

L. DE MARZO, S. MAROTTA

Anatomy of the alimentary canal in female Coccoidea: an iconographic review

Abstract - Original observations on the alimentary canal of Coccoidea are reported; they refer to 31 species in the families Ortheziidae, Margarodidae, Pseudococcidae, Eriococcidae, Kermesidae, Micrococcidae, Cerococcidae, Coccidae, Lecanodiaspididae, Aclerdidae, Asterolecaniidae and Diaspididae. Seven types of alimentary canal were found throughout.

Key words: Coccoidea, alimentary canal, anatomy.

INTRODUCTION

Scale insects exhibit large variability in the structure of their alimentary canal. In most species, variations affect either the presence/absence of filter chamber or an interrupted condition; most in detail, they regard some accessory parts. Extensive studies on this matter are those of Berlese (1893, 1894, 1896) and Pesson (1935, 1944), improved subsequently by Bielenin (1963), Foldi (1972, 1973, 1990, 1997), De Marzo et al. (1998).

This review bases on original observations (31 species in 12 families) and makes now an attempt to classify the different types of alimentary canal.

MATERIALS AND METHODS

Oviger and/or preoviger females were dissected in saline solution (NaCl 0.9%) added with methylene blue. Other specimens from the same samplings were mounted on slides for taxonomic identification.

Terminology: see table 1.

Species examined: see explanations of tables 2-5.

Type classification characters - (a) alimentary canal structure: interrupted/uninterrupted; (b) filter chamber: present/absent; (c) connection tube: absent/present; (d) caecum: present/absent; (e) interruption position: either at anus or at the level of Malpighian tubules.

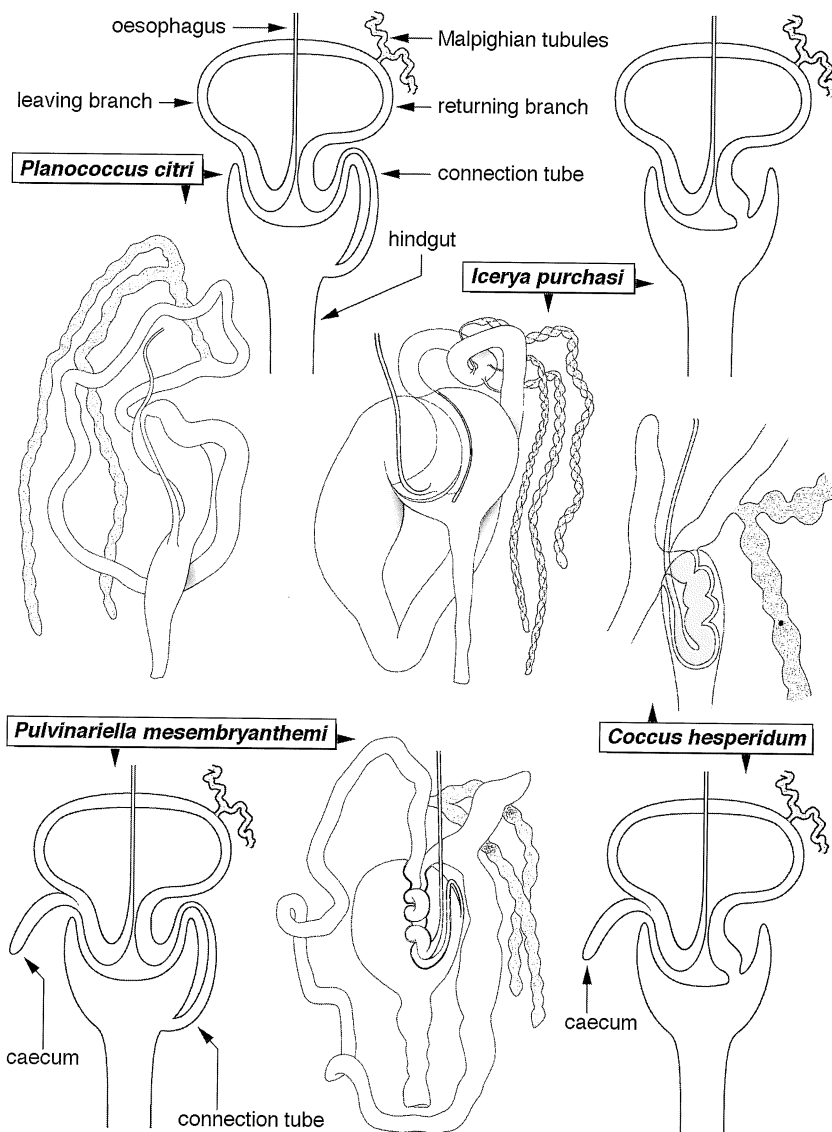


Fig. 1 - Schemes of filter chambers of Coccoidea and corresponding examples redrawn from Berlese (1894) and Pesson (1944).

