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ABSTRACT

Hybrids between the clariid species *Clarias macrochephalus* and *C. batrachus* and the pangasiid species *Pangasius sutchi* were obtained by horemone injection of brood stock and artificial fertilization. Pure parental crosses as well as all possible hybrid combinations were obtained. Fertility, hatchability, and post-yolk absorption survival was high (66-99%) in all pure parental crosses and in all crosses between the two species of *Clarias*. In corsses between *Clarias* and *Pangasius* fertilization was also very hith (68--97 %) but hatchability varied from 11 to 23 % and post-yolk absorption survival from 0 % in *Pangasius sutchi* ♂× *Clarias batrachus* ♀ to about 50% in *Pangasius sutchi* ♂× *Clarias macrochephalus* ♀. The longestlived hybrids of *Pangasius* and *Clarias* were those of *Pangasius sutchi* ♂× *Clarius macrocephalus* ♀ which survived until the experiment was prematurely terminated due to poor water quality caused by overfeeding after 4½ months, at which point they has grown to the lengths of 8–14 cm. The hybrids comprised four morphotypes, two relatively *Pangasius*-like, and two relatively *Clarias-like*, but all were markedly different from the parental species.

INTRODUCTION

Clarias macrocephalus Gunther, 1864, *Clarias batrachus* Linnaeus, 1758, and *Pangasius sutchi* Fowler, 1937 are economically important food fishes. They are fast-growing and production a high yeild per unit area. In Thailand these fishes are known respectively as Pla Duk Ui. Pla Duk Dan, and Pla Sawai but throughout this paper they will be referred to be their scientific names. At present, they are artificially bred and raised in ponds in commercial scale, especially in central Thailand. Experimental hybridization between *Pangasius*

and *Clarias* was initiated with the ultimate goal of producting a new variety of kind of fish useful for aquaculture. Small numbers of hybrid young were first obtained in 1976 (Boonbhram et al. 1977) but were not reported upon in detail. The experiments reported herein demonstrate that *Pangasius–Ciarias* hybrids can survive at least to the size of fingerling.

The immediate first feeding larvae of the hybrids generally appeared unhealthy, with a high proportion of abnormalities, and most died shortly after absorption of the yolk-sac. The few longer-surviving *Pangasius sutchi* ♂× *Clarias macrocephalus* ♀ appeared healthy and vigorous, fed welll, and grew almost as fast as non-hybrid young of the parental species. The *Pangasius–Clarias* hybrids include four discrete morphotypes.

MATERIALS AND METHODS

Mature brood stock of *Clarias macrocephalus*, *C. batrachus*, and *Pangasius sutchi* (Fig. 1) were injected with pituitary extracts of their own species and all possible pure parental and hybrid combinations were artificially produced. The experiments began in July 1980 at the Department of Aquaculture, Faculty of Fisheries, Kasetsart University and were prematurely terminated when the surviving *Pangasius-Clarias* hybrid fingerlings were killed by some toxic substances resulting from decayed uneaten feed in December 1980.

Embryo hatched in clear plastic bowls 45 cm. in diameter and 13 cm. deep with circulating water. In all of the hybrid crosses, the eggs from *Clarias* females represent the total offspring from a single parent. Since the fecundity of *Pangasius* is many times that of *Clarias*, a sub-sample of comparable numbers of eggs was taken from a single *Pangasius* female for the hybrid crosses. Embryos were kept in the plastic bowls until the yolksac was absorbed and then transferred to aquaria. Eggs of *Clarias macrocephalus*, *C. batrachus*, and *Pangasius sutchi* averaged 1.1 1.2, and 1.5 mm in diameter, respectively. Counts of eggs were facilitated by placing bowls with spawn on top of graph paper on light table. Hatched embryos and later larvae were counted while being transferred in a fine-meshed hand-net from one bowl into another or into an aquarium. Larvae and fingerlings were fed with a paste-like feed composed of 60% fish meal, 25% soybenan meal, 10% rice bran, and 5% dried duck weed. Feed of similar composition is widely used in Thailand for raising *Pangasius* and *Clarias* to stocking sizes of about 10–15 cm and 3–5 cm, respectively.

RESULTS

Data on numbers of spawned eggs, fertilized eggs (as determined by counts of developing eggs one hour after exposure to milt), hatchlings, and surviving post yolk-sac larvae for all of the experimental crosses are presented in Table 1. Fertility was relatively high in all crosses (68–99%). Hatchlings were comparable in intraspecific crosses *Pangasius* and *Clarias* (66–82%) and in interspecific crosses of *Clarias* (71–75%) but relatively low in the interfamilial crosses between *Pangasius* and *Clarias* (only 11–23%). A similar trend is observed in post yolk-sac absorption survival. In intra and inter-specific crosses survival was high (76-91%). In the interfamilial crosses it was very low (0–15%) except in *Pangasius sutchi* ♂ × *Clarias macrocephalus* ♀, for which it was about 50%. None of the larvae of crosses between *Pangasius sutchi* and *Clarias batrachus* survived more than a few days, but 18 of the *Pangasius sutchi* ♂ × *Clarias macrocephalus* ♀ were still alive after 4½ months and had grown to 8–14 cm in total length when they were killed by some toxic substances.

