Hydrobiologia vol. 56, 2, pag. 127-128, 1977

DAILY TIMING OF HATCHING OF A ROTIFER, KERATELLA COCHLEARIS

Robert KEEN & Todd MILLER

Division of Biology, Kansas State University, Manhattan, KS 66506 USA;
Department of Zoology, University of Vermont, Burlington, VT 05401 USA

Received March 23, 1977

Keywords: rotifer, *Keratella,* egg hatching

Abstract

Groups of *Keratella cochlearis* f. *tecta* were collected over a complete diel period from a shallow pool. Observed in the laboratory, the hatchings of the field-produced eggs were not significantly periodic.

Introduction

In addition to having intrinsic interest, problems of periodicities of zooplanktonic reproduction are important in estimating parameters of population dynamics and secondary production (Edmondson, 1971). This experiment was aimed at determining whether significant periodicity occurred in production of offspring in a natural population of *Keratella cochlearis* (Gosse).

Methods

A small, half-meter deep, decorative pool in St. John Vianney cemetery in South Burlington, Vermont, supports a relatively dense population of *K. cochlearis* from about May through October. The species in the pool is apparently the spineless form *tecta;* spined forms never represent more than one percent of the population. Amictic *K. cochlearis* generally carry a single egg which remains attached to the female until it hatches. We attempted to detect periodicity in hatching of this rotifer's eggs, following with some modification the procedures used to discover periodicity in egg laying of a marine copepod (Harding *et al.,* 1951; Marshall & Orr, 1955).

Our observations were made 26-27 September 1974 when water temperature in the pool remained constant at 17.4°C. We sampled the rotifer population four times through a complete diel period, at about 1700, 2300, 0500 and 1100 hours. Each time, we concentrated 10 liters collected from the center of the pool, to one liter with a 37 μm-mesh net. We 'randomly' picked 48 egg-bearing *K. cochlearis* from each concentrated sample and isolated these animals, one in each cup of 48-cup tissue culture trays (Linbro FB-48-TC). About 0.3 ml of water from the one-liter concentrate was used in each of the cups. After covering the trays tightly, we put them into a temperature chamber. For our four collections, each tray was put into the chamber within an hour after collecting the rotifers, i.e., at 1800, 2400, 0600, and 1200 hours. The trays were held at 20.0 ± 0.3°C., under dim continuous tungsten illumination. We inspected the rotifers every six hours after putting the trays into the chamber, carefully noting each time whether each rotifer was yet carrying its egg, or if the egg had hatched, and whether juvenile and discarded egg membrane were present.

Result and discussion

Without exception, all of the 192 rotifer eggs hatched, producing living juveniles within 24 hours after the trays were first put into the chamber. Numbers of eggs which hatched over successive six-hour intervals are shown in Fig. 1. There are two possible indications of periodicity:

Dr. W. Junk b.v. Publishers - The Hague, The Netherlands

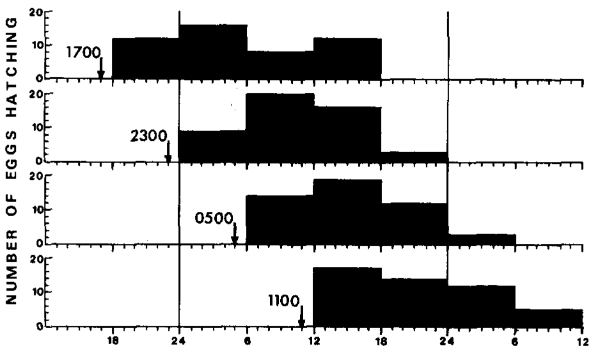

Fig. 1. Number of *K. cochlearis* eggs hatching in six-hour intervals, for four collections made at 1700, 2300, 0500 and 1100 hours.

a noticeable maximum of eggs hatched in the second six-hour interval for every collection except that from 1100, and a noticeable minimum hatched in the final six-hour interval for every collection except that from 1700. These two features had also been observed in some preliminary collections. We had supposed that the second interval maximum could have been caused by the shock of collecting and handling, or by the warmer temperature and continuous light in the chamber. We also had thought that the fourth-interval minimum could have been caused by a developmental time at 20°C of less than 24 hours, but more than 18 hours. Accordingly, we made these four collections at intervals so that analysing them together would reveal any true diel periodicity in hatching of eggs.

Grouping results from each six-hour interval during the day gives these numbers of eggs hatching:

0000-0600: 41
0600-1200: 40
1200-1800: 47
1800-2400: 64

The effect of such grouping is to nullify any artifacts of development which may have been introduced with bringing the organisms from the pool and subsequently manipulating them. Thus, should developmental rate have been accelerated in the temperature chamber, this grouping would yet show any periodicity in egg hatching. If there were no periodicity in hatching, expected numbers in each interval would be 48. A Chi-square test of the observed values gave $\chi^2 = 7.708$, 3 d.f., with $P > .05$. We do not reject the hypothesis of randomness of egg hatching, and the observed maxima and minima are not significant.

Periodicity of amictic egg hatching in rotifers in a shallow water system would be unexpected intuitively. Reproductive periodicities in zooplankton have been explained by the apparent adaptiveness of depositing young in water layers where growth and survival are maximized for reasons of food, temperature or sinking rates (Marshall & Orr, 1955). In this shallow pool, these advantages would not accrue to periodicity in production of young. Additionally, the shallow water insures that daily temperature fluctuations are considerable. To achieve synchrony of hatching at the most advantageous period, the rotifers would have to be able to predict future water temperatures, on which developmental times are dependent. This is particularly true for rotifers which carry their eggs or release them free into the water. The copepod *Calanus,* which may release its eggs into the water with a strong periodicity (Harding *et al.,* 1951), lives in thermally predictable marine systems. Ovoviviparous rotifers and Cladocera which retain the developing eggs may be able to control time of release, should some period be advantageous in shallow systems.

Acknowledgements

We thank Mr. Albert Audette for access to the cemetery pool. Work was partly supported by University of Vermont NSF Institutional Grant 72-124.

References

Edmondson, W. T. 1971. Reproductive rate determined indirectly from egg ratio. In Edmondson, W. T. & Winberg, G. G., eds., A manual on methods for the assessment of secondary productivity in fresh waters, Blackwell, Oxford & Edinburgh, pp. 165-169.

Harding, J. P., Marshall, S. M. & Orr, A. P. 1951. Time of egg-laying in the planktonic copepod Calanus. Nature, 167: 953.

Marshall, S. M. & Orr, A. P. 1955. The biology of a marine copepod. Oliver & Boyd, Edinburgh & London. 195 pp.