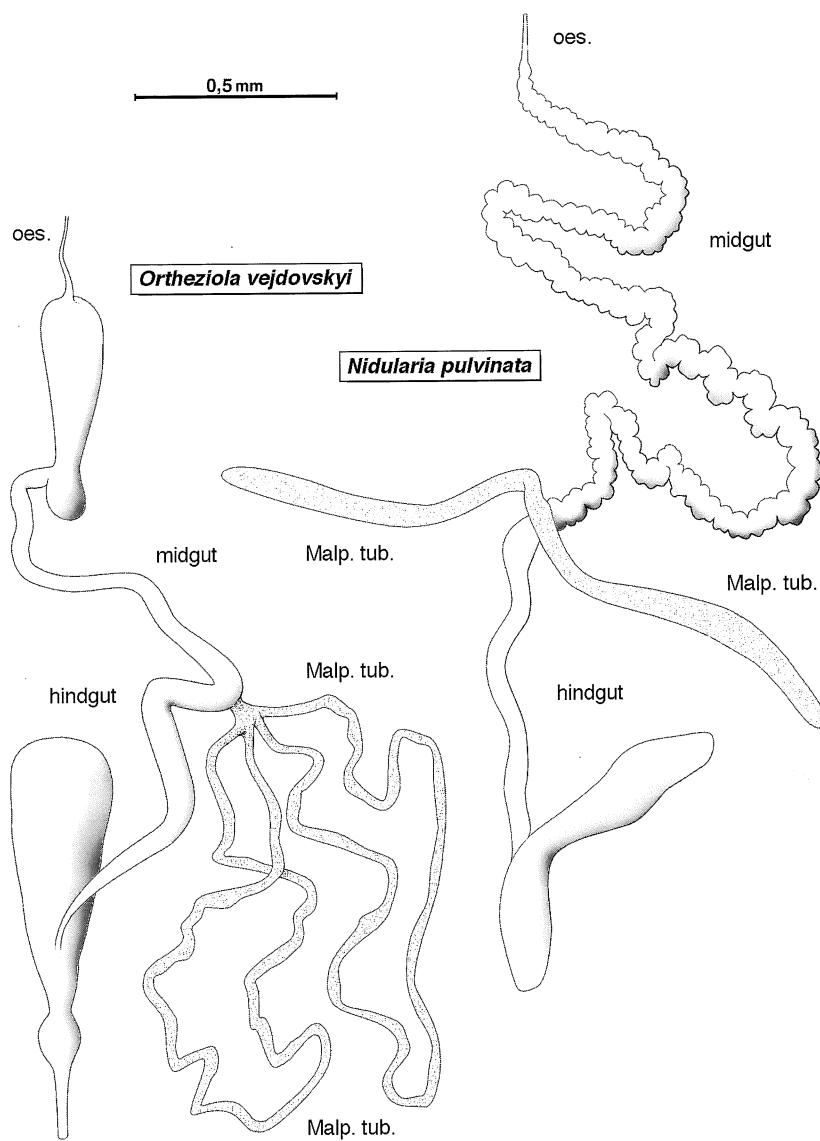


Fig. 2 - Type A, alimentary canal uninterrupted, filter chamber absent: *Ortheziola vej dovskyi* Sulc (Ortheziidae), *Nidularia pulvinata* (Planchon) (Kermesidae).

