FINE STRUCTURE OF THE GENITAL SYSTEM IN THE BEE PARASITE, 
VARROA JACOBSONI (GAMASIDA: DERMANYSSINA) WITH 
REMARKS ON SPERMIGENESIS, SPERMATOZOA AND 
CAPACITATION

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ABSTRACT

Alberti, G. and Hänel, H., 1986. Fine structure of the genital system in the bee parasite, 
Varroa jacobsoni (Gamasida: Dermanyssina) with remarks on spermiogenesis, sperma-

The female genital tract of Varroa jacobsoni is composed of a sperm-access system 
comprising paired solenostomes located between coxa III and IV, paired tubules, paired 
rami, an unpaired sperm duct, and an unpaired spermatheca. Another part of the female 
genital system is confined to egg development and oviposition. It is composed of an ovary 
(s.str.), in which oocytes mature, and a lyrate organ functioning as a nutrimentary struc-
ture. Both compartments, regarded as parts of the gonad, are connected by a region 
named the camera spermatis. This part is also in continuity with the oviduct I, which is 
provided with a muscular layer and numerous nerve endings. The following cuticle-lined 
oviduct II leads to the genital orifice through which the eggs are deposited. The fine structure 
of all these parts is described. Attention is drawn especially to the peculiar sperma-
theca which contains the "inner cells" which are thought to connect by way of free cells 
with a specialized region of the camera spermatis, thus establishing a "cellular bridge" 
through which penetration of capacitated spermatozoa into the ovary s.str. may occur. 
Lyrate organ and oocytes are connected via intercellular bridges/nutritive cords and are 
thus comparable to the telotrophic ovarioles of certain insects.

The male genital system, composed of unpaired testis, paired vasa deferentia, unpaired 
accessory gland and ductus ejaculatorius, is described ultrastructurally. Spermiogenesis 
occurs in cysts and spermatozoa belong to the "ribbon type". The vasa deferentia are pro-
vided with a muscular layer. For the first time receptors are detected in the proximal part 
of the ductus ejaculatorius. The accessory gland produces a proteinaceous secretion.

Spermatozoa were observed in the female rami and spermatheca. Only in the latter 
were elongated, capacitated spermatozoa seen.
INTRODUCTION

Since the early 1960s the mite *Varroa jacobsoni* has invaded colonies of the European honey bee, *Apis mellifera* (Delfinado, 1963). Originally a blood-sucking parasite of the Asian bee, *Apis cerana*, the mite has been introduced nearly world-wide by man, and “varroatosis” has become one of the most dangerous pests of honey bees (Griffiths and Bowman, 1981; De Jong et al., 1982). As a consequence of the economical and ecological importance of the mite recent papers have most often focussed on life cycle and control of the parasite (Ritter, 1981; Cavalloro, 1983). Hirschmann (1980) redescribed the female and published figures of the protonymph, deutonymph and male for the first time. Only few data on anatomy or histology are available (De Ruijter and Kaas, 1983). The genital system of *Varroa jacobsoni* was recently investigated by Akimov and Yastrebtsov (1984, 1985) with the light microscope. Our study on the fine structure of the genital system of *Varroa jacobsoni* is intended to increase knowledge of this mite, which is a prerequisite for better pest management in the future. Beyond the applied aspect, however, the mite offers many other problems worthy of investigation. The close interrelationship of the life cycle of the parasite with that of the host may be mentioned. The female mite enters the brood cell of the bee immediately before capping, and deposits an egg every 24 h (H. Hänel, unpubl. results). These give rise to a “family” of usually one male and several females (the number of which depends on the caste of the bee larva) plus the mother mite (Ifantidis, 1983). When the brood cell is opened, development of some mites is complete and the fertilized females leave the cell, invading new cells or worker bees after spending some days on adult bees. Certain specializations of the female ovary are thought to contribute to the fast development needed to complete ontogenesis in the shelter of the capped cell (Alberti and Zeck-Kapp, 1986).

*Varroa jacobsoni* is a species belonging to a group of gamasid mites, the Dermanyssina (Johnston, 1982), possessing a peculiar mode of insemination named podospermy (Athias-Henriot, 1968). This term means that spermatozoa are introduced by way of the modified chelicerae of the male into paired sperm induction pores (solenostomes) which are located between the bases of coxae III and IV. The present paper gives a detailed description of the female genital tract and completes the findings on the ovary published elsewhere (Alberti and Zeck-Kapp, 1986). Furthermore, the process of spermiogenesis is investigated, including the fate of the spermatozoa in the female.

Fine structure of spermatozoa of Anactinotrichida, to which the Varroidae belong, are classified into vacuolated spermatozoa, found for example in ticks, and into ribbon spermatozoa, which have been observed in the Parasitina and Dermanyssina (Alberti, 1984). Numerous papers have dealt with the capacitation of the tick spermatozoa (e.g. Feldman-Muhsam and Filshie, 1979). The present investigation is the first study of the fine structure of this