Induced Reproduction and Reproductive Characteristics of *Rhinelepis aspera* Agassiz, 1829 (Osteichthyes: Siluriformes, Loricariidae)

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ABSTRACT

Rhinelepis aspera is the largest Loricariidae species found in the São Francisco river basin where it is now rarely caught. Brooders kept in tanks were hypophysed with crude carp pituitary extract (CCPE). Approximately 82% of the females responded positive to the treatment. The egg was opaque, demersal, round, yellow and adhesive. Egg stripping was done at 212 hour-degrees (= 8.2 h) after application of the second dose of CCPE (water temperature = 25-26 ºC). Hatching of the larvae occurred at 1022 hour-degrees (= 42.2 h), after fertilization of the eggs (water temperature =24-25 ºC). Fertilization rate of the eggs was 72%. Absolute fecundity (AF), initial fertility (IF) and final fertility (FF) in relation to the females' body weight are expressed, respectively, by the equations: AF = - 33993 + 122308 Wt (r^2 = 0.88), IF = - 14823 + 58619 Wt (r^2 = 0.71) and FF = - 6553 + 29741 (r^2 = 0.61)

Key words: Hypophysation, *Rhinelepis aspera*, Siluriformes, São Francisco River

INTRODUCTION

The black armored catfish *Rhinelepsis aspera* Agassiz, 1829 ('cascudo-preto') is an important and currently rare commercial fish of the São Francisco River, although still found in large numbers in its main tributary, the Paracatu River. Its flesh is firm, tasty and practically devoid of bones and fat. It is caught with gill nets. Among the Loricariidae of the São Francisco river basin, *R. aspera* is the one that reaches the largest size, and can exceed 4 kg of body weight. *R. aspera* can be found throughout the basin of the São Francisco and Paraná rivers, with its typical location in the São Francisco river (Fowler, 1954).

There are few references on induced reproduction of Loricariidae: *Plecostomus* (= *Hypostomus*) *plecostomus* found in the rivers of northeastern Brazil (Azevedo, 1938) and *Rhinelepis aspera*, from the Paraná river basin (Maranhão *et al.*, 1988).

This work presents the results obtained from hypophysation of the *R. aspera* at Três Marias Hydrobiological and Hatchery Station, CODEVASF, at Três Marias, MG, Brazil. Preliminary results on induced spawning of this species were presented earlier (Sato *et al.*, 1988).

MATERIALS AND METHODS

Fourteen *Rhinelepis aspera* males and 17 females were used in this study during the reproductive seasons of 1995-1996 and 1996-1997. They were caught in the Paracatu river and

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kept in a 200 m^2 pond with average depth of 1 m at Três Marias Hydrobiological and Hatchery Station of CODEVASF at Três Marias, State of Minas Gerais. Broodstock density was maintained at 1kg of fish/8 m^2 of pond.

The method employed to induce spawning was hypophysation (Ihering *et al.,* 1935; Ihering, 1937), using crude common carp pituitary extract (CCPE). Injections of CCPE (one for males and 2 for females), the interval between injections, the moment of egg stripping (in hour-degrees) and the rate of fertilization (estimated after closing of the blastopore) followed the methods described in WOYNAROVICH & HORVÁTH (1980). The injections were applied intramuscularly close to the dorsal fin. Fertilization was performed 'dry' and the eggs were placed in 20-liter funnel type incubators.

Following data were recorded for the females: total length (Lt, cm), body weight (Wt, g), Fulton's condition factor ($K = Wt.100/Lt^3$), ova (stripped eggs) weight (g), weight of the gonads (Wg = weight of ova + weight of the gonads after stripping, in g), diameter of fresh, non-hydrated eggs and of hydrated eggs (µm), diameter of the yolk sac at blastula stage (µm), the perivitelline space (µm), thickness of the chorion (µm), fertilization rate (taken after blastopore closure, %), gonadosomatic index (GSI = Wg.100/Wt, %), absolute fecundity (AF), initial (IF) and final fertility (number of stripped eggs and number of viable eggs after closing of the blastopore, respectively), and length of the newly hatched larvae (µm). Relative fecundity, relative initial fertility, and relative final fertility were estimated in relation to female total length and body weight.

RESULTS AND DISCUSSION

The fishes were in condition to be hypophysed from November to February. Brood selection was based on the following characteristics: females with more protruding and reddish urogenital papilla; males releasing milky semen when abdominal pressure was applied.