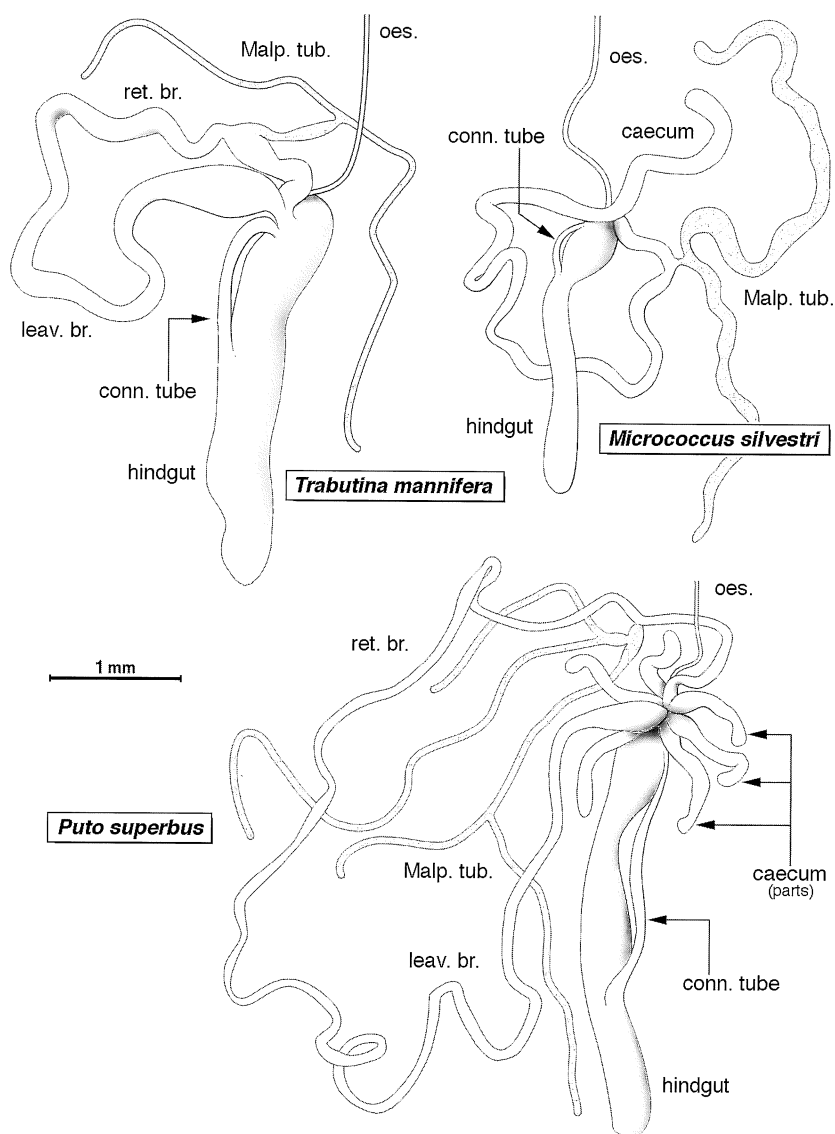


Fig. 3 - Type B, filter chamber present, connection tube present, caecum absent: *Planococcus citri* (Risso), *Pseudococcus vovae* (Nassanov), *Trabutina mannifera* (Hardwich) (Pseudococcidae), *Gossyparia spuria* (Modeer) (Eriococcidae), *Pollinia pollini* (Costa) (Cerochocidae), *Lecanodiaspis sardoa* Targioni-Tozzetti (Lecanodiaspididae), *Planchonia arabidis* Signoret (Asterolecaniidae). Type C, filter chamber present, connection tube present, caecum present: *Puto superbus* (Leonardi) (Pseudococcidae), *Micrococcus silvestrii* Leonardi (Micrococcidae). Caecum of *Puto superbus* is composed by 6 parts.

