluid.

In the late second-instar pupal stage, secretion of adult cuticle commenced. The primordia of sternal glands appeared in the sternites III to VII, and they assumed semicircular in a sagittal section (Fig. 1b), as in sternal glands of the adult. The secretory cells (ca. 12 μm in height), however, were smaller than those of the adult and had only a small subcuticular space (ScS in Fig. 1b). A cuticular ridge and some secretory ductules were found in this stage. Some flat cells (asterisk in Fig. 1c) adjacent to the cuticular ridge were observed. These cells appear to form this cuticular ridge. These cells are not present in the sternal glands of mature adults but found only in sternal glands of newly emerged adults (Sudo, unpublished observation). Most probably these cells degenerate after completion of the

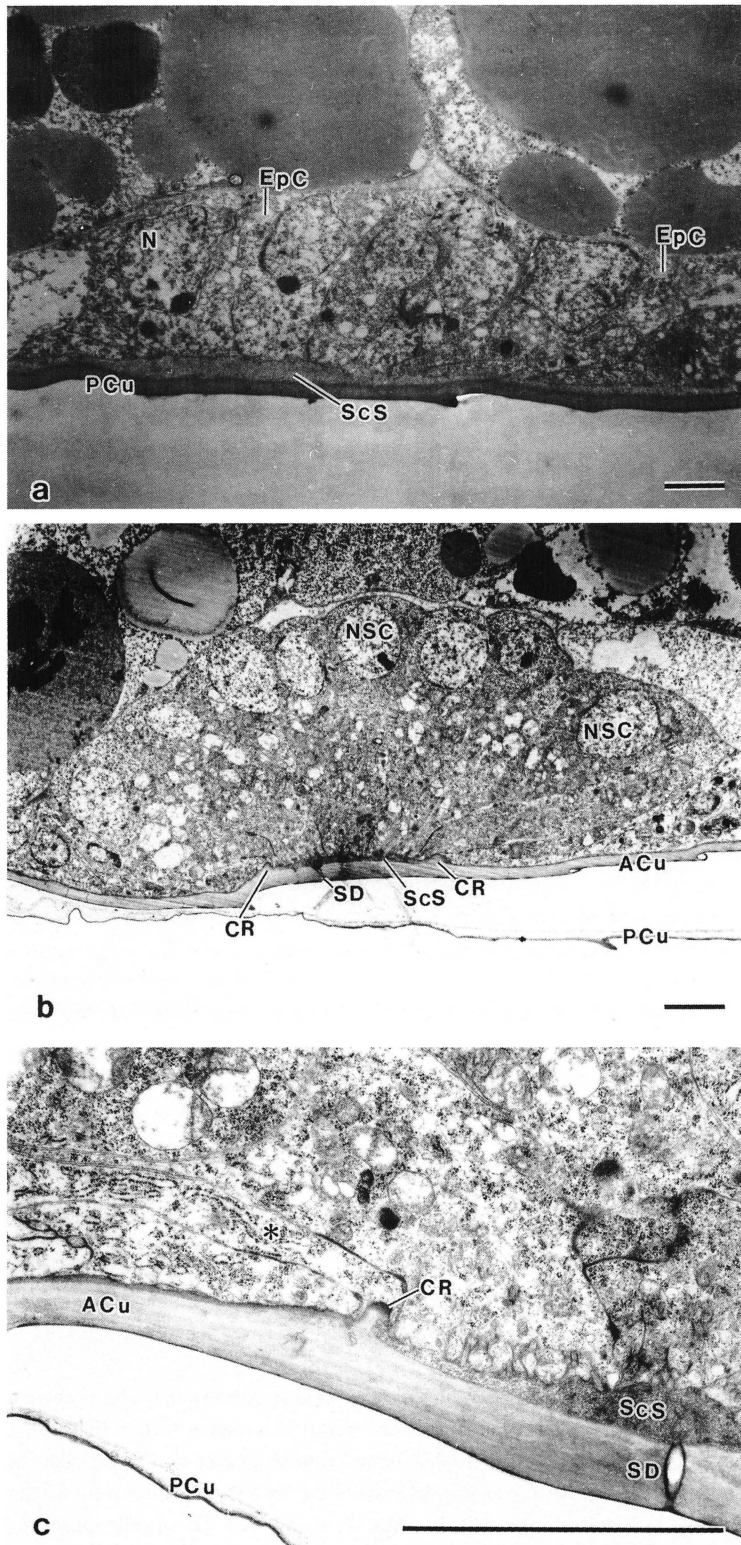


Figure 1

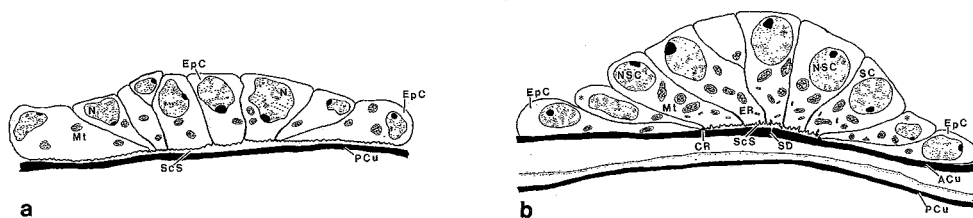


Fig. 2 Diagrammatic representation of the morphogenesis of the primordium of a sternal gland (sagittal section), in the second-instar pupae of *Frankliniella intonsa*. a. In the early stage without an adult cuticle. b. In the late stage with an adult cuticle (ACu). Asterisks show the epithelial cells that form the cuticular ridge (CR). EpC: epithelial cell, ER: endoplasmic reticulum, Mt: mitochondria, N: nucleus of epithelial cell, NSC: nucleus of secretory cell, PCu: second-instar pupal cuticle, SC: secretory cell, ScS: subcuticular space, SD: secretory ductules.

formation of a cuticular ridge. Further studies are needed to clarify the role of these flat cells.