The results obtained are summarized in Table I. During the treatment, the females stayed practically immobile, showing no sign of ovulation moment. The same behavior was reported by Azevedo (1938) for *P. plecostomus*. Of the 17 treated females, 14 (82,35%) responded releasing viable eggs.

Stripping was performed with difficulty due to their bodies being covered by bony plates. It occurred at 212 ± 5 hour-degrees (= 8.2 h) after the application of the second dose of CCPE at water temperature of 25.8 ± 0.4 ^{0}C. The males released milky semen easily. Stripping of *R. aspera* from the Paraná river basin was performed at 280-340 hour-degrees, at water temperature of 22 ^{0}C (Maranhão *et al.*, 1988).

R. aspera egg was opaque, adhesive, spherical, demersal, yellowish in color and apparently has a double membrane. After hydration, the eggs increased in volume by 1.34 times. *P. plecostomus* has also sticky and yellowish eggs, measuring 3.3 mm before hydration and become only slightly hydrated in contact with water (Azevedo, 1938). For *P. commersonii* (= *Hypostomus commersonii*), from the East basin in the State of Paraná, mature eggs were yellowish in color and had a diameter of 4.2 mm (fixed in formalin) (Agostinho *et al.*, 1982). In Venezuela, the largest egg diameter recorded for *Hypostomus argus* was 3.25 mm, while for *Pterygoplichtys multiradiatus*, the largest recorded diameter was 3.5 mm (Winemiller, 1989). Eggs of *Hypostomus affinis* and *Hypostomus luetkeni* of the Paraíba do Sul river basin, State of Rio de Janeiro were also yellow (Mazzoni, 1993). *R. aspera* eggs from the Paraná river basin had the diameter of 1.48 mm, the yolk sac diameter of 1.25 mm and the perivitelline space of 0.11 mm (measurements taken from material fixed in formalin) (Nupelia-Fuem, 1996).

The GSI of hypophysed females was 13.72% (range = 10.5 - 17.98%). Maximum GSI value of 17.56% was recorded for *Plecostomus commersonii* (Agostinho *et al.*, 1982), 28.74% for *Hypostomus affinis* (Mazzoni, 1993), 19.53% for *Hypostomus luetkeni* (Mazzoni, 1993), 11.01% for *Rhinelepis aspera*, and 23.58% for *Hypostomus* sp (Vazzoler, 1996), the last two species from the Paraná River.

Absolute fecundity in *R. aspera* females ranging from 42.5 to 60.5 cm (Lt) was 149,486 eggs (range = 81,900 – 347,604). For *R. aspera* of the Paranapanema River, Agostinho

Table I. Reproductive characteristics of the black armored catfish *Rhinelepis aspera*, hypophysed at Três Marias Hydrobiological and Hatchery Station, during the reproductive seasons of 1995/96 and 1996/97.