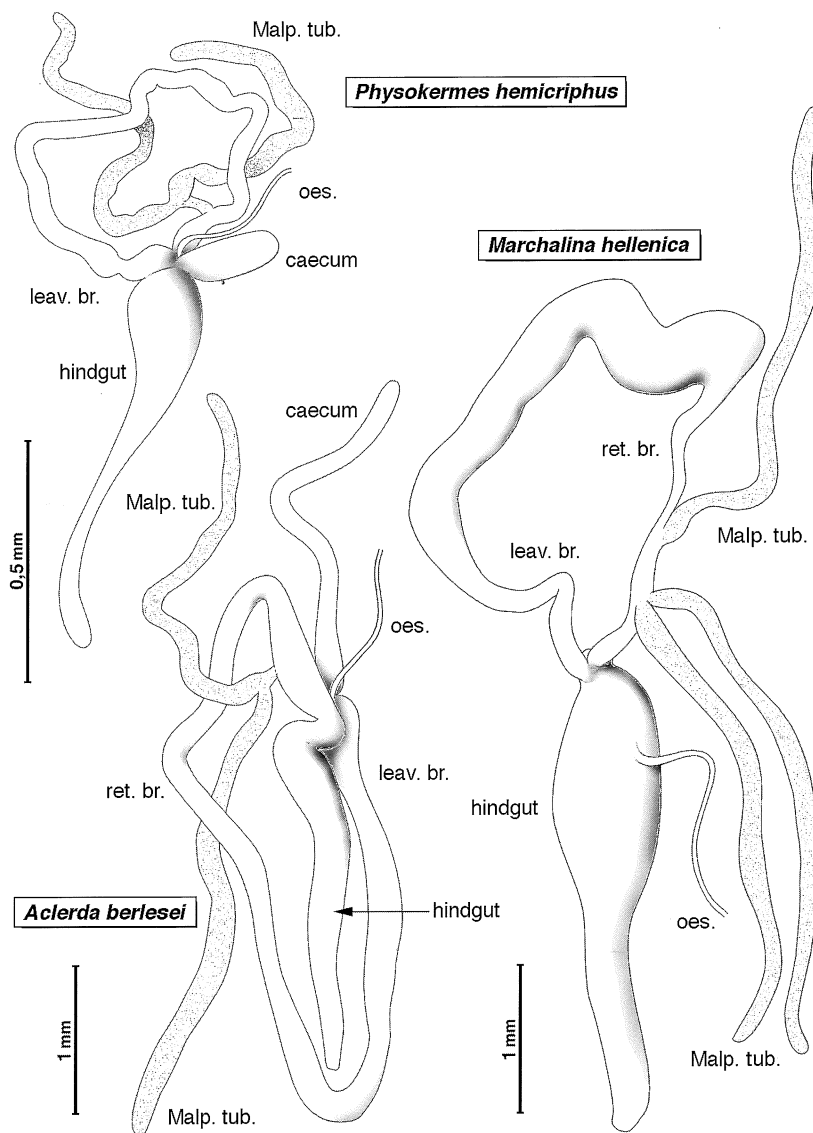


Fig. 4 - Type D, filter chamber present, connection tube absent, caecum present: *Ceroplastes rusci* (Linné), *Coccus pseudomagnoliarum* (Kuwana), *Lichtensia viburni* Signoret, *Parthenolecanium corni* (Bouché), *Physokermes hemicriphus* (Dalman), *Saissetia oleae* (Olivier) (Coccidae), *Aclerda berlesei* Buffa (Aclerdidae). Type E, filter chamber present, connection tube absent, caecum absent: *Icerya purchasi* Maskell, *Marchalina hellenica* (Gennadius).