Figure 2 is a schematic representation of the morphogenesis of the primordium of a sternal gland (sagittal sections). First in the early second-instar pupal stage, the epithelial cells (EpC in Fig. 2a) in the region in which each primordium of the sternal gland will be formed secrete an adult cuticle. After deposition of the adult cuticle, or in the late second-instar pupal stage, two kinds of cells differentiate from these epithelial cells: secretory cells and cuticular ridge-forming cells. The epithelial cells in the inner area to the cuticular ridge-forming cells (asterisks in Fig. 2b) are transformed into secretory cells. They become larger, and the primordia of sternal glands become semicircular in shape (Fig. 2b). On the other hand, the epithelial cells (EpC in Fig. 2b) in the outer area to the cuticular ridge-forming cells gradually degenerate.

Acknowledgments: We thank Dr. T. Murai, National Institute of Fruit Tree Science, for his helpful advice on rearing methods for thrips.

References

Bode, W. (1978) Ultrastructure of the sternal glands in *Thrips validus* Uzel (Thysanoptera, Terebrantia). *Zoomorphologie*, **90**, 53–65.
 Sudo, M. and T. Tsutsumi (2002) Ultrastructures of the sternal glands in two thripine thrips and one phlaeothripine thrips (Thysanoptera: Insecta). *Proc. Arthropod. Embryol. Soc. Jpn.*, **37**, 35–41.

Fig. 1 TEMs of the primordia of sternal glands, in second-instar pupal males of *Frankliniella intonsa* (sagittal section). a. A layer of epithelial cells in the early second-instar pupal stage without an adult cuticle, located in the region in which the primordium of the sternal gland will be formed in the late second-instar pupal stage. b. Gross structure of the primordium of a sternal gland of the late stage with an adult cuticle (ACu). c. Magnified image of a cuticular ridge (CR) and a cuticular ridge-forming cell (asterisk). EpC: epithelial cell, N: nucleus of epithelial cell, NSC: nucleus of secretory cell, PCu: second-instar pupal cuticle, ScS: subcuticular space, SD: secretory ductules. Scales = 2 μm.