The 18 *Pangasius sutchi* ♂ × *Clarias macrocephalus* ♀ hybrids which survived to the age of 4½ months and grew to 8–14 cm were not simply intermediate between the parental species, nor did they represent a morphologically grade series. Rather, four distinct morphotypes were observed. Specimens of these were preserved and illustrated (Fig. 2). The morphotypes may be briefly characterized as follows: 1) relatively *Pangasius*-like, with a moderately long dorsal fin, rayed adipose fin, 2 or 3 pairs or barbels, and a forked caudal fin; 2) similar to 1, but with a truncate or slightly emarginate caudal fin; 3) relatively *Clarias*-like, with a single long dorsal fin, no adipose fin, 3 or 4 pairs of barbels, and a deeply forked caudal fin, and 4) similar to 3, but with a truncate or slightly emarginate caudal fin. Unfortunately the preserved specimens of three of the four morphotypes have been lost, and their respective numbers were not recorded. However, in the post yolk-sac larvae it had been noted that approximately 70% had two well-separated dorsal fins and only about 30% a single long dorsal fin, and that the former type tended to have fewer barbels. Five specimens of morphotype 1 are still available. These are kept with the type-specimens in the fish collection of Kasetsart University's Kuseum of Fisheries (catalog number KUMF 2941). Characteristics of the parental species and of the five extant specimens of hybrid morphotype 1 are presented in Table 2, while the comparable data for morphotypes 2–4 are unavailable.

DISCUSSION

Artificially obtained hybrids between Pangasiidae and Clariidae demonstrate that distantly related catfishes with relatively profound morphological and physiological differences can produce viable offspring. Whether *Pangasius–Clarias* hybrids may be useful for aquaculture remains to be demonstrated. Further experiments also should be conducted to determine whether fertile hybrids capable of self-reproduction can be produced. This has theoretical as well as practical interest. The question of whether hybridization of distantly related taxa can lead to evolution of new species is beyond the scope of the present paper, but the advanced survival of *Pangasius–Clarias* hybrids suggests that an origin of distinctive taxa by hybridization (heterogenetic combination) might be possihle. The likelihood of such a possibility would be increased if it can be demonstrated that interfamilial hybrids of *Pangasius* and *Clarias* are capable of self-reproduction,

It is hoped that karyotypic studies can be done in connection with more experimental hybridization of *Pangasius* and *Clarias*. Diploid chromosome sets of 50 and 52 have been reported for *Clarias batrachus* and of 62 for Indian species *Pangasius pangasius* (LeGrande, Unpublished). No karyotypic data are available for *Pangasius sutchi* and *Clarias macrocophalus* but if they exhibit comparable differences in chromosome number then thier hybrids may be characterized by distinctive karyotypes which could account for the discrete morphotypes observed.

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Table 1. Breeding outcome of pure parental and hybrid crosses of *Pangasius* and *Clarias*.

Species/Cross	Spawned eggs number	Fertile eggs number (% of spawned)	Hatchlings number (% of fertile)	Surviving larvae number (% of hatchlings)
Pure parents				
Clarias macrocephalus	109,600	102,345 (93%)	83,570 (82%)	63,254 (76%)
Clarias batrachus	52,154	47,538 (91%)	31,250 (66%)	28,378 (91%)
Pangasius sutchi	305,659	302,450 (99%)	232,850 (77%)	195,363 (84%)
Clarias hybrids				
C. macrocephalus ♂× *C. batrachus* ♀	6,755	6,538 (97%)	4,878 (75%)	4,285 (88%)
C. batrachus ♂× *C. macrocephalus* ♀	5,617	5,300 (94%)	3,754 (71%)	3,138 (83%)
Pangasius–Clarias hybrids				
P. sutchi ♂× *C. macrocephalus* ♀	3,883	2,850 (73%)	316 (11%)	"150" ("50%")[1]
C. macrocephalus ♂× *P. sutchi* ♀	3,573	3,450 (97%)	786 (23%)	31 (4%)
P. sutchi ♂× *C. batrachus* ♀	3,425	2,340 (68%)	438 (19%)	0 (0%)
C. batrachus ♂× *P. sutchi* ♀	5,327	4,850 (91%)	537 (11%)	83 (15%)

[1] This count was inadvertently omitted when collecting the data, the figure given is an estimate

Table 2. Comparison of morphological characters in *Pangasius sutchi*, *Clarias macrocephalus*, and their hybrid of morphotype 1.

