

Research Note

BRIEF NOTES ON THE CYTOLOGY OF NEOTROPICAL COLEOPTERA. 5. STORAGE AND ACTIVATION OF LARGE SPERM CELLS IN MALE ALTICINAE¹

Evidence for the polyphyletic origin of increased spermatocyte size has been encountered in various invertebrates.^{2,3} Because the large volume of such spermatocytes is not much reduced during spermiogenesis, the sperm cells become unusually large (megaspermy). The trend is of evolutionary significance, because it has finally resulted in several taxa characterized by large spermatocyte and spermatozoon size. Among Coleoptera, so far as is known, there are three families in which cases of megalaspermy have been found. The most remarkable case, reported by Mazzini³ in a Clerid, *Divales bipustulatus* F., has remained unique, because its relatives have not been checked in this respect. In this case, the spermatozoa reach a length of 10 mm, which exceeds the entire length of the male body. Large spermatocytes and spermatozoa characterize coprophagous scarabs *Phanaeus*, *Onthophagus*, *Aegialia*, and, especially, *Aphodius*.^{2,4} Most Alticinae have long spermatozoa compared, for instance, to Criocerinae or Cassidinae. The longest fleabeetle spermatozoa have been encountered in the tribes Alticini and Oedionychini, especially in the subtribe Oedionychina, where the sperm cells ap-

proximate the male body in length. An enlarged spermatocyte I is a prerequisite for the successful meiotic behavior of the giant sex chromosomes of Oedionychina.⁵

How can thousands of such giant spermatozoa be produced simultaneously in an often very restricted space, and how can they be transported out of the male genital system, especially in species like Oedionychina, where spermatophores are not formed? For instance, in *Alagoasa bicolor* (L.), the spermiogenesis occurs in a follicle 0.4 to 1 mm in diameter, the sperm cells reaching a length of 4.5 mm. Bruck⁶ discovered the accommodative mechanism in this species. The tails of the elongating spermatids are positioned, *in statu nascendi*, around the extreme periphery of the follicle's equator. The spermiocysts, containing 16 spermatids each, do not rupture thereby. Every bundle of 16 gyrates almost four times around the follicle equator. The bundles become very tightly packed, resulting in a ring-like aggregate in the follicular periphery.

Single bundles of 16 are occasionally coiled off from the ring, shedding the cyst off at the same time. The result is a freely floating nude disc of 16 spermatozoa, about

¹Manuscript submitted to Editorial Board 6 February 1987.

²Virkki, N., 1951. Zur Zytologie einiger Scarabaeiden, Ann. Zool. Soc. Vanamo 14: 1-104.

³Mazzini, M., 1976. Giant spermatozoa in *Divales bipustulatus* F. (Coleoptera: Cleridae), Intern. J. Insect Morphol. Embryol. 5: 107-115.

⁴Virkki, N., 1956. Zur Kenntnis der postmeiotischen Ereignisse der Samenentwicklung bei den Skarabäiden, Z. Zellf. 44: 64-65.

⁵Smith, S. G. and N. Virkki, 1978. Animal Cytogenetics: Coleoptera. Edit. B. John. Borntraeger, Stuttgart. 366 pp.

⁶Bruck, T., 1978. The structure of the male genital system of *Alagoasa bicolor* (L.) (Coleoptera: Chrysomelidae) with special reference to sperm transportation, M.Sc. Thesis, Dept. of Biology, University of Puerto Rico, Río Piedras, Puerto Rico.

