Chromosomal investigation of *Ctenopharyngodon idella* × *Aristichthys nobilis* hybrids[1]

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Summary. Diploid, triploid, and gynogenetic offspring resulted from hybridizing female *Ctenopharyngodon idella* with male *Aristichthys nobilis.*

Artificial hybridization involving *Ctenopharyngodon idella* and *Aristichthys nobilis* has resulted in the production of an intergeneric hybrid[2-5]. Evaluation of this hybrid by various researchers has produced different results with regard to viability[6,7] and morphology[2,7-9]. So far, chromosomal studies have revealed that the *C. idella* × *A. nobilis* hybrid is triploid[10,11]. However, Mantelman[12] reported diploid and polyploid hybrids resulted when *C. idella* was crossed with *Hypophthalmichthys molitrix.* This study was undertaken to determine the ploidy of a large number of *C. idella* × *A. nobilis* hybrids.

Materials and methods. Chromosome numbers were determined for 231 fish produced by crossing grass carp females, *C. idella,* with bighead carp males, *A. nobilis.* 29 of the fish were from a spawn produced in 1979 while the remainder were produced in 1980. The crosses were made at Lonoke, Arkansas by J.M. Malone. All specimens were immature and of undetermined sex.

Chromosomes were prepared from either gill epithelium[11] or head kidney[13] after phytohemagglutinin[14], colchicine and hypotonic pretreatments. Slides were stained in 10% Giemsa for 30 min. Chromosomal counts were made on at least 10 metaphase spreads for each fish.

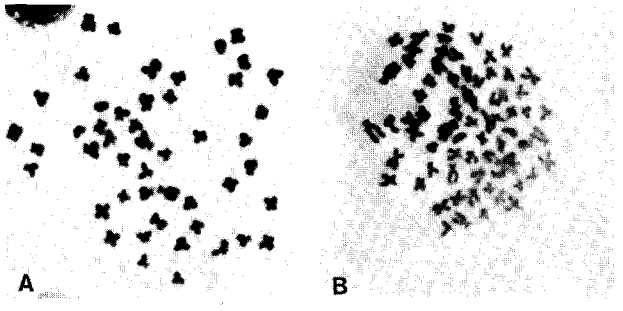
Results and discussion. Chromosomal counts revealed that both diploid and triploid hybrids occurred when *C. idella* females were crossed with *A. nobilis* males (table). Diploid hybrids possessed 48 chromosomes which is also the diploid number for both parental species[11]. Triploid hybrids had 72 chromosomes (fig.). Triploidy has previously been reported in *C. idella* × *A. nobilis* hybrids[10,11]. In addition, Mantelman[12] found diploid and polyploid hybrids when *C. idella* was crossed with *Hypophthalmichthys molitrix.*

A relatively high percentage (35.1%) of the diploid hybrids were deformed whereas only 5.1% of the triploids had abnormalities (table). Many diploids had a caudal peduncle which was bent upward and/or a lower jaw which was skewed to either the right or left. Opercular and gill abnormalities were also noted in some of the diploid hybrids. Berry and Low[9] reported similar deformities in hybrids produced by crossing female *A. nobilis* with male *C. idella.*

4 fish were studied which were distinctly different from both diploid and triploid hybrids. These fish possessed 48 chromosomes and were identical to the maternal species. Electrophoretic analyses of these fish showed them to possess lactate dehydrogenase and esterase isozyme patterns identical to *C. idella.* No evidence of paternal inheritance was noted. Unless contamination had occurred, these 4 fish must have arisen by gynogenesis. Andriyasheva[7] also reported the occurrence of gynogenetic fish when *C. idella* and *A. nobilis* were crossed. Gynogenesis has been reported to be induced in cases of remote hybridization of fish[2,15]. Thus, in some cases the *A. nobilis* sperm fused with the *C. idella* egg to produce a diploid hybrid with 48 chromosomes. However, triploid hybrids with 72 chromosomes also occurred. Triploidy in these cases is believed to result from the retention of a polar body by the ovum[11]. In addition, the sperm occasionally stimulated the egg to begin developing but did not fuse with the egg pronucleus and thus participate in the formation of the embryo. If in such cases the egg retained the 2nd polar body, a diploid gynogenetic fish resulted; however, failure to retain the polar body could also result in a haploid embryo which would most likely die. No haploid fish was observed in this study; however, chromosomes were not examined in embryos. Mantelman[12] had predicted the occurrence of diploid, haploid, and gynogenetic offspring based on hybridization studies with carp. Thus, some of the reported differences in *C. idella* × *A. nobilis* hybrids may be a reflection of the ploidy of the hybrid. Further genetic studies are needed to determine the specific cause of polar body retention in intergeneric crosses between *C. idella* and *A. nobilis.*

Offspring from *Ctenopharyngodon idella* × *Aristichthys nobilis* matings

Type of offspring	Number of fish	Chromosome No.	% Fish with abnormalities
Diploid	148	48	35.1
Triploid	79	72	5.1
Gynogenetic	4	48	0



Chromosomes of *Ctenopharyngodon idella* × *Aristichthys nobilis* hybrids. *A* Diploid hybrid with 48 chromosomes. *B* Triploid hybrid with 72 chromosomes.

1 This research was supported in part by a contract with the Coachella Valley Water District, Coachella, California.

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