Parameter	N	Mean ± SD	CV	Range
MALES				
Total length (Lt, cm)	14	48.3 ± 6.0	12.5	40.5 – 59.0
Body weight (Wt, g)	14	1338 ± 399	30.0	768 – 2100
Single dose of CCPE (mg /kg of Wt)	14	2.6 ± 0.2	8.9	2.5 - 3.0
FEMALES				
Total length (Lt, cm)	14	49.8 ± 6.0	12.1	42.5 - 60.5
Body weight (Wt, g)	14	1500 ± 525	35.0	890 – 2770
Fulton's condition factor (K)	14	1,19 ± 0,14	11.89	1,00 - 1,46
Doses of CCPE (mg /kg of Wt)				
first dose	14	1.0 ± 0.1	8.9	0.8 - 1.0
second dose	14	5.8 ± 0.4	7.4	5.0 - 6.0
Interval between doses (h)	14	14.3 ± 0.4	2.9	14.0 - 15.0
Hour-degrees at stripping	14	212 ± 5	2.0	205 – 220
Water temperature at stripping (ºC)	14	25.8 ± 0.4	1.7	25.0 - 26.0
Gonadosomatic index (GSI, %)	14	13.72 ± 2.13	15.53	10.50 - 17.98
Ova weight. 100/Wt (%)	14	6.77 ± 1.65	14.39	4.62 - 9.71
Eggs/g of ova (n)	14	718 ± 31	4.0	669 – 779
Egg measurements (µm)				
Non-hydrated egg diameter	120*	1584.00 ± 42.59	2.69	1503.60 – 1653.96
Hydrated egg diameter	120*	1752.54 ± 49.71	2.84	1662.08 – 1843.87
Yolk sac diameter	120*	1286.38 ± 39.83	3.10	1220.59 – 1350.44
Perivitelline space width	120*	182.50 ± 29.60	1622	118.30 – 248.16
Chorion thickness	120*	50.58 ± 6.61	13.07	40.40 - 60.60
Egg fertilization rate (%)	14	72.4 ± 8.8	12.1	55.3 - 83.6
Absolute fecundity (AF)	14	149486 ± 68547	46.0	81900 – 347604
Initial fertility (IF)	14	73114 ± 36530	50.0	41899 – 183574
Final fertility (FF)	14	51171 ± 19949	39.0	31550 – 107758
Relative fecundity (n of eggs/kg of female)	14	98364 ± 14991	15.0	73783 – 125489
Relative IF (n of stripped eggs/kg of female)	14	48560 ± 11895	24.0	31526 – 68837
Relative FF (n of viable eggs/kg of female)	14	34932 ± 9098	26.0	25242 – 55918
Relative fecundity (n of eggs/cm of female)	14	2917 ± 960	33.0	1883 – 5746
Relative IF (n of stripped eggs/cm of female)	14	1429 ± 533	37.0	933 – 3034
Relative FF (n of viable eggs/cm of female)	14	1012 ± 294	29.0	725 – 1781
Hour-degrees to hatching	14	1022 ± 31	3.0	980 – 1070
Water temperature to hatching (ºC)	14	24.2 ± 0.4	1.8	24.0 - 25.0
Lt of hatched larvae (µm)	120*	4175.75 ± 104.48	2.5	3999.88 – 4368.29

N = number of observations; CCPE = crude carp pituitary extract; SD = standard deviation; CV = coefficient of variation; * = measurements taken from 6 females (20 eggs or 20 larvae/female).

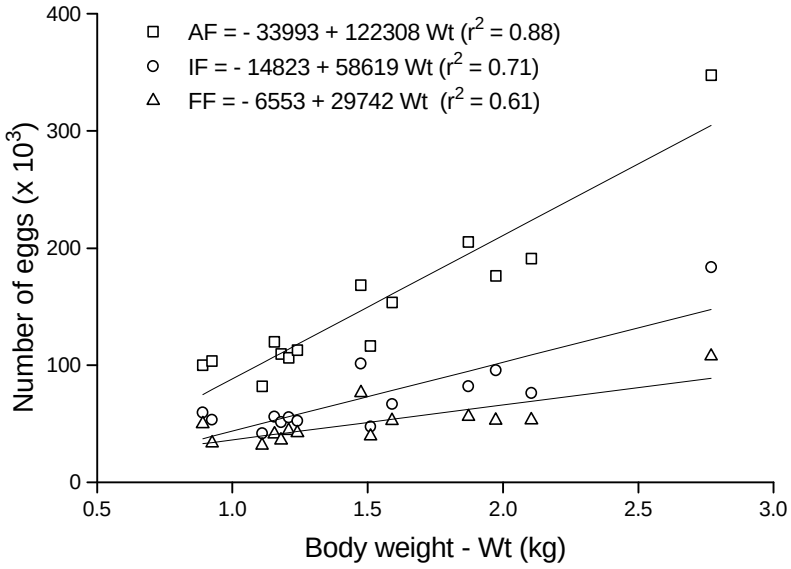

Figure 1. Linear relations of absolute fecundity (AF), initial fertility (IF), and final fertility (FF) on body weight (Wt), taken from 14 *Rhinelepis aspera* females hypophysed at Três Marias Hydrobiological and Hatchery, during the reproductive seasons of 1995/96 and 1996/97.

