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The Genital System in *Dichelobius*

(Anopsobiidae, Lithobiomorpha, Chilopoda)

by

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Abstract: An anatomic-morphological study of the genital system in *Dichelobius* (Anopsobiidae, Lithobiomorpha) shows: The female genital system is similar to that described already for the other Chilopoda Anamorpha. The male genital system is asymmetrical. The functional gonad is composed of a macrotestis, followed by a functional microtestis, which is long and coiled. The rudimentary gonad is present as a thin filamentous duct. The two male genital ducts meet to form a short canal which opens near the lower part of the seminal vesicles. These data suggest two evolutionary lines, with distinct origins in the order Lithobiomorpha.

1. Introduction:

In a previous paper (PRUNESCU & JOHNS 1969) the presence of two gonads in males of *Anopsobius neozelandicus* SILVESTRI was reported: one undifferentiated and primitive, the other functional, divided into a macrotesticular ampulla, followed caudally by a microtestis.

2. Material and Methods:

The present paper is based on the study of two males, one of them damaged, and of one female of *Dichelobius bicuspis* RIBAUT, all from the collection of the Museum of Natural History of Basel, Switzerland. They were preserved in ethyl alcohol.

3. Results:

The male genital system is asymmetrical in the same way as that of *Anopsobius neozelandicus*. The functional testicle consists of an elongated ovoid-shaped macrotestis that produces spermatocytes, spermatids and large spermatozoa, and which is followed by a functional, long and coiled microtestis, the diameter of which is 3 - 4 times less than that of the macrotestis. The microtestis continues caudally with a narrow vas deferens.

The rudimentary testicle consists of a narrow tube, closed at its anterior end. Its rudimentary genital duct unites with the functional deferent canal. The two genital ducts fuse 20 µm before the opening of the single resulting canal at the basis of the seminal vesicles (Fig. 1 - 4). The seminal vesicles are long, reaching the pediferous segments IV or V. They secrete a colloid (Fig. 2 - 4) which surrounds the fascicles of spermatozoa. Posterior to the point of fusion of the two seminal vesicles, the genital tract divides into two ejaculatory canals which pass round the intestine and approach again on the anterior dorsal wall of the genital atrium (Fig. 6, 7). The ejaculatory canals join again to form a single very short (about 20 µm) ejaculatory duct, which opens in the median zone of the dorsal wall of the atrium (Fig. 8).

The dorsal accessory glands are a pair of long tubular glands, with central canals (Fig. 5). The two glands join in their subproximal part (Fig. 7). The efferent canal of the dorsal glands shows spe-

