ABSTRACT

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Germ cell cysts and simultaneous sperm and oocyte production in a hermaphroditic nematode.

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Studies of gamete development in the self-fertile hermaphrodites of Caenorhabditis elegans have significantly contributed to our understanding of fundamental developmental mechanisms. However, evolutionary transitions from outcrossing males and females to self-fertile hermaphrodites have convergently evolved within multiple nematode sub-lineages, and whether the C. elegans pattern of self-fertile hermaphroditism and gamete development is representative remains largely unexplored. Here we describe a pattern of sperm production in the trioecious (male/female/hermaphrodite) nematode Rhabditis sp. SB347 (recently named Auanema rhodensis) that differs from C. elegans in two striking ways. First, while C. elegans hermaphrodites make a one-time switch from sperm to oocyte production, R. sp. SB347 hermaphrodites continuously produce both sperm and oocytes. Secondly, while C. elegans germ cell proliferation is limited to germline stem cells (GSCs), sperm production in R. sp. SB347 includes an additional population of mitotically dividing cells that are a developmental intermediate between GSCs and fully differentiated spermatocytes. These cells are present in males and hermaphrodites but not females, and exhibit key characteristics of spermatogonia - the mitotic progenitors of spermatocytes in flies and vertebrates. Specifically, they exist outside the stem cell niche, increase germ cell numbers by transit-amplifying divisions, and synchronously proliferate within germ cell cysts. We also discovered spermatogonia in other trioecious Rhabditis species, but not in the male/female species Rhabditis axei or the more distant hermaphroditic Oscheius tipulae. The discovery of simultaneous hermaphroditism and spermatogonia in a lab-cultivatable nematode suggests R. sp. SB347 as a richly informative species for comparative studies of gametogenesis.