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UNISEX AND POLYPLOID POPULATIONS OF CYPRINID AND SILURID FISH

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A B S T R A C T. Methods were worked out of an induced gynogenesis for carp and European catfish and a method of producing triploid carp, adequate to Polish conditions. Survival and growth rates of the gynogenetic carp were much lower than of non-gynogenetic fish. Triploid carp during the first and second year of life did not differ from the diploid ones with respect to the survival. However, they showed lower survival in the third year. Growth rates of triploid carp appeared somewhat greater than of diploids during the second year of life only.

Key words: GYNOGENESIS, EUROPEAN CATFISH, GYNOGENETIC CARP, TRIPLOID CARP, GROWTH, SURVIVAL

INTRODUCTION

Producing unisex and polyploid fish populations involves the so-called chromosome manipulation which aims at sex control and at obtaining highly inbred specimens in a short period. A literature review on this subject can be found in Thorgaard (1986).

This investigation had a dual purpose:

- to develop methods (suitable for Polish conditions) of obtaining all-female carp and European catfish populations by means of induced gynogenesis,
- to test in farm conditions the production potential of unisex as well as of triploid carp.

MATERIAL AND METHODS

Common carp of Zator, Hungarian, Yugoslavian, and Japanese lines were used as well as the European catfish reared over several generations in the ponds of Zator.

In order to find out the most suitable dose of UV irradiation for sperm inactivation, the sperm was diluted in Alsever's fluid (4 g NaCl, 8 g sodium citrate, 20.5 g glu-

cose, in 1000 ml of water) and irradiated with an 80 W UV lamp for 1 to 10 minutes and used to fertilise the eggs. The optimum irradiation was defined as the one after which the semen used to fertilise the eggs would produce only haploid embryos.

To determine the optimum period for a thermal shock, the eggs were subjected to such a shock beginning from 1 up to 10 minutes after fertilisation, while the shock itself lasted for 1 to 5 minutes. The greatest percentage of gynogenetic offspring indicated the optimum time and duration of the thermal shock.

Triploid carp were produced similarly as the gynogenetic fish except that normal sperm (non-inactivated) was used. The obtained fish were checked whether they were triploid measuring erythrocyte nuclei which should be greater in triploid carp. The relationship between chromosome numbers in division platelets and the size of erythrocyte nuclei was determined in earlier experiments (unpublished) carried out on *in vitro* leucocyte cultures.

Survival and growth of gynogenetic and triploid carp were compared with those of the control fish reared in separate and partly the same ponds.

RESULTS AND DISCUSSION

The method of artificial gynogenesis, developed on the basis of experimentation, consists of exposing the eggs, 4 minutes after their fertilisation with inactivated sperm, to a 2 minute thermal shock (39°C). It was found that irradiation of sperm with an 80 W UV lamp over 8 or 10 minutes brought about the greatest number of gynogenetic fry (Kołdras et al. 1994).

The method of artificial gynogenesis of European catfish, worked out during 2 years of experimentation, consists of the following: eggs, fertilised in a 0.35% NaCl solution with inactivated sperm, are exposed to a thermal shock (39.5°C) over 2 minutes. The catfish sperm was inactivated in the same way as of carp, but UV irradiation time was 10 minutes.

The method of obtaining triploid carp involves the thermal shock, as in the case of artificial gynogenesis, of eggs fertilized with non-irradiated sperm.

The gynogenetic carp exhibited lower survival and growth rates than the non-gynogenetic ones. The young-of-the year gynogenetic fish showed 11% survival, while survival of the non-gynogenetic fish was 54%. The individual weights were 20 g and

