

Viability of Sperm in Two Land Snails, *Achatina fulica* Bowdich and *Macrochlamys indica* Godwin-Austen

BY

S. K. RAUT¹ AND K. C. GHOSE

Department of Zoology, Calcutta University, 35, B. C. Road, Calcutta - 700 019, India

INTRODUCTION

ONE OF THE MOST IMPORTANT aspects of the reproduction and maintenance of a population level in terrestrial snails is the viability of sperms. The sperms received in copulation are stored temporarily in the storage organ of the snails. Information on the survival of sperms in the storage organ has been reported for only a few land snail species, viz.: *Helix aspersa* (TAYLOR, 1900) and *Limicolaria martensiana* (OWINY, 1974). Among aquatic snails, *Viviparus* (ANKEL, 1925), *Crepidula* (COE, 1942), *Lymnaea* (CAIN, 1956) and *Oncomelania* (ROTH, 1960, cited in HYMAN, 1967: 301) are on record. Nothing is known concerning this in *Macrochlamys indica*, but *Achatina fulica* kept in isolation has been reported to lay viable eggs up to 382 days (MEER MOHR, 1949). A series of experiments (RAUT, 1977) established that cross-fertilization is essential for laying eggs in both *A. fulica* and *M. indica*. A number of broods extending over a considerable period is obtained from a single specimen after one mating, though repeated mating is a common phenomenon.

MATERIALS AND METHODS

Twelve pairs of cage-reared snails each of *Achatina fulica* and *Macrochlamys indica* were selected immediately after their first mating since the attainment of sexual maturity. They were marked pairwise as A₁ A₂, B₁ B₂, . . . L₁ L₂, for *A. fulica* and a₁ a₂, b₁ b₂, . . . l₁ l₂ for *M. indica*.

Forty-eight cages, each measuring 50×50×50 cm, were used for the study. The sides and roofs of the cages were covered with 1.0 mm polythene net. All 48 cages were placed on soft, humus-rich soil in a shady place in the

Calcutta University campus, Ballygunge, Calcutta, exposed to natural light, temperature, humidity and rainfall. Only 1 mated snail was placed in each cage on March 30, 1975. The snails were kept active throughout the year by spraying with water when required, and a regular food supply was maintained until January 29, 1977, the date of termination of the experiments. The viable period of sperms was calculated from the date of the last brood since mating.

EXPERIMENTAL RESULTS

Of the 24 *Achatina fulica* B₂, D₁, F₁ and L₁ did not lay eggs. A₁, A₂, E₁, G₁, G₂, H₂ and L₂ laid their first brood on April 18, 1975, while the remaining 13 specimens laid eggs at different dates between the 26th and 61st day after mating. Most of the snails deposited 3 broods, while only 3 snails (A₂, G₂ and H₂) laid 5 broods. The last brood was laid by the snail K₂, 341 days after mating. The snails were maintained in a similar environment for a further period of 6 months. Subsequently they were dissected and the spermatheca as well as the talon were examined but no viable sperms were present. The viable period ranges (N=20) from 42 to 341 days with a mean, standard deviation and standard error of 149.2, 87.54 and 19.11 days, respectively.

Out of 24 *Macrochlamys indica*, e₁, g₁ and k₂ did not lay eggs. The first egg laying took place on April 8, 1975 by the snails b₁, b₂, c₂ and k₁, while others laid their first clutch between 12 and 39 days from the date of mating. The last clutch laid by the snails a₂ and l₂ was on July 19, 1976, i. e., 476 days after copulation. Most of the snails laid 6 broods during the period. They were maintained for another 6 months and dissection of spermatheca did not reveal viable sperms. The period of sperm viability ranges (N=21) from 63 to 476 days with a mean, standard deviation and standard error of 279.35, 101.54 and 22.71 days, respectively.

¹ Present address: Zoological Survey of India, Mollusca Section, 8, Lindsay Street, Calcutta - 700 016, INDIA

DISCUSSION

In some pulmonates the spermatozoa are produced in the ovotestis throughout the year and the ovotestis duct remains packed with sperms. Fertilization is dependent on the oogenesis cycle (CHATTERJEE, 1970; FRETTER & PEAKE, 1975; RAUT, 1977).