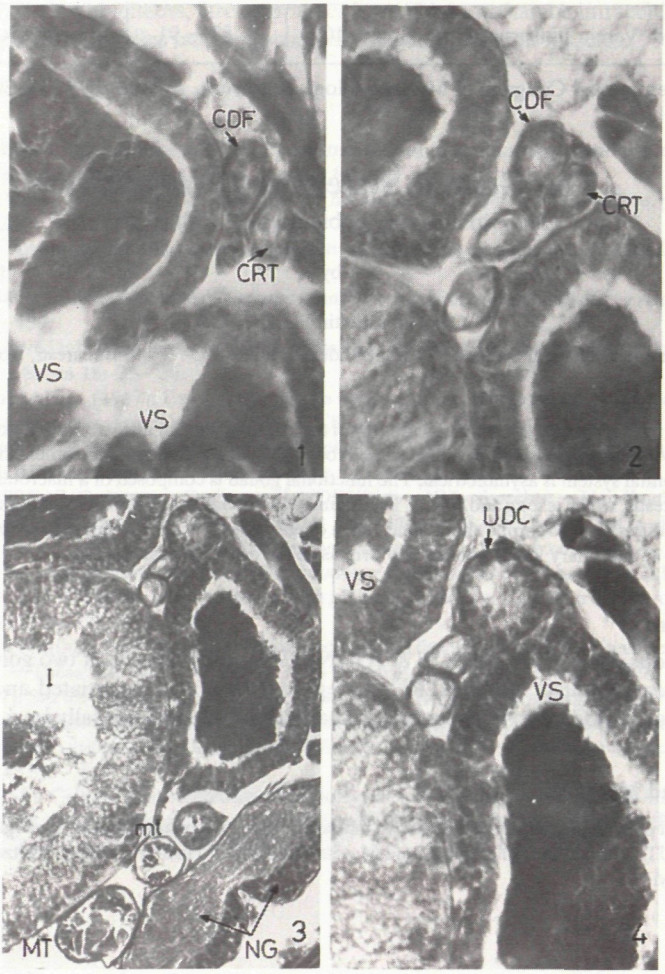

Fig. 1: Functional deferent canal (CDF), canal of rudimentary genital tract (CRT), seminal vesicles (VS). 256 x

Fig. 2: Functional deferent canal (CDF) and canal of rudimentary genital tractus (CRT) before their fusion. 256 x

Fig. 3: Cross section at the level of the fusion of deferent canals, slightly before the dorsal fusion of seminal vesicles and the opening of the unpaired deferent canal into this zone; macrotestis (MT) and microtestis (mt) may be observed between the intestine (I) and the nerve ganglia (NG). 142 x

Fig. 4: Detail of Fig. 3. The unpaired deferent canal (UDC) resulting from the fusion of the canals in Figs 1, 2 before its opening into the fusion zone of the two seminal vesicles (VS). 256 x

cialized histological structures, forming the central canal of the anterior part of the genital atrium (Fig. 7). The ventral accessory glands are a pair of long tubular glands, whose canals fuse medianly to form a single canal, situated ventrally to the atrium (Fig. 6). This canal opens medio-ventrally in the middle zone of the atrium (Fig. 7). The genital atrium is a complex structure, constituted from a chitinous tegumentary invagination to which the canals of the accessory glands and ejaculatory ducts are associated (Fig. 8).

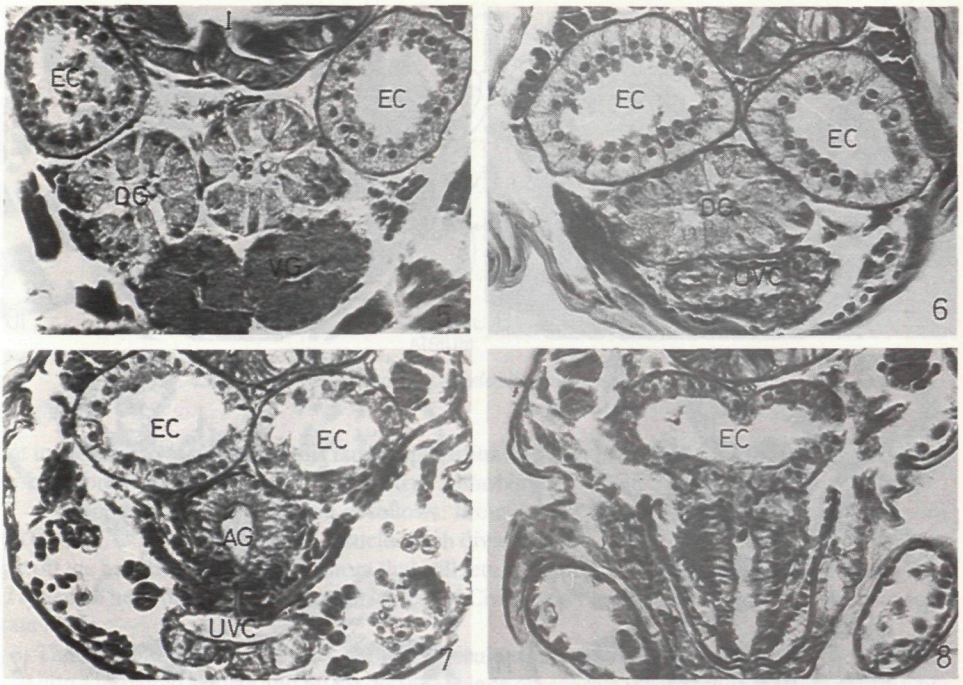

Fig. 5: Ejaculatory canals (EC) and ventral (VG) and dorsal accessory glands (DG); dorsally, posterior intestine (I). 252 x