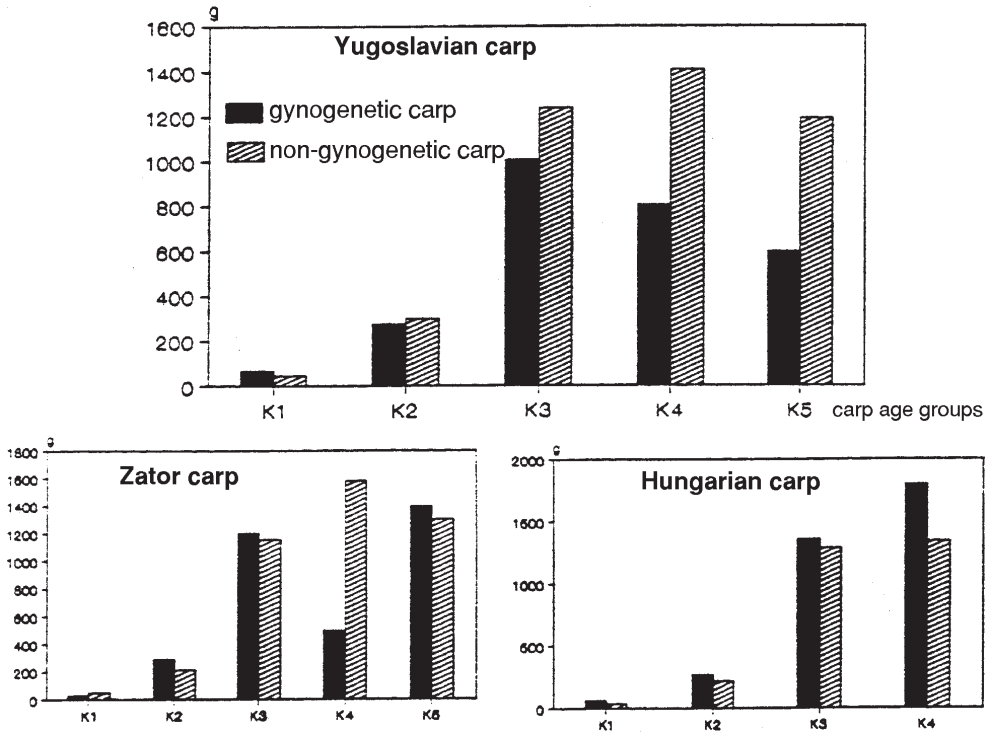

Fig. 1. Annual weight increments of carp

63 g respectively (Kołdras et al. 1994). Survival of gynogenetic carp until the age of 3 years was merely 3%, whereas of normally produced fish - 37%.

Comparisons of annual weight increments during subsequent years of life of gynogenetic and pure breeds of carp are shown in Fig. 1. Weight increments and survivals of gynogenetic carp and of hybrid carps are compared in Figs 2 and 3.

Triploid carp during the first and the second year of life did not differ from the diploid population as regards the survival, whereas their survival was lower in the third year (22%) than of diploids (53%). Growth rates of triploid carp (Fig. 4) were somewhat faster than of diploids during the second year only (Mejza et al. 1993).

Although the gynogenetic fish are usually characterised by lower survival and lower growth rates than the non-gynogenetic ones, it seems that artificial gynogenesis may be useful in carp culture, especially when one aims at rapid preservation of certain attributes of shape or certain coloration. This method will certainly play an important role in strictly genetic research. As regards the triploidisation, one can presume

