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# MORPHOLOGY OF THE VENOM GLAND IN RELATION TO WORKER SIZE IN LEAF-CUTTING ANTS (FORMICIDAE, ATTINI)

**E. Schoeters and J. Billen**

Zoological Institute, K.U.Leuven, Naamsestraat 59, B-3000 Leuven (Belgium)

**Summary** - The secretory filaments of the venom gland in workers of the leaf-cutting ants *Atta sexdens sexdens* and *A. sexdens rubropilosa* show morphological differences related to the worker's size. The smallest individuals are characterized by a relatively long unpaired filament with a bifurcation in its distal region. This bifurcation occurs more proximally in bigger workers, with no unpaired portion left in the major workers and soldiers. This is the first report of an intraspecific variation of the venom gland morphology in ant workers.

**Key words** : *Atta sexdens sexdens*, *Atta sexdens rubropilosa*, Attini, morphology, venom gland, allometric growth.

**Résumé : Morphologie de la glande à venin par rapport à la taille des ouvrières chez les fourmis champignonnistes (Formicidae, Attini)**

Selon leur taille, les ouvrières des fourmis champignonnistes *Atta sexdens sexdens* et *A. sexdens rubropilosa* montrent des différences morphologiques des filaments sécréteurs de leur glande à venin. Chez les individus les plus petits, la glande est caractérisée par un filament impair qui se ramifie en deux filaments pairs dans sa région distale. Cette bifurcation se trouve plus proximalement chez les individus de taille plus grande, tandis que chez les ouvrières majeures et les soldats, la partie impaire n'existe plus, et ce sont les deux filaments (exceptionnellement avec une ramification distale secondaire) qui prennent leur origine dans le réservoir. Cette contribution forme le premier rapport d'une variation intraspécifique dans la morphologie de la glande à venin chez les ouvrières des fourmis.

**Mots-clés** : *Atta sexdens sexdens*, *Atta sexdens rubropilosa*, Attini, morphologie, glande à venin, croissance allométrique.

## Introduction

The venom gland in social insects is the source of the often toxic defensive secretions, and to this purpose displays a peculiar compartmentalized composition (Blum & Hermann, 1969) : the main biosynthetic activity is situated in two secretory filaments, that carry the preliminary secretion into the morphologically complex convoluted gland, where the substances acquire their final toxicity. The

venom from there enters the reservoir sac, where it will be stored until the moment of discharge through the sting. The conspicuous cuticular lining of the reservoir probably prevents self-toxication against the venom (Hefetz & Blum, 1978).

In the Formicidae, the secretory filaments may extend from the reservoir as a single filament that branches some distance from it (Ponerinae, Ecitoninae, Pseudomyrmecinae, Myrmeciinae and Nothomyrmeciinae), or are paired over their entire length, as in the more evolved Myrmicinae, Formicinae and Dolichoderinae (Hermann, 1969, 1984 ; own observations). The present contribution reports on the intraspecific occurrence of both types in the venom gland of workers of leaf-cutting ants (Myrmicinae, Attini).

## Material and methods

Leaf-cutting ant workers were available from laboratory colonies of *Atta sexdens sexdens* (L.) (collected after the queen's nuptial flight in December 1973, in Cayenne, French Guyana) and *Atta sexdens rubropilosa* Forel (nuptial flight November 1987, Viçosa, MG - Brasil). After measuring their maximal head width, workers belonging to all size groups were dissected and their venom glands accurately drawn with the help of a projector microscope.

## Results and discussion

In the smallest workers of both *A. sexdens sexdens* and *A. sexdens rubropilosa* (head width less than 1 mm), the venom gland without exception occurs with a relatively long unpaired filament that branches into two at a reasonable distance from the reservoir (Fig. 1A). Increasing worker size goes along with a reduction of the unpaired portion, the secretory part of the gland thus gradually changing from a Y- to a V-shape (Figs. 1B,1C). Major workers (Fig. 1D) and soldiers as a result only have paired filamentous glands, that exceptionally may even undergo a secondary bifurcation in some soldiers (Fig. 1E). The diameter of the reservoir sac and the overall length of the secretory filaments increase with the size of the ant, the diameter of the filaments, however, retains a constant thickness of approximately 50 µm in all individuals.

