MORPHOLOGICAL VARIATION IN THE REEF CORALS *TURBINARIA MESENTERINA* AND *PAVONA CACTUS*: SYNTHESIS OF TRANSPLANT, HISTOCOMPATIBILITY, ELECTROPHORESIS, GROWTH, AND REPRODUCTION STUDIES

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ABSTRACT

Mechanisms underlying morphological variation in two highly variable reef corals are discussed. Surveys of growth form distributions established whether morphs of either species were associated with specific biotopes. Where such associations were identified, the physical environment was monitored, and the likelihood of an environmental correlate of the observed variation was evaluated. Reciprocal transplantation of morphs between biotopes tested for phenotypic plasticity in the two species. Histocompatibility tests and electrophoretic surveys were used to determine whether populations had a clonal structure, and to determine if morphs were associated with specific genotypes. Morphometric analyses of variation in colony shape and corallite structures suggested ways in which colony growth and colony shape are related in these two species. Comparisons of the seasonality of gametogenic development and breeding were used to evaluate the probability of reproductive isolation between morphs.

Morphological variation in *Turbinaria mesenterina* was continuous, but the convoluted and plate morphs (the two extremes of the morphological range) had non-overlapping depth distributions. Colonies transplanted between depths were phenotypically plastic, indicating that growth form variation is environmentally induced in this species. Morphometric analyses demonstrated that colonies changed the angle of corallite addition in response to changes in depth. It is suggested that the angle of polyp budding is a plastic trait, which varies in response to light intensity. This represents a photoadaptive mechanism, enabling the colony to control the degree of stratification of photosynthetic tissues. Although it is suggested that light is the primary controlling factor, depth-related differences in both sedimentation and water turbulence undoubtedly contribute to net colony morphology. Histocompatibility and electrophoretic studies revealed an absence of asexual reproduction within the population, and precision in the self-recognition response in this species. Linear extension rates and patterns in seasonal growth were identical for both morphs. Comparison of the timing of gametogenic development and breeding,

age of reproductive maturity, and population sex ratios suggested that the two morphs were not reproductively isolated. *T. mesenterina* is gonochoric, and has an extended autumn breeding season, unlike the majority of species on the Great Barrier Reef which spawn in an episodic, spring mass spawning (Harrison *et al.*, 1984, Willis *et al.*, 1985, Babcock *et al.*, 1986). Possible proximate and ultimate cues controlling differences in spawning seasonality among corals are discussed.

In contrast, morphological variation in *Pavona cactus* was discontinuous, and no clear pattern emerged from an analysis of growth form distributions in relation to environmental variation. Colonies transplanted between depths and reef slopes were phenotypically stable. Histocompatibility tests and electrophoretic surveys revealed a clonal population structure, and imprecision in the self-recognition response. All clonemates displayed the same growth form, despite large spatial separation in several cases. This evidence, in conjunction with the finding of phenotypic stability, suggests a genetic basis for the observed morphological variation in this species. Analyses of variation in the dimensions of fronds and corallite structures, suggests that the allocation of energy to extension and infilling growth processes differs between the convoluted and columnar morphs. It is suggested that such differences are genetically controlled in *P. cactus*.

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