Column

Unique Genetic Properties of Acroporids

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Many species of the coral genus *Acropora* participate in 'mass spawning', the synchronous spawning by multiple species. In Okinawa, mass spawning occurs typically once a year, on a night near the full moon in early summer. Huge quantities of eggs and sperm are released simultaneously within an hour by vast numbers of colonies of various species. Synchronized spawning certainly promotes the fertilization of gametes released by sedentary colonies within each species. However at the same time, mass spawning may raise a problem of species identities caused by interspecific crossing, unless eggs and sperm have an effective mechanism of recognition and fertilization only within their own species.

If such species exist that are currently undergoing speciation, the species involved may still be connected reproductively and genetically, although each species has developed its own identity. In reverse, if multiple species are undergoing fusion, the species involved may hybridize to some extent and share a common gene pool through the exchange of genes via hybrids (gene introgression).

These possibilities were tested by systematic crossing experiments and genetic analyses (Hatta *et al.* 1999). Eggs and sperm collected from each individual colony were separated, mixed in various combinations of intra- and interspecies, and the fertilization rate was scored for each individual cross and summed. The fertilization rate within species was always high, and self-fertilization was almost none. Interspecific fertilization was observed among 6 species out of 8 species tested so far. The interspecific fertilization rates varied by individual cross, from 10% to near 100%, and showed non-reciprocal efficiency in combination of eggs and sperm between each pair of species. Strikingly, cross-fertilization was observed even between species that have very different morphologies, such as arborescent and corymbose.

All hybrid embryos developed normally to planula larvae, they were inherited genes from the parents in the Mendelian manner, and metamorphosed to primary polyps. The hybrids may grow to form colonies by asexual reproduction after passing the critical step of development, metamorphosis. The further interests and problems are morphologies and fertility of the hybrids. However, it is very difficult to grow acroporids from primary polyps to mature colonies.

The genetic relationships of the species used for crossing experiments were described using DNA sequences of a marker gene. The 8 species did not form a separate cluster for each species in the phylogenetic tree, instead, they were divided to three genetic groups (Fig.1). Within each group, individuals of different species are as closely related as within the same species. An important feature is that the cross fertilization was observed within each genetic group. This unusual genetic relationship of the acroporids is conceived as a result of gene introgression driven by hybridization in the near past in nature.

A significant number of hybrids would be produced in nature every year, because eggs are exposed to a high concentration of sperm released from neighboring colonies of different species in the mass spawning events. Since hybrids do not necessarily express intermediate phenotypes, some hybrid acroporids might reveal unexpected morphologies and currently be recognized as independent species. Hybridization might mediate diversification of species and morphologies in mass-spawning acroporids.

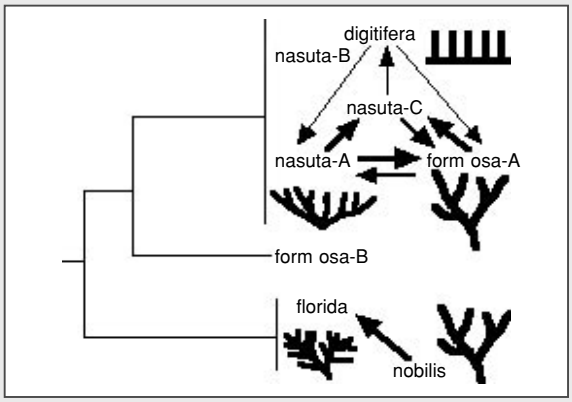

Fig.1. Schematic diagram of genetic, reproductive and morphological features of acroporids. Cross-fertilization is represented by arrows, and morphological types are indicated by signs on the genetic phylogeny tree.