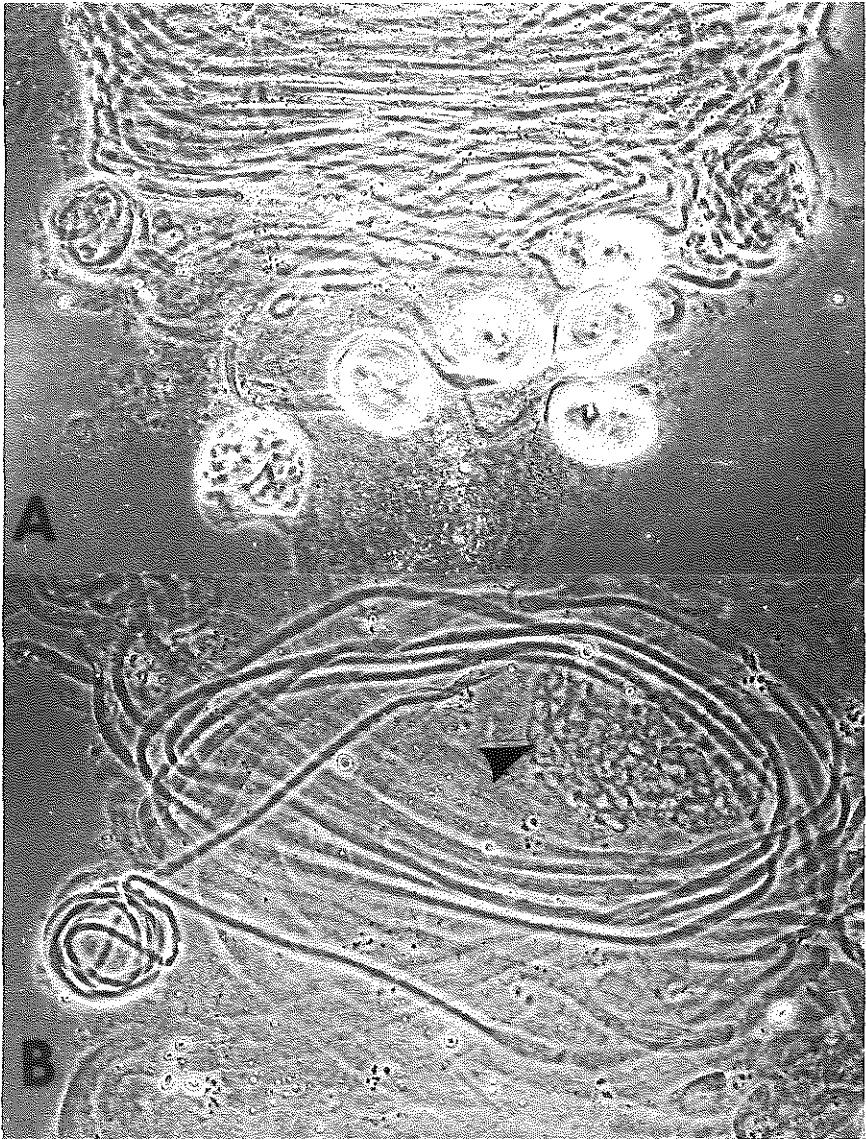


FIG. 1.—*Syphrea cylindrica* spermiogenesis, 350 \times . — A. Flattened base of a testis follicle showing coiling-off of several sperm bundles from the large loose gyres. — B. The coiling starts at the middle region of the sperm bundle. Arrowhead: abandoned spermiocysts. *Syphrea* spp. have 64 sperm cells per bundle.

0.1 mm in diameter, small enough for a convenient passage through the male genital ducts. The coiling-off is the only flagellar activity observed in the male and female. In both sexes, swimming of spermatozoa is precluded because of their length. The coils are apparently propelled out of the male by muscle contraction in the genital ducts.⁷

Figure 1 documents almost the same system in a more primitive fleabeetle, *Syphrea cylindrica* (Weise). The difference is that a tightly packed ring is not formed. The situation resembles that of *Aphodius*. In *Aphodius*, however, the bundles coil off from the peripheral gyres with their sper-

miocyst on, and some flagellar undulation occurs in the coiled tails. The cysts are shed when the bundles enter the *vas deferens*.⁴

Clearly, similar mechanisms of storage and transportation of extra large sperm cells have evolved separately in the Coleoptera.

Niilo Virkki

Tanya Bruck

Aida Denton

Agricultural Experiment Station

Department of Crop Protection

and

(T.B.) Department of Biology

Río Piedras Campus of UPR

⁷Mann, J. S. and R. A. Crowson, 1983. On the internal male reproductive organs and their taxonomic significance in the leaf beetles (Coleoptera: Chrysomelidae), *Entomol. Gener.* 9: 75-99.