INTERSPECIFIC FERTILE HYBRIDS OF HAPLOCHROMINE CICHLIDAE (TELEOSTEI) AND THEIR POSSIBLE IMPORTANCE FOR SPECIATION

by

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SUMMARY

Hybridization tests were carried out with the allopatric and sympatric haplochromine cichlids *Haplochromis burtoni* (Lake Tanganyika), *H. nubilus* (L. Victoria), *H. elegans* (L. George) and *H. "black lividus"* (L. Victoria).

Female *H. nubilus* crossed with male *H. burtoni* produce lethal hybrids which do not survive the larval stage. The reciprocal cross, female *H. burtoni* × *H. nubilus*, produces F1, F2, F3 hybrids with a normal sex ratio, and fertile backcrosses F1 × *H. burtoni* and F1 × *H. nubilus* with a skewed sex ratio. In behavioral tests female *H. nubilus* spawn readily with *H. burtoni* males (lethal cross), whereas female *H. burtoni* spawn rarely with male *H. nubilus* (fertile cross). The inheritance of coloration, the "egg-dummies" pattern on the anal fin, and reproductive vigor in the hybrids are analysed in detail.

Crosses which involve male *H. elegans* × female *H. nubilus* and male *H. "black lividus"* × female *H. nubilus* are fertile but have skewed sex ratios in favor of the females. The importance of environmental instability, learning and hybridization in cichlid fish speciation are discussed.

INTRODUCTION

Cichlid fish are an enigma for the student of speciation. On the one hand, they are extremely diverse. Hundreds of species, most of them endemics, have been described on the basis of morphological characteristics by taxonomists (Fryer & Iles, 1972; Greenwood,
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1981; RIBBINK et al., 1983; VAN OIJEN et al., 1981). This morphological diversity reflects the cichlids' ability to specialize with respect to certain kinds of food items (Barel, 1983).

On the other hand, cichlids are very similar genetically: most gene loci are allelically identical (Sage & Selander, 1975; McKaye et al., 1984; Kornfield, 1984; Sage et al., 1984). This contradictory state of affairs is currently interpreted in three different ways:

1) Cichlids show trophic radiation through polymorphism without speciation, i.e. there are only a few distinct species (Sage & Selander, 1975).

2) Cichlids show incomplete assortative mating and habitat speciation with reduced gene flow between color morphs, i.e. they form numerous incipient species (McKaye et al., 1984).

3) Cichlids in fact form numerous species (Hoogerhoud et al., 1983).

These three interpretations all relate to a single problem: what constitutes a species among cichlids? Without going into the details and polemics surrounding this concept—which can be defined as "a group of actually or potentially interbreeding natural populations" (biological species, Mayr, 1942) or as "what a competent taxonomist says it is" (Regan, cited in Mishler & Donoghue, 1982)—we thought it would be interesting to test the degree of viability and fertility of hybrids among different taxa of sympatric and allopatric cichlids. One of our aims is thus to test the usefulness of the concept of "biological species" for the cichlid fish taxonomy.

Hybridization describes any cross between populations having different adaptive gene complexes (Grant, 1981). Such populations may be different races or morphs, different types of subspecies, or different species. The outcome of such crosses may tell us something about the taxonomic affinities of the populations crossed: if they are only races or morphs, we expect no pre- or post-mating barriers; if they are types or subspecies, we expect different degrees of pre-mating but no post-mating barriers; if they are biological species we expect to find almost complete pre- and post-mating barriers, for example skewed sex-ratio, sterility, or inviability of the hybrids.

Pre-mating barriers are defined as those which prevent cichlids from spawning; they are usually behavioral, morphological and ecological barriers between species occurring in the same geographical area. Post-mating barriers prevent the interspecific crosses from being completely fertile by means of genetic or cytoplasmic incompatibility (Mayr, 1982).

In plants, extensive hybridization occurs and is accepted as one of the mechanisms underlying their speciation (Grant, 1981; Stebbins, 1982). Invertebrates also hybridize successfully (Dobzhansky et al.,