Fig. 6: Dorsal glands united into a single gland (DG), and the canals of the ventral glands forming a single ventral canal (UVC); dorsal, ejaculatory canals (EC). 315 x

Fig. 7: Anterior zone of genital atrium: the central and single ventral canals (UVC) communicate with the chitinous atrium (AG); dorsally the ejaculatory canals (EC). 280 x

Fig. 8: Median zone of the genital atrium; ejaculatory canals (EC) united before opening into the atrium. 336 x

The female genital system consists of a large, elongated ovary, situated dorsal to the midgut. The ovary divides caudally into two symmetrical oviducts which run round the posterior intestine and open into the anterior corners of the glandular atrium. The two seminal receptacles, where sperm is deposited, are large ovoid structures. Each continues as a narrow coiled canal surrounded by strong circular musculature (Figs 9 - 11). The canals of the seminal receptacles open on papillae into the dorsal wall of the caudal zone of the female genital atrium (Fig. 12). The dorsal accessory glands are a pair of aciniform serous glands each of which opens into a long and thin canal, closely following the canal of the respective seminal receptacle. The canals of the dorsal glands open individually into the sides of the dorsal wall of the atrium, where the canals of the seminal receptacles cross the atrial wall. The ventral accessory glands are a pair of tubular glands with granular acidophilous secretion. The glands continue caudally with canals that open in the sides of the glandular atrium. The female genital atrium consists of an anterior glandular atrium, surrounded by modified tegumentary glands (Figs 9, 10), and a chitinous posterior atrium (Fig. 10). In the glandular atrium, the oviducts and the canals of the dorsal glands open into the chitinous atrium and the initial parts of the canals of the receptacles become more prominent. The atrium opens with a large genital orifice, comprising a dorsal and a ventral wall, loosely connected at their edges.

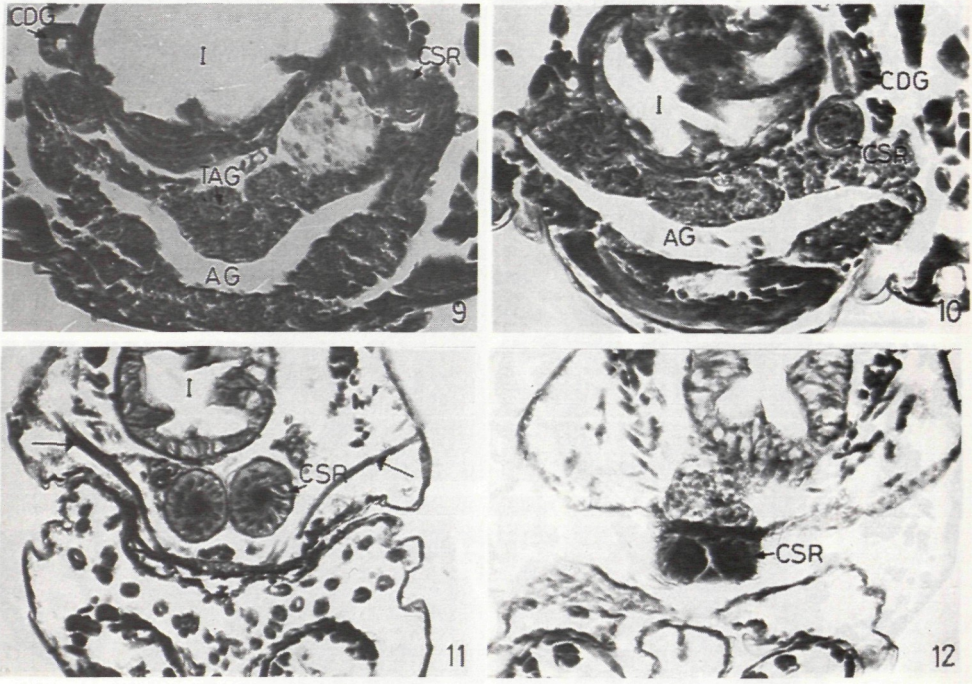

Fig. 9: Anterior zone of female genital atrium (AG) surrounded by tegumental atrial glands (TAG); canals of dorsal glands (CDG) and canals of seminal receptacles (CSR); canals of the ventral glands open into the genital atrium (AG). 168 x

