

## Hybridization Experiments in Rhodeine Fishes (*Cyprinidae*, *Teleostei*)

### The Interspecific Hybrids of *Rhodeus ocellatus* and *Rhodeus sericeus amarus amarus*

J. J. DUYVENÉ DE WIT

(Zoology Department, University of the Orange Free State, South Africa)

#### Introduction

In order to investigate the degree of genetic affinity existing between rhodeine species a number of interspecific and intergeneric hybridization experiments have been performed. In a previous paper<sup>1)</sup> the successful intergeneric hybridization of two Japanese bitterling species, *Rhodeus ocellatus* (KNER) and *Acheilognathus lanceolata* (TEMMINCK & SCHLEGEL) has been reported.

Although the geographical distribution of the Rhodeinae is mainly restricted to the eastern part of Asia, including Japan and Taiwan, one strain succeeded in invading the western hemisphere, proceeding as far as Germany and the Netherlands. According to HÖLČIK<sup>2)</sup> this strain is represented by three subspecies and the name of the form which is represented in Western Europe (*Rhodeus amarus* BLOCH) has recently been changed by this author into *Rhodeus sericeus amarus amarus* BLOCH.

In view of existing ecological differences and the enormous distance separating the Japanese and the European species, the question arose whether the presence of genetic affinity, or at least gametic compatibility, between *R. ocellatus* and *R. s. a. amarus* could be demonstrated.

#### Material, Methods and Results

##### The interspecific hybrids between *R. ocellatus* ♀ and *R. s. a. amarus* ♂

(a) *Artificial insemination.* Fifty-three eggs of two female *R. ocellatus* were artificially inseminated with sperm of one male *R. s. a. amarus*. In 51 eggs fertilization was complete. After hatching and rearing 50 larvae reached the free-swimming stage, but circumstances prevented us from rearing them to the adult stage.

(b) *Natural interbreeding.* The spawning behavior of *R. s. a. amarus* is very similar to that of *R. ocellatus* and, therefore, we decided to investigate whether both species would propagate when fresh water mussels were put at their disposal.

The kinds of bivalves, which are used by Japanese and European bitterlings for depositing their eggs are not available in South Africa. Two other species of

bivalves, *Aspatharia wahlbergi* KRAUSS, and *Unio caffer* KRAUSS, were used instead. As bitterlings are not represented in the African continent, it remained to be seen whether these African bivalves would be capable of serving as incubators for rhodeine eggs.

Two male *R. s. a. amarus* of Dutch origin, four female *R. ocellatus* from Japan and five South African bivalves (*A. wahlbergi* and *U. caffer*) were brought together in a well aerated aquarium. Within two weeks spawning could be observed at regular intervals. There was no predilection for one of both najad species. Three weeks after the first spawnings the first fry were seen to be released by the bivalves.

Fourteen one-day-old hybrids were arbitrarily selected and have been raised to the adult stage. A representative hybrid specimen is illustrated in Fig. 5, together with specimens of the parental species (Figs. 1 and 3).

Except for one specimen, which is considered to represent a cross-mutant<sup>3)</sup> showing striking similarity with *Acheilognathus rhombea*, TEMMINK & SCHLEGEL, the hybrids were fairly uniform in size and intermediate between the parental species. All specimens showed a male phenotype. In the spawning season, which lasted about the whole year round, the hybrids displayed full breeding colors and spawning behavior. Tubercles were abundantly present on the top of the snout, but spermatogenesis was impaired.

#### **The interspecific hybrids between *R. s. a. amarus* ♀ and *R. ocellatus* ♂**

(a) *Artificial insemination.* Thirty eggs of one female *R. s. a. amarus* were inseminated with sperm of one male *R. ocellatus*. All eggs developed into viable larvae, but they were not raised to the adult stage.

(b) *Natural interbreeding.* Two male *R. ocellatus* of Japanese origin and four female *R. s. a. amarus* of Dutch origin were placed in a well aerated aquarium, together with five bivalves belonging to the species *A. wahlbergi* and *U. caffer*.

Just as in the reciprocal combination spawning occurred without predilection for one of both najad species, and after an incubation period of approximately three weeks the first school of fry was obtained. Seventeen one-day-old hybrids were arbitrarily selected and raised to maturity. A representative hybrid specimen, together with specimens of the parental species, is illustrated in Figs. 6, 2 and 4 respectively.

All 17 hybrids were fairly uniform in size and intermediate between the parental species. They showed a male phenotype and displayed full nuptial colors and spawning behavior in the breeding season, which lasted almost the whole year round. Tubercles were present on the top of the snout, but spermatogenesis was impaired.

The taxonomic description of both hybrid forms will be published separately.

### General Observations

In both hybrid forms symptoms of senility manifested themselves earlier than in the parental species, but in contrast to the hybrids between *A. lanceolata* and *R. ocellatus* the occurrence of neoplasms has not been observed.

### Acknowledgements

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### Summary

1. By means of hybridization experiments the presence of genetic affinity between *Rhodeus sericeus amarus amarus* from Western Europe and *Rhodeus ocellatus* from Japan could be established.

2. Both kinds of hybrids obtained from this combination were intermediate between the parental species and showed a male phenotype.

3. In the spawning season, both kinds of hybrids displayed full breeding colors and spawning behavior, but