Proc. Indian natn. Sci. Acad. **B52** No. 6 pp 729–731 (1986)

Observations on the Egg Types and Males of *Collotheca tenuilobata* Anderson (Rotifera: Collothecidae)

S S S SARMA and T RAMAKRISHANA RAO
Department of Zoology, University of Delhi, Delhi 110 007

(Received 29 September 1986)

The different egg types and hitherto-unreported males of the sessile rotifer *Collotheca tenuilobata* are described. Resting, mictic, and amictic eggs were observed in live individuals isolated from pond plankton, and males were obtained by hatching mictic eggs in the laboratory. The resting eggs were the largest, followed by amictic and micitic eggs, a trend recorded in many other rotifier species also. The male of this species, unlike the sessil female, is free-swimming and short-lived. It is suggested that records of the relative frequencies of the three egg types in different species in regularly collected plankton samples could provide valuable information necessary for understnading the reproductive ecology of rotifiers in Indian freshwater ecosystems.

Key Words: Rotifera, mictic reproduction, *Collotheca tenuilobata,* **Resting eggs**

Introduction

Many aspects of reproduction in rotifers, particularly the predominantly parthenogenetic mode of reproduction, periodic switch to sexual mode of reproduction, sexual dimorphism and formation of resting eggs, have received considerable attention in recent years (Gilbert 1983a, Gilbert & Williamson 1983, Pourriot & Snell 1983), but our current knowledge of their reproductive biology is far from complete. Because of the sporadic nature of sexual reproduction, the males of many rotifer species are yet to be described. Not clearly understood are the intrinsic and extrinsic factors that trigger a change from amictic to mictic mode of reproduction in nature. This is particularly so in the case of rotifers from the tropical and subtropical freshwater bodies of India. Much of the currently available information on Indian rotifers pertains to their taxonomy, systematics and geographical distribution (Sharma & Michael 1980, sharma 1983). Different egg types and males have rarely been described (Vasisht & Agarwal 1978, Rao & Sarma 1985). We describe here the hitherto unreported male of *Collotheca tenuilobata* Anderson, a sessile rotifer belonging to the family Collathecidae, and also our observations on different egg types of other rotifer species obtained from live plankton samples or laboratory cultures.

Materials and Methods

Collotheca tenuilobata is a sessile rotifer that builds a gelatinous sheath. Because of its habit of contracting into the sheath at the slightest disturbance, it is difficult to isolate and identify this species from routinely preserved plankton collections. This fact explains why, in spite of its apparently common occurrence, *C. tenuilobata* had not been reported in any of the numerous papers on the regional taxonomic lists of rotifers in India. Except for the first description of this species by Anderson (1889), we were unable to find any published record of its occurrence in Indian waters. Interestingly, *C. tenuilobata* was also missing from the recent, comprehensive Rotifer synopsis by Sharma and Michael (1980).

Collotheca was isolated from live plankton samples collected from local ponds using a 53 μm mesh Nytex sieve. Algal fronds and twigs to which the rotifers were attached were carefully transferred to glass cavity blocks containing dechlorinated water with laboratory-cultured *Chlorella* cells at a density of 1×10^6/ml, and maintained at 25 ± 1°C in a B.O.D. incubator. Nearly all the individuals in the sample were found to have different eggs within the gelatinous sheath. Observation at high magnification and egg diameter measurements helped us delineate all the three types of eggs—mictic, amictic and resting. Female

C. tenuilobata bearing mictic eggs were isolated and the eggs allowed to develop and hatch. Camera lucida drawings were made for the resulting males as well as the females and different types of eggs carried by them.