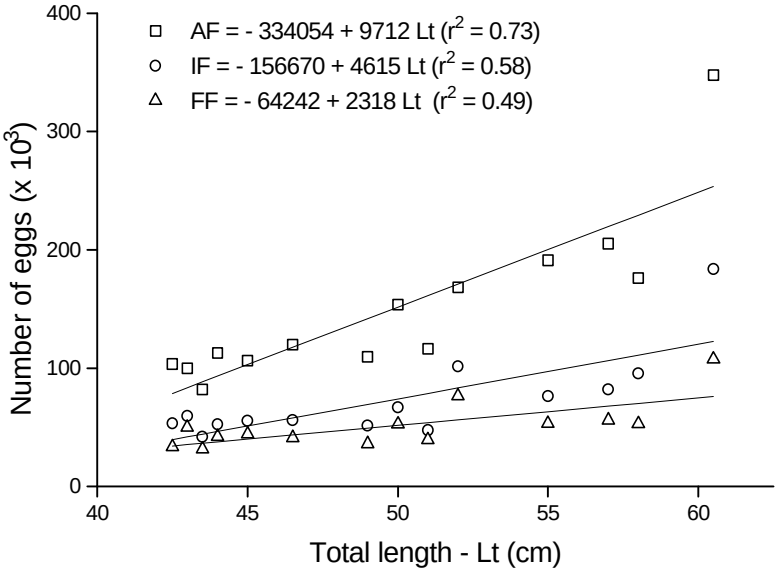

Figure 2. Linear relations of absolute fecundity (AF), initial fertility (IF), and final fertility (FF) on total length (Lt), taken from 14 *Rhinelepis aspera* females hypophysed at Três Marias Hydrobiological and Hatchery Station, during the reproductive seasons of 1995/96 and 1996/97.

(1985) estimated the absolute fecundity as 43,380 eggs (range = 10,800 – 181,200) for females of 28.3 cm to 48.4 cm Lt and Winemiller (1989), as 289 eggs (Lt = 6.0cm) in *Hypostomus argus* and 763 eggs (Lt =23.3 cm) in *Pterygoplichtys multiradiatus. Hypostomus affinis* had absolute fecundity of 1295-2310 eggs while the absolute fecundity in *Hypostomus luetkeni* was 367-936 oocytes (Mazzoni, 1993). The relation between absolute fecundity, initial fertility and final fertility and Wt and Lt are indicated in Figures 1 and 2. These values increased proportionally to Wt and Lt.

Hatching of *R. aspera* larvae occurred at 1022 ± 31 hour-degrees (= 42.2 h) after fertilization of the eggs at water temperature of 24.2 ± 0.4 ^{0}C. For *R. aspera* of the Paraná River, Maranhão *et al.* (1988) recorded larvae hatching after 24 hours, and Azevedo (1938) described the *P. plecostomus* egg hatching at 7 or 8 days after fertilization. The larvae presented a sucker-type structure around the mouth that stuck to substrates or to the superficial water layer. The newly-hatched larvae measured 4,176 µm Lt and lost their vitelline sac 84-96 h after hatching. *R. aspera* larvae from the Paraná river basin lost their vitelline sac 48 h after hatching (Maranhão *et al.*, 1988). The larval Lt was 3.56 mm (Nupelia-Fuem, 1996) in formalin-fixed material. Vertical movements in the water column by the larvae were not observed in the present work.

Observations on brood mortality due to hypophysation was not carried out in the present paper. Sato et al. (1988) had already indicated that the species was highly resistant to the treatment.

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RESUMO

Rhinelepis aspera é a espécie que atinge maior porte dentre os Locariidae da bacia do rio São Francisco onde é hoje raramente capturada. Reprodutores mantidos em viveiros foram hipofisados com extrato bruto de hipófise de carpa (EBHC). Aproximadamente 82% das fêmeas responderam positivamente ao tratamento. Seus ovos eram opacos, demersais, arredondados, amarelados e adesivos. A extrusão dos ovos foi feita a 212 horas-graus (= 8,2 h) após a aplicação da segunda dose de EBHC (temperatura da água = 25-26 ^{o}C). A eclosão das larvas ocorreu a 1022 horas-graus (= 42,2 h) após a fertilização dos ovos (temperatura da água = 24-25 ^{o}C). A taxa de fertilização dos ovos foi de 72%. Fecundidade absoluta (AF), fertilidade inicial (IF) e fertilidade final (FF) em relação ao peso corporal das fêmeas foram expressa, respectivamente, pelas equações: AF = – 33993 + 122308 Wt (r^2 = 0,88), IF = – 14823 + 58619 Wt (r^2 = 0,71) e FF = – 6553 + 29741 (r^2 = 0.61).

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