EFFECT OF HIGH TEMPERATURE ON SEX DETERMINISM AND SEX DIFFERENTIATION PROCESS IN AFRICAN CATFISH, *Clarias gariepinus*

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Fish display a large variety of sex determination mechanisms and patterns of sexual differentiation. Two systems of sex determination were reported in gonochoristic fish: genetic sex determination (GSD) and environmental sex determination (ESD). In ESD species, phenotypic sex can be controlled by environmental factors like temperature. The aim of this study was to determine high temperature effect and its mechanism on sex determination process in the African catfish, *Clarias gariepinus*.

Ten high temperature – HT (36°C) treatments groups were constituted, with 500 larvae each (Table 1). Before and after each treatment and in control groups, fish were reared at 28°C. Once the most thermosensitive period was determined, fish were sampled at the beginning and end of HT application, to assess sex steroid hormones (testosterone, 17β-estradiol, and 11-ketotestosterone) concentrations and *foxl2*, *cyp19a1b* and *dmrt1* genes relative expressions in the head.

Our results show that the sex differentiation pathway can be orientated by HT in African catfish with the most thermosensitive period extends from 6 to 8 dph (Table 1). When applied during these 3 days, HT frequently induces 90 to 100% of males in progenies (Fig. 1). Thus, we can conclude that the African catfish display a temperature-induced sex reversal process. Sex-ratio in control groups highly fluctuate according to the progeny (Fig. 1), suggesting that minor genetic factors play an important role in sex determinism process.

Masculinization did not influence sex steroid levels nor *cyp19a1b* and *dmrt1* genes expressions. Nevertheless, after HT application, lower thermosensitive progenies showed high *cyp19a1b* relative expression, while in control groups, higher thermosensitive progenies displayed high *dmrt1* relative expression at 14 dph. Expression of *foxl2* was not detected in the head during the experimental period. However, to our knowledge, this is the first report of *dmrt1* expression in teleost fish head (perhaps in brain).

Table 1: Effect of high temperature (36°C) on the sex-ratio in *C. gariepinus*. χ^2 were calculated between each control and a theoretical expected sex-ratio (50:50). Batches reared at HT (36°C) were compared to their respective control for each progeny. * significantly different ($p<0.05$) from 50 %; ** significantly different ($p<0.05$) from the control. P: Progeny

Moment of HT application (dph)	Progeny 1		Progeny 2	
	% Males	χ^2	% Males	χ^2
Control	36	3.99*	44	0.72
0-2	54	6.55**	58	3.92*
3-5	58	9.71**	70	13.80**
6-8	96	80.21**	96	64.38**
9-11	50	3.99**	66	9.78**
12-14	48	2.96	40	0.33
15-17	52	5.19**	44	0.00
18-20	38	0.09	48	0.32
21-23	50	3.99**	38	0.74
24-26	38	0.09	50	0.72
27-29	48	2.96	57	3.38

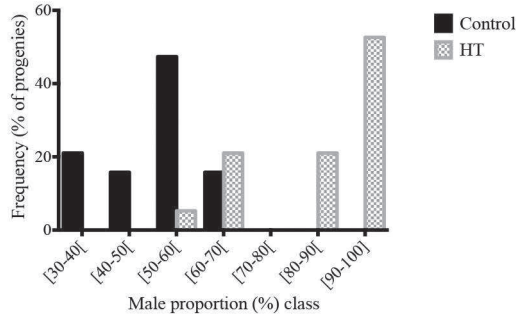

Fig. 1. Sex-ratio distribution in 19 progenies *of C. gariepinus* juveniles exposed to 36°C from 6 to 8 days post-hatching (control maintained at 28°C).