

A novel epithelial intramandibular gland in the ant *Pyramica membranifera* (Hymenoptera, Formicidae)

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Social insects in general, and ants in particular, are known for the overwhelming development of their exocrine system (3, 9). As all exocrine glands are ectodermal in origin, they are always in one way or another associated with cuticle, which has long made it difficult to study their occurrence and structural organisation. Glands found in close association with the rigid exoskeleton, and especially with its hardest parts such as the mandibles or antennae, sting or legs, have therefore often long remained unknown. The use of plastic embedding, however, has made it possible to section through the hardest cuticle, which has resulted in the discovery of several hitherto unknown glands (e.g. 2, 3, 4, 10, 11). Among these discoveries is also the intramandibular gland, which occurs as a common exocrine structure within the mandibles of all major ant subfamilies (14). It corresponds to the gland type with bicellular units (1), each unit consisting of a duct cell and a secretory cell (type 3 glandular cells according to the classification by NOIROT & QUENNEDEY: 12). During a histological investigation of the mandibles of the tiny dacetone ant *Pyramica* (formerly *Trichoscapa*) *membranifera*, our attention was drawn to the occurrence of an intramandibular glandular epithelium, which we here describe, and which description represents the first report on the existence of an epithelial gland inside the mandibles in ants.

Pyramica membranifera (Emery, 1869) workers were collected in Sant Cugat (Barcelona), Spain. The anterior parts of their heads were fixed in 2% glutaraldehyde and postfixed in 2% osmium tetroxide (buffered at pH 7.3 with Na-cacodylate). After dehydration in a graded acetone series, they were embedded in araldite and sections made with a Reichert Ultracut E microtome. Semithin sections for light microscopy were stained with methylene blue and thionin; double-stained thin sections were viewed in a Zeiss EM900 electron microscope.

The mandibles of workers of the small dacetone ant *Pyramica membranifera* show at their inner distal margin a conspicuous glandular epithelium with a thickness of 10 μm (Fig. 1). The columnar epithelial cells display an obvious microvillar differentiation of the apical cell membrane and a basal position of the rounded nuclei (Fig. 2). The cytoplasm is characterized by the presence of numerous mitochondria, and an abundance of rounded electron-lucid vesicles with a diameter between 0.5 and 2 μm (Fig. 2). Endoplasmic reticulum could not be discerned, neither of the smooth nor of the granular type. The cuticle overlaying the epithelium is perforated by numerous vertical pore canals with a diameter of approx. 0.2 μm , that open at the external surface (Fig. 3).

Exocrine structures inside the mandibles of ants have been reported for many species (14), but these intramandibular glands invariably were formed by bicellular units (type 3 cells according to NOIROT & QUENNEDEY: 12) with duct cells opening at the upper mandibular surface. Epithelial glands (type 1 cells according to NOIROT & QUENNEDEY: 12) so far have never been found inside ant mandibles, and among social insects have only been described for some stingless bee species (5). The function of this novel gland in ants so far remains unknown. The numerous mitochondria and secretory vesicles are indicative of an active metabolism, while the apical microvilli and cuticular pores (13) would facilitate the discharge of the secretory products to the outside. One possible function for the secretion could be related to the predatory habits of Dacetini. This group of ants is highly specialised in capturing mainly Collembola and other soil microfauna (7, 15). Freshly-captured entomobryomorph Collembola were present in the nests of *P. membranifera* at the collection site in Sant Cugat, in a small cell close to the colony. During the capture process, dacetone ants approach prey very slowly and the hypothesis has been proposed that foraging workers attract or appease Collembola via an allomone (6). This author proposed two possible origins for that allomone, the petiolar spongiform appendages or the labrum. The intramandibular gland here described could be the source of this substance.

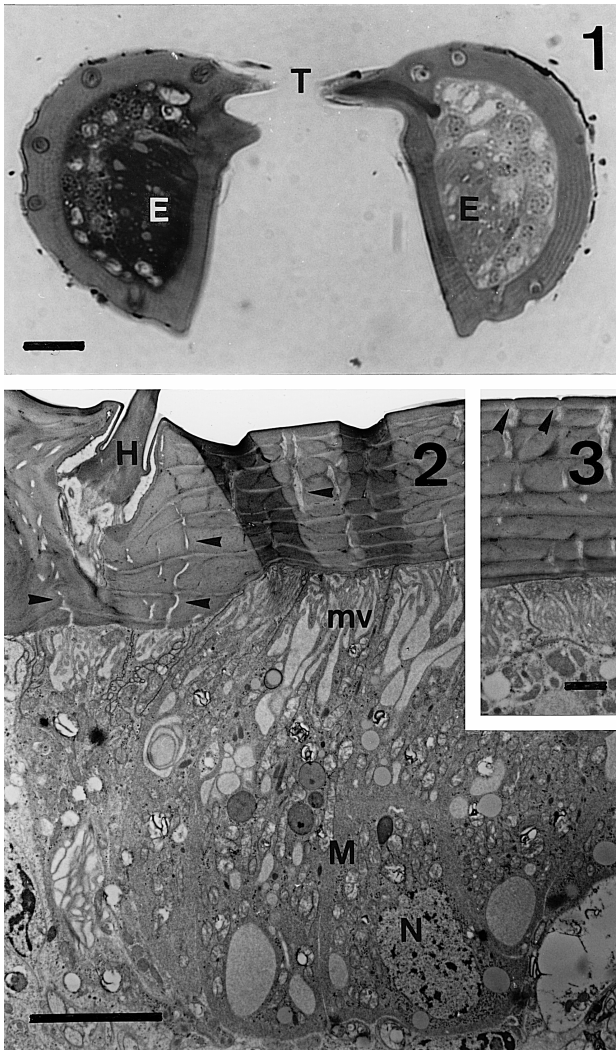


Fig. 1. – Semithin section through distal tip of mandibles of *P. membranifera* worker. E = glandular epithelium, T = mandibular tooth, scale bar 10 µm.

Fig. 2. – Electron micrograph showing epithelial gland and overlying cuticle. Note narrow pores crossing cuticle (arrowheads), apical microvilli (mv), mitochondria (M), electron-clear vesicles and basally-located nuclei (N); H = hair. Dark zones in cuticle represent artefact folds due to sectioning. Scale bar 5 µm.

Fig. 3. – Detail of cuticular pores opening at external surface (arrowheads), scale bar 1 µm.

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