Observations and Discussion

To the extent we were able to observe, C. tenuilobata is not amphoteric; however, in wuite a few specimens we observed both resting eggs and mictic eggs being carried simultaneously in the gelatinous sheath of the same individual (figure 1a). Furthermore, we also observed the release of mictic eggs into the gelatinous sheath that had already a few restings eggs. It appears that a frest fertilization by a male is necessary for the formation of each resting egg (Gilbert 1983b). The number of mictic eggs on each female was variable but high (11.8 ± 4.4.); the number of resting eggs was 2 ± 1. The three types of eggs showed distinct size differences (figure 1 b, c, d), resting eggs being the largest (diameters: 104 and 74 μm), followed by the amictic (diameters: 84 and 58 μm) and mictic (diameters: 52 and 46 μm) eggs. This trend, noted by us in the monogonont *Brachionus patulus* also (Rao & Sarma 1985), and in other species by various workers, is quite possibly a characteristic of the entire group. We also noted that the number of mictic eggs carried by the mictic female at a time is almost always greater than the number of amictic eggs carried by an amictic female, the latter being influenced often by temperature and food availability. These differences in size and number were found very useful in distinguishing mictic and amictic females.

As in nearly all the rotifers studied, sexual dimorphism in *C. tenuilobata* was extremely prominent. The males, significantly smaller than the females, have both their anterior and posterior ends ciliated figure 1e). Compared to the sessile female, the male is an active swimmer and does not build the typical gelatinous sheath. The average lifespan of *C. tenuilobata* male was about 20 hr. In gross morphology, the males resemble closel the males of *C. ornata, C. campanulata, C. pelagica* and *C. trilobata* described by other (Koste 1978, Pontin 1978).

As pointed out in introduction, much remains to be understood about the periodicities of asexual and sexual modes of reproduction in rotifers in Indian freshwater systems and about the environmental factors that might influence them. Unlike the temperate lakes and ponds, many freshwater bodies in India are characterized by high temperature regimes, variable trophic conditions, and periodic dring-up and flooding due to monsoons. The acute paucity of infomation on the reproductive ecology of Indian rotifers appears to be largely due to the continued emphasis on traditional limnological approaches which generally involve periodic plankton

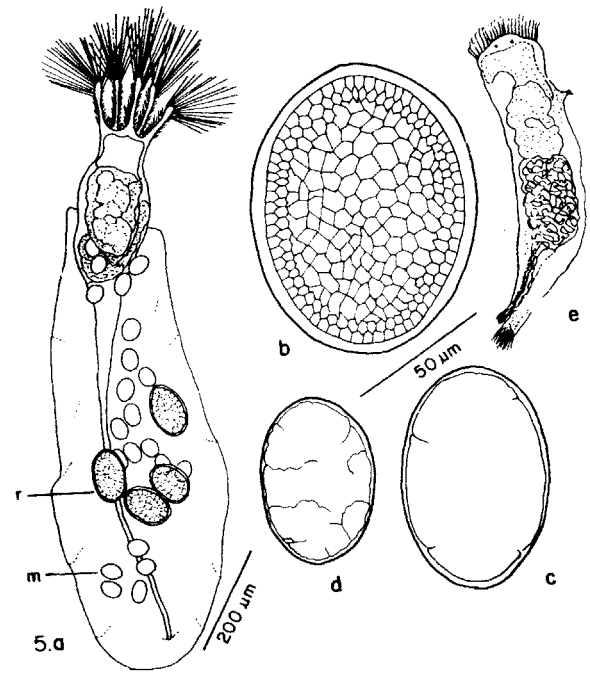

Figure 1 *Collotheca tenuilobata;* **a,** mictic female carrying resting (r) and mictic (m) eggs; **b,** resting egg; **c,** amictic egg; **d,** mictic egg; **e,** male.