Wide variations in the viable periods of sperms both in aquatic and land snails have been reported by a number of workers. In general, the period is longer in land forms. In aquatic snails the sperms are active for at least 116 days in *Lymnaea* (CAIN, 1956), 150 days in *Viviparus* (ANKEL, 1925), 365 days or more in *Crepidula* (COE, 1942) and 540 days in *Oncomelania* (ROTH, 1960, cited in HYMAN, 1967: 301). In land snails, the period is 520 days in *Limicolaria* (OWINY, 1974) and 1460 days in *Helix* (TAYLOR, 1900). MEER MOHR (1949) observed that *Achatina fulica* laid viable eggs as long as 382 days. It appears that the sperms were viable for about 366 to 367 days, since *A. fulica* required 16 to 17 days for the development of fertilized eggs. The gestation period and the time required for fertilization were observed to be 20 and 3 to 4 days, respectively (RAUT, 1977).

From the limited information available on the viable period of sperms in prosobranchs, basommatophorans and pulmonates it appears that the period varies with species and within the species. The interspecific variation in sperm viability is probably a specific character, which is supported by the fact that in spite of living in the similar environment, the period differs considerably in *Achatina* and *Macrochlamys*. Intraspecifically such variation is presumably influenced by the habitat, since the viable period of sperms in *A. fulica* was at least 366-367 days in Sumatra (MEER MOHR, 1949) and 42-341 (average 149.2) days in Calcutta.

The long viable period of sperms in pestiferous snails and their ability to lay a number of broods after one mating make it possible for them to populate a new area with the introduction of a single gravid specimen, and this demands our constant vigilance to prevent further spread of agri-horticultural snail pests.

SUMMARY

1. The maximum viable periods of sperms observed in *Achatina fulica* and *Macrochlamys indica* were 341

and 476 days, respectively. It ranges from 42 to 341 (149.2 $\pm$ 87.54) days in *A. fulica* and 63 to 476 (279.35 $\pm$ 101.54) days in *M. indica*.

2. The interspecific variation in sperm viability is probably a specific character, whereas intraspecific variation is presumably governed by the bio-physical factors of the habitat.
3. The long viable period of sperms is an additional advantage to the species in permitting it rapidly to populate a new area.

ACKNOWLEDGMENT

The authors wish to express their sincere thanks to the Indian Council of Agricultural Research for financial support.

Literature Cited

- ANKEL, WULF EMMO
1925. Zur Befruchtungsfrage bei *Viviparus viviparus* L. nebst Bemerkungen über die erste Reifungsteilung des Eies. *Senckenbergiana* 7: 37-54
- CAIN, G. L.
1956. Studies on cross-fertilization and self-fertilization in *Lymnaea stagnalis oppressa* Say. *Biol. Bull.* 111: 45-52
- CHATTERJEE, B.
1970. Studies on the reproductive system in some Indian gastropods. Ph. D. Thesis, Calcutta Univ., Calcutta
- COE, WESLEY ROSWELL
1942. The reproductive organs of the prosobranch mollusk, *Crepidula onyx* and their transformation during the change from male to female phase. *Journ. Morphol.* 70: 501-512
- FRETTER, VERA & J. PEAKE
1975. Pulmonates. vol. 1: xxxviii+417 pp.; Acad. Press, London
- HYMAN, LIBBIE HENRIETTA
1967. The Invertebrates. 6, Mollusca 1: vii+792 pp.; illust. McGraw-Hill Book Co., N. Y., St. Louis, London
- MEAD, ALBERT RAYMOND
1961. The giant African snail: A problem in economic malacology. xvii+257 pp. Univ. Chicago Press
- MOHR, J. C. VAN DER MEER
1949. On the reproductive capacity of the African giant snail, *Achatina fulica* (Fér.) *Treubia* 20 (1): 1-10
- OWINY, A. M.
1974. Some aspects of the breeding biology of the equatorial land snail *Limicolaria martensiana* (Achatinidae: Pulmonata). *Journ. Zool. London* 172: 191-206
- RAUT, S. K.
1977. Ecology and ethology of *Achatina* (*Lissachatina*) *fulica fulica* Bowdich and *Macrochlamys indica* Godwin-Austen. Ph. D. Thesis, Calcutta Univ., Calcutta
- TAYLOR, JOHN W.
1900. Monograph of the land and fresh water Mollusca of the British Isles. 1. Structural and General. Leeds, Taylor Bros. 454 pp.



Raut, Sk and Ghose, K C. 1979. "VIABILITY OF SPERM IN 2 LAND SNAILS, ACHATINA-FULICA BOWDICH AND MACROCHLAMYS-INDICA GODWIN-AUSTEN." *The veliger* 21, 486-487.

View This Item Online: <https://www.biodiversitylibrary.org/item/134933>

Permalink: <https://www.biodiversitylibrary.org/partpdf/97650>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: In Copyright. Digitized with the permission of the rights holder.

Rights Holder: California Malacozoological Society

License: <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Rights: <https://www.biodiversitylibrary.org/permissions/>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.