Fig. 10: Chitinous zone of the female genital atrium; canals of dorsal glands (CDG) and canals of seminal receptacles (CSR), dorsally, the posterior intestine (I). 252 x

Fig. 11: Female genital atrium in the caudal zone, its side walls not present; canals of seminal receptacles (CSR), muscles (arrow) which open the atrium's orifice. 266 x

Fig. 12: Papillary opening of the canals of the seminal receptacles (CSR) in the caudal zone of the atrium. 224 x

4. Discussion:

The male genital system of *Dichelobius* presents a series of characters that bring it near to the genital system of Scutigeromorpha (FAHLANDER 1938, PRUNESCU 1969): two anterior genital tracts, macro- and microtestis; macro- and microspermatogenesis. Emphasis must be laid on the rudimentary state of one of the gonads, a trend which seems to characterize the family Anopsobiidae and which indicates a separation from the genital systems with symmetrical and functional testicles seen in the order Scutigeromorpha.

The lithobiid trends consist in the lack of numerous and symmetrical parts of the deferent canals such as characterize the male genital system of the Scutigeromorpha, as well as in the union of the ejaculatory canals into a single canal. Another important feature of *Dichelobius* is the presence of a single pair of ventral accessory glands as opposed to two pairs in the family Lithobiidae.

The female genital system of Chilopoda is rather uniform; only small differences exist between Lithobiomorpha and Scutigeromorpha. The female genital system of *Dichelobius* resembles more the situation in Lithobiidae, showing simplifications possibly due to small size: e. g. the dorsal diverticle of the atrium does not exist in this genus; it is poorly developed in the Scutigeromorpha and is well developed in the Lithobiidae. The genital system of the Anopsobiidae suggests the possibility

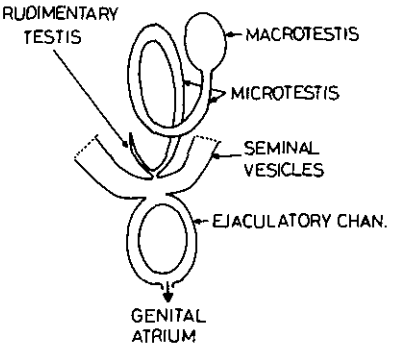

Fig. 13: Male genital system in *Dichelobius* and *Anopsobius*, schematic.

that in the course of evolution this family split from the main branch of Chilopoda Pleurostigmophora before the appearance of the first true Lithobiidae.

Chilopods could have evolved as follows: From the primitive Chilopoda Pleurostigmophora (PRUNESCU 1965), with paired testicles each divided into a macro- and a microtestis may have split off the branch of Notostigmophora that still retain the primitive organization of the male genital system. The evolution of the genital system of Chilopoda Pleurostigmophora followed two separate lines:

The main line, from which the Lithobiidae resulted, characterized by fusion of the two male gonads into a unpaired testicle and by the disappearance of separate macro- and microtestis. The Chilopoda Epimorpha resulted from this line. The paired male gonads which appear in embryonic development unite early into an unpaired testicle in Lithobiidae, whereas in Sccolopendromorpha they form several pseudometameric testicular vesicles, and in the Geophilomorpha a pair of testicular vesicles.

The evolutive line of Anopsobiidae. The two genera belonging to this family (*Anopsobius, Dichelobius*) each possess one rudimentary gonad and one active gonad, the latter consisting of macro- and microtestis. The anatomy of the male genital system of the Anopsobiidae supports the hypothesis that this family could have split off early from the primitive branch of Lithobiomorpha, when the male gonads had not yet achieved the union and when the microtestis had not yet disappeared. However, the type of male gonopods specific to Henicopidae and Anopsobiidae must have been present already. The feeding apparatus and the form of the forcipules favour this hypothesis as they seem to be closer to those of Lithobiidae than those of the Scutigeromorpha.

5. Literature:

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