collection, identification and enumeration of different species, and description of geographic variation in morphological characteristics. In some instances, notable attempts have been made to establish correlations between their seasonality and abundance, and certain physico-chemical parameters of their habitat (Vasisht & Sharma 1976, Jyoti & Sehgal 1979). We strongly believe that there is now a justified need to shift the emphasis in rotifer studies to their ecology in order to understand fully not only their reproductive pattern but their role in the zooplankton community organization in our freshwater ecosystems. Because of the global distribution pattern of freshwater rotifer species (Ridder 1981), it is doubtful if taxonomic pursuits alone will continue to be rewarding. Experimental manipulations in the field and controlled experiments using laboratory-cultured clones can be expected to yield greater insights into the ecology of Indian rotifers. Even from periodic plankton collections, fresh or preserved, valuable information on rotifer reproductive biology can be gathered. For instance, once adequate familiarity with different types of rotifer eggs is gained, their relative frequencies can be recorded from the regular plankton collections providing information necessary for an understanding of the role of environmental factors on reproductive

patters. If fresh, live samples were available, mictic females can be isolated on the basis of egg diameter measurements and males hatched from the mictic eggs with relative ease. Using this approach, we were able to observe and record in our routine plankton collections, mictic, amictic and resting eggs of *Brachionus calyciflorus, B. patulus, B. falcatus, B. rubens, B. angularis, Polyrthra trigla* and *Filinia longiseta* and resting eggs in a few other species. By hatching mictic eggs in the laboratory, we were able to record the males of *Brachionus patulus, B. bidentata, B. plicatilis, B. angularis* and *B. forficula*. In experimental cultures, males of *Asplanchna brightwelli* and *A. intermedia* were also recorded. In India, more rotifer studies employing the approaches we suggested here are needed for a complete understanding of their reproductive biology and ecology under conditions characterizing Indian freshwater ecosystems.

Acknowledgement

One of us (SSS) is thankful to the University Grants Commission for the award of a Junior Research Fellowship.

References

Anderson H H 1889 Notes on Indian Rotifers; *J. Asiatic Soc.* Bengal **58** 345–358

Gilbert J J 1983a Rotifera; in *Reproductive Biology of Invertebrates. I. Oogenesis, Oviposition and Oosorption* pp 181–209 eds K G Adiyodi and R G Adiyodi (New York: John Wiley & Sons)

—— 1983b Rotifera; in *Reproductive Biology of Invertebrates. II. Spermatogenesis and Sperm Function* pp 181–193 eds K G Adiyodi and R G Adiyodi (New York: John Wiley & Sons)

—— and Williamson C E 1983 sexual dimorphism in zooplankton (Copepoda, Cladocera, and Rotifera); *Ann. Rev. Ecol. Syst.* **14** 1–33

Jyoti and M K and Sehgal H 1979 Ecology of rotifers of Surinsar, a subtropical, freshwater lake in Jammu (J & K), India; *Hydrobiologia* **65** 23–32

Koste W 1978 *Rotatoria Die Radertiere Mitteleuropas Ein Bestimmungswerk, begrundet von Max Voigt* Überordnung Monogononta Vol 2 (Stuttgart : Gebrüder Bortraeger)

Pontin R M 1978 *A Key to the freshwater planktonic and semiplanktonic Rotifera of the British Isles;* Freshwater Biological Assiciation Scientific Publication No. 38

Pourriot R and Snell T W 1983 Resting eggs in rotifers; *Hydrobiologia* **104** 213–224

Rao T R and Sarma S S S 1985 Mictic and amictic modes of reproduction in the rotifer *Brachionus patulus* Mueller; *Curr. Sci.* **54** 499–501

Ridder M de 1981 Some considerations on the geographical distribution of rotifers; *Hydrobiologia* **85** 209–225

Sharma B K 1983 The Indian species of the genus *Brachionus* (Eurotatoria; Monogononta: Brachionidae); *Hydrobiologia* **104** 31–39

—— and Michael R G 1980 Synopsis of taxonomic studies on Indian Rotatoria; Hydrobiologia **73** 229–236

Vasisht H S and Sharma B K 1976 Seasonal abundance of rotifer population in a fresh-water pond in Ambala City (Haryana), India; J. Zool. Soc. India **28** 35–44

—— and Agarwal P 1978 Male of the rotifer *Epiphanes senta* (Ehrenberg); *Curr. Sci.* **47** 441–442