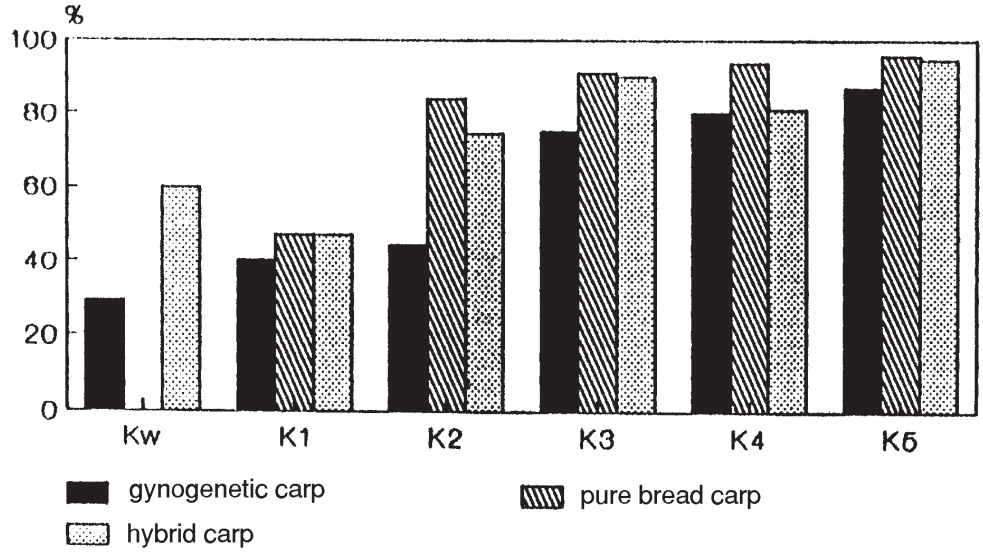

Fig. 2. Survival of gynogenetic and non-gynogenetic pure breeds and hybrid carp

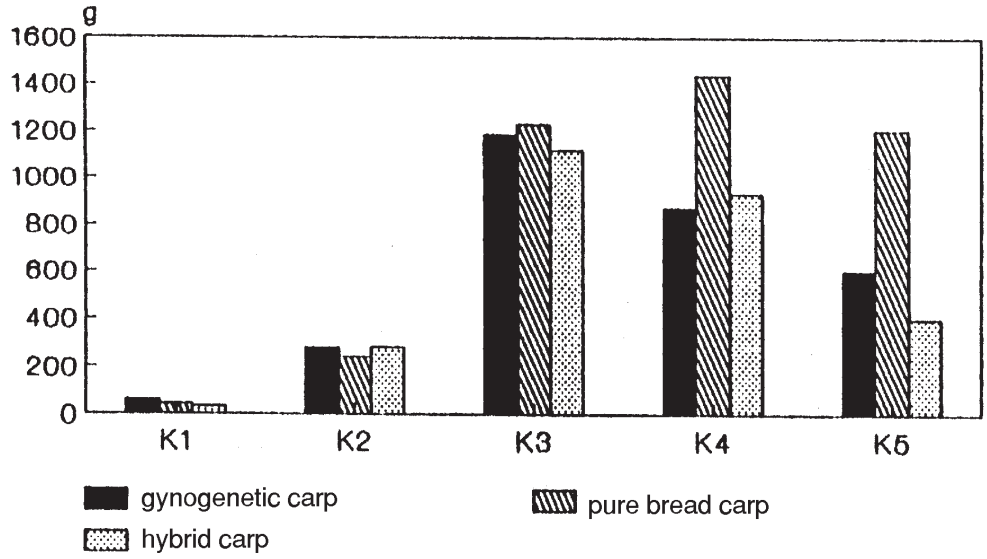

Fig. 3. Annual weight increments of carp

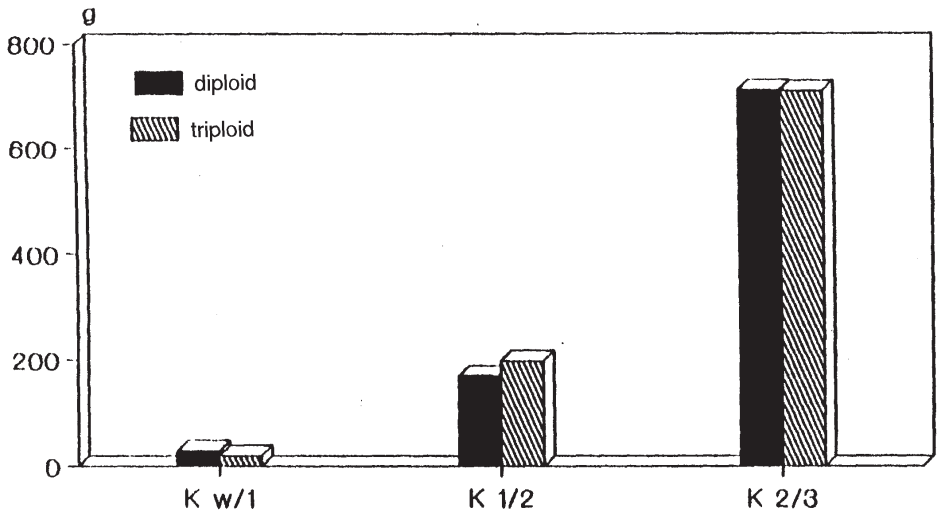

Fig. 4. Annual weight increments of diploid and triploid carp

that this method will be applicable in producing interspecific fish hybrids, this being difficult or even impossible by the way of natural „crossing". That method can also play some role in producing sterile fish populations.

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STRESZCZENIE

POPULACJE JEDNOPŁCIOWE I POLIPLOIDALNE RYB KARPIOWATYCH I SUMOWATYCH

Przeprowadzone badania wykazały, że w warunkach polskich najlepszym sposobem uzyskiwania tylko samiczej populacji karpia (karpie gynogenetyczne) jest poddanie ikry po 4 minutach po zaplemnieniu (inaktywowanymi plemnikami), szokowi termicznemu (39°C) trwającemu 2 minuty. Okazało się, że plemniki karpia najlepiej inaktywować 8-10 minut promieniami UV używając lampy 80 W.

Odnośnie suma europejskiego, okazało się, że dla uzyskania tylko samiczej populacji najlepiej jest zaplemnioną (inaktywowanymi podobnie jak u karpia plemnikami) ikrę poddać gorącemu (39,5°C) szokowi trwającemu 2 minuty. Dla uzyskania karpi triploidalnych zastosowano taką samą metodę, jak przy gynogenezie z tym, że do zaplemnienia używano plemników nieaktywowanych. Przeżywalność i wzrost karpi gynogenetycznych były znacznie niższe niż karpi niegynogenetycznych. Karpie triploidalne odnośnie przeżywalności w pierwszym i drugim roku życia nie różniły się od karpi diploidalnych. Wzrost karpi triploidalnych tylko w drugim roku życia był nieco lepszy niż karpi triploidalnych.

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