Spawning of hermatypic corals in Bermuda: a pilot study

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Abstract

This study investigates spawning of 4 hermatypic coral species from the subtropical environment of Bermuda. Laboratory evidence of spawning behaviour is supported by synchronous field observations. Development of scleractinian planulae to postlarval stages is recorded. Diploria strigosa, D. labyrinthiformis, Montastrea annularis and M. cavernosa shed highly buoyant, pigmented eggs (300-440 µm diam.) during July to September 1986. Brief spawning periods, synchronous between conspecific colonies, were recorded for M. annularis (July and August) and M. cavernosa (August) within 1 d of the last quarter of the lunar cycle. In August, there were overlaps amongst the spawning dates of D. strigosa and the Montastrea species. Nocturnal spawning periods differed between M. annularis and M. cavernosa. This constitutes the first evidence from an Atlantic community of overlapping spawning dates amongst several faviid species, and of the accumulation of scleractinian eggs and planulae in surface slicks.

Introduction

Studies of factors affecting gene flow and larval recruitment in western Atlantic hermatypic coral communities are limited by the paucity of information on the spawning and larval biology of representative species. Furthermore, the lack of research into reproduction and ontogeny of some common species impedes advances in knowledge of techniques for the culture of larvae for experimental purposes, as well as the identification of species at early stages of development. Increasing human influence on the diverse coral reef environments in the region (Wells, 1988) accentuates the need for such basic knowledge of ecologically important taxa.

Contrary to earlier indications that scleractinians predominantly brood internally fertilized embryos (see Fadlallah, 1983, for a review), recent research revealed that many hermatypic species, from the Pacific, the Red Sea and the Caribbean, exhibit 'broadcasting' reproductive strategies in which eggs and sperm are shed in spring or summer (e.g., Babcock et al., 1986; Shlesinger & Loya, 1985; Szmant, 1986). Knowledge of spawning behaviour, diurnal and lunar periodicity of spawning and larval development is drawn mainly from communities in the Pacific and the Red Sea. The few observations available on timing and mode of gamete release in Atlantic species are restricted to Szmant's (1986) notes on spawning behaviour in Diploria strigosa and spawning dates in Montastrea annularis and Acropora cervicornis in Puerto Rico.

Reports of extensive accumulations of planulae during late August and early September in surface
waters off Bermuda (Butler, 1980) suggest the possibility that coral spawning is highly synchronized in this subtropical Atlantic reef environment. Similar slicks have been described after the mass spawning of scleractinians on the Great Barrier Reef (Bull, 1986; Oliver & Willis, 1987). According to Butler (1980), the slicks off Bermuda were thought to comprise soft coral planulae, but no further documentary evidence is available to demonstrate the origin of these larval masses. Subsequent studies of gamete development in two of the most abundant hermatypic corals in Bermuda, *D. strigosa* (see Wyers, 1985) and *M. annularis* (S.C. Wyers, unpubl.) showed that both are mature between late June and mid-September. These results raised the question of whether the slicks of larvae observed could be indicative of spawning episodes in the scleractinian community. The present account describes a pilot investigation of summer spawning in *Montastrea* and *Diploria* species in Bermuda, with qualitative notes on the occurrence and composition of larval slicks occasionally recorded in coastal waters.

**Material and methods**

*Laboratory and field monitoring of spawning*

Egg release in the faviid species *Diploria strigosa* (Dana), *D. labyrinthiformis* (L.), *Montastrea annularis* (Ellis & Solander) and *M. cavernosa* (L.) was monitored each night from 11 July to 30 September 1986 under laboratory conditions. Corals were collected on 5 July from the northwest rim reefs (see Logan (1988) for reef zones) and were transferred to aquaria at the Bermuda Biological Station for Research. Initial specimens were replaced with freshly collected colonies on 15 August. Colony surface areas (projected area covered by tissue, cm\(^{-2}\)) were: *D. strigosa* (240–440); *D. labyrinthiformis* (320–560); *M. annularis* (60–240); *M. cavernosa* (180–240). Organisms attached to the underneath of colonies were removed.

Colonies (4–6 of each species) were maintained in an outdoor seawater system, exposed to the ambient light regime (13–14 h light, 11–10 h dark). During the day, they were kept in glass tanks (120 l) under flow-through seawater conditions, while at night, each was placed in a separate container of static seawater at about 1 h before sunset to monitor spawning in individual colonies. Containers were examined routinely for eggs 13–14 h later. Mean seawater temperature in the flow-through system was 27.4 °C in July and 28.3 °C in August, with a range of 25–29 °C throughout the observation period.

On nights of intensive spawning in the aquaria, the behaviour of colonies after sunset was briefly examined with a hand-held light at maximum intervals of 15 min. Eggs were collected within 1 h of release. In trials to culture *M. annularis* planulae, gamete clusters from 3 colonies were mixed within 40 min of spawning. *D. strigosa* planulae were cultured from eggs spawned in an aquarium stocked with 10 colonies. Eggs and larvae were maintained in glass dishes (10–20 cm diam.) under static conditions, replacing the seawater daily. Cultures were transferred to flow-through conditions after settlement.

Spawning in the above 4 species was monitored on a lagoonal patch reef by SCUBA divers on the nights of 27 and 28 August 1986. Specimens of each species were examined at intervals of 15 min or less during a 4 h period starting at sunset and finishing at midnight.

*Examination of larval slicks*

Pink slicks of eggs or larvae have been occasionally reported in Bermuda waters from 1981 to 1986. The morphology of component organisms was microscopically examined (see Wyers (1985) for histological methods). For further identification, eggs and larvae were cultured as described above. Microscope slides, previously immersed in seawater for several days, were presented as substrates for larval settlement.