Character	*Pangasius sutchi*	*Clarias macrocephalus*	Hybrid morpnotype 1
Dorsal fin rays	I, 6–7	65–67	I, 28–29
Adipose fin	present, rayless	absent	present, 12–13 ray s
Anal fin rays	31–34	47–53	39
Pectoral fin rays	I, 10	, 9	I, 8–9
Pelvic fin rays	8–9	6	7–8
Pairs of barbels	2	4	3
Gill rakers	12–16, small, far apart	22, long, close–set	18, long, close–set
Accessory breathing organ	absent	present	absent
Myotomes	47	58–60	53–55

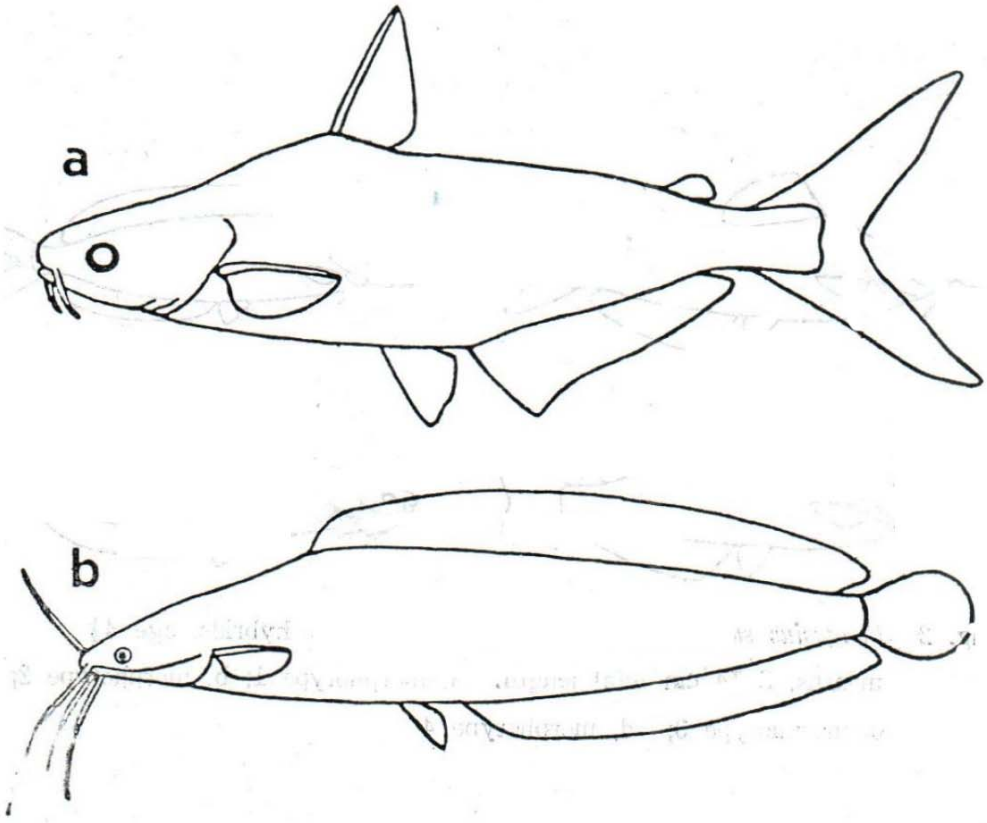

Fig. 1 a, *Pangasius sutchi*; b, *Clarias macrocephalus*

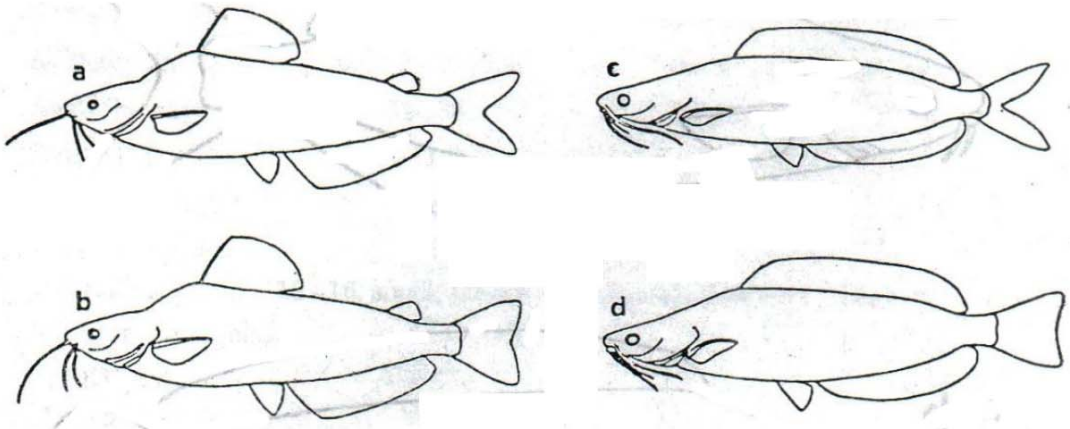

Fig. 2 *Pangasius sutchi* ♂ × *Clarias macrocephalus* ♀. hybrids, age 4½ months, 8–14 cm total length. a, morphotype 1; b, morphotype 2; c, morphotype 3; d, morphotype 4