The allometric growth of the venom gland with a very clear and gradual proximally shifting of the bifurcation region of the unpaired secretory filament and the eventual disappearance of the latter so far has never been observed in workers of the same species. According to Hermann *et al.* (1970), the venom gland of *Atta texana* workers is characterized by two distinct free filaments without bifurcation. Considering the scale bar in their illustrations, however, only major workers (which in fact are much easier to be dissected) appear to have been used in their study, and then are consistent with our actual findings. Only for the honey bee *Apis mellifera*, the position of the bifurcation has been found in the very proximal region in the queen, and almost at the far distal end in the workers (Snodgrass, 1956 ; de Lello, 1976). The evolution of the Hymenopterous venom gland has been reported to show a gradual reduction from a large number of dichotomously branching secretory filaments in the primitive forms to two basal filaments in the higher groups (Robertson, 1968).

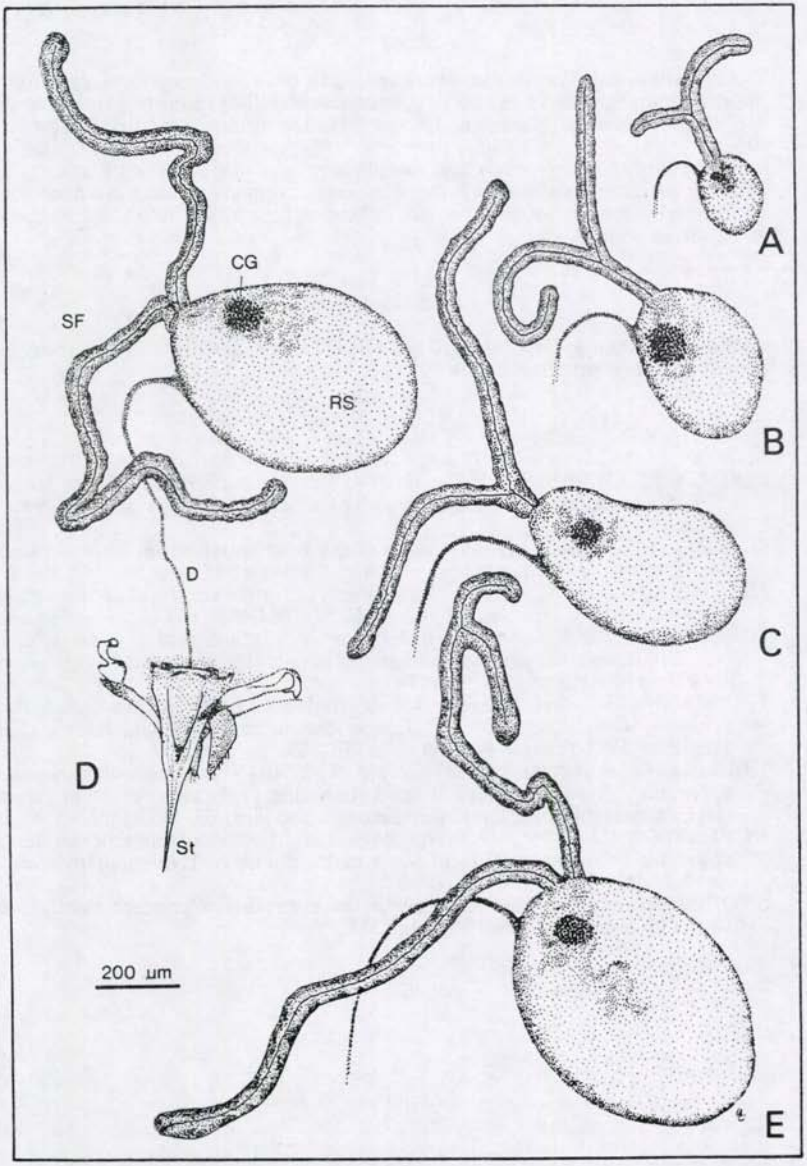


*Fig. 1. - Appearance of the venom gland in workers of the different size groups of* Atta sexdens sexdens. *Corresponding head widths are 0.7 mm (A), 1.3 mm (B), 2.5 mm (C), 4.0 mm (D) and 4.7 mm (E).* CG = *convoluted gland,* D = *duct,* RS = *reservoir sac,* SF = *secretory filaments,* St = *sting.*

Also within the Formicidae, there seems to be a tendency to evolve from a bifurcated appearance in the more primitive subfamilies towards a situation with two single filaments (Hermann, 1969, 1984). The present and first report of a similar intraspecific variation therefore may recommend a more cautious interpretation of the venom gland morphology as a phylogenetic character. The aberrant morphology of the secretory filaments in some Australian myrmicine and dolichoderine species yet gave another indication for caution in this regard (Billen & Taylor, in prep.).

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