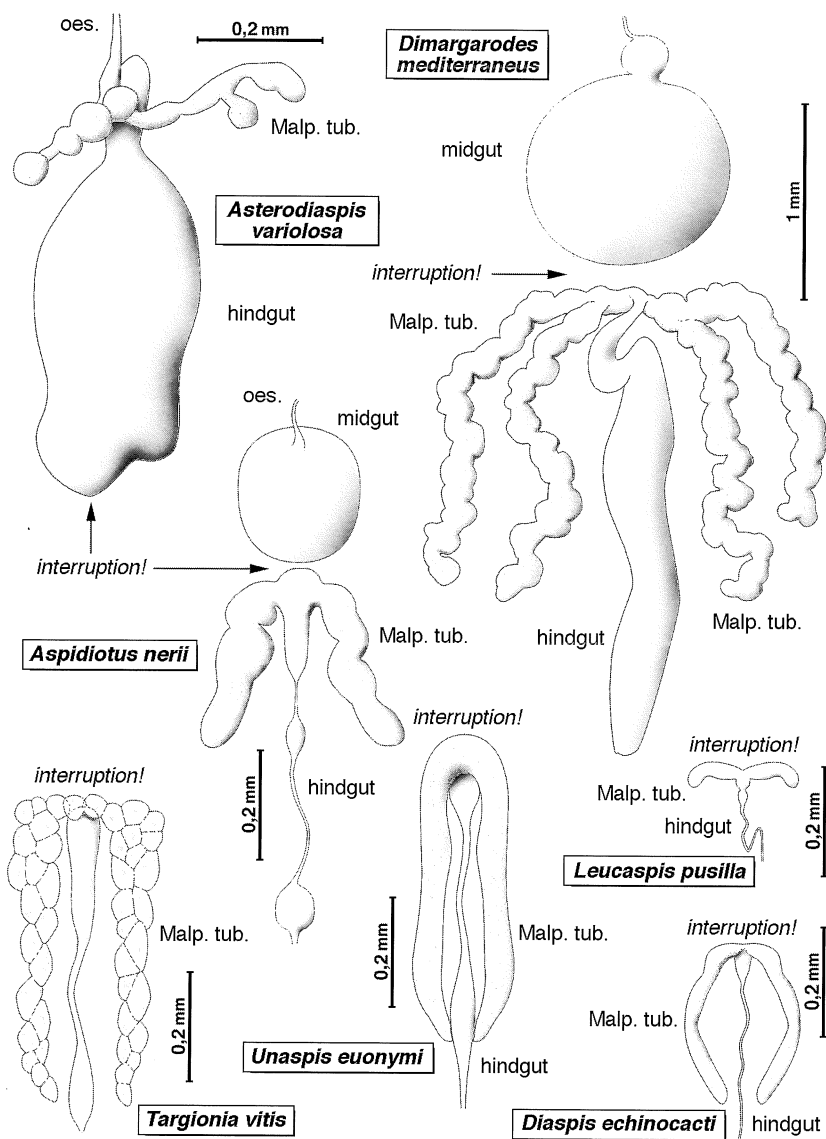


Fig. 5 - Type F, alimentary canal interrupted at anus: *Asterodiaspis variolosa* (Ratzeburg) (Asterolecaniidae). Type G, alimentary canal interrupted at the level of Malpighian tubules: *Dimargarodes mediterraneus* (Silvestri) (Margarodidae), *Aonidia lauri* (Bouché), *Aonidiella aurantii* (Maskell), *Aspidiotus nerii* Bouché, *Lepidosaphes beckii* (Newman), *Carulaspis minima* Targioni-Tozzetti, *Diaspis echinocacti* (Bouché), *Leucaspis pusilla* Löw, *Targionia vitis* (Signoret), *Unaspis euonymi* (Comstock) (Diaspididae).

REFERENCES

- BERLESE A., 1893 - Le Cocciniglie italiane viventi sugli agrumi. Parte I: I *Dactylopius* - Riv. Patol. veg., 2: 1-106 + tavv.
- BERLESE A., 1894 - Le Cocciniglie italiane viventi sugli agrumi. Parte II: I *Lecanium* - Riv. Patol. veg., 3: 107-201 + tavv.
- BERLESE A., 1896 - Le Cocciniglie italiane viventi sugli agrumi. Parte III: I *Diaspiti* - Riv. Patol. veg., 4: 203-477 + tavv.
- BIELENIN I., 1963 - Anatomical and histological investigations of the genus *Lecanium* Burm. Part IV. The alimentary canal of *Lecanium pomeranicum* Kaw. (Homoptera, Coccoidea) - Zoologica Poloniae, 13: 221-253.
- DE MARZO L., A. TRANFAGLIA, 1998 - Nuovi esempi di canale alimentare interrotto in Rincoti Coccoidei - Atti XVIII Congr. Naz. It. ent., Maratea 21-26 giugno 1998, p. 87.
- FOLDI I., 1972 - Données ultrastructurales et histochimiques sur le tube digestif et en particulier sur la chambre filtrante de deux Cochenilles, *Icerya purchasi* Mask. et *Planococcus citri* Risso (Insecta, Homoptera) - Thèse Doct.-Ing. Univ. Pàris VI, 82pp.
- FOLDI I., 1973 - Etude de la chambre filtrante de *Planococcus citri* (Insecta, Homoptera): Histochimie et ultrastructure. Z. Zellforsch. Microsc. 143: 549-568.
- FOLDI I., 1990 - Internal anatomy. In: D. Rosen (ed.), Armoured Scale Insects, their Biology, Natural Enemies and Control. Vol. A. Elsevier Sciences Publ., Netherlands: 65-80.
- FOLDI I., 1997 - Internal anatomy of the adult female. In: Y. Ben-Dov & C. J. Hodgson (eds.), Soft Scale Insects, their Biology, Natural Enemies and Control. Vol. A. Elsevier Sciences Publ., Netherlands: 73-90.
- PESSON P., 1935 - Contribution à l'étude du tube digestif des Coccides - Bull. Biol. Fr. Bel., 69: 138-152.
- PESSON P., 1944 - Contribution à l'étude morphologique et fonctionnelle de la tête, de l'appareil buccal et du tube digestif des femelles de Coccides - Thèse, Fac. Sci. Univ. Pàris: 266 pp.

PROF. LUIGI DE MARZO - Università della Basilicata, Dipartimento di Biologia, Difesa e Biotecnologie Agroforestali, Contrada Macchia Romana, 85100 Potenza, Italy

DR. SALVATORE MAROTTA - Università della Basilicata, Dipartimento di Biologia, Difesa e Biotecnologie Agroforestali, Contrada Macchia Romana, 85100 Potenza, Italy. E-mail: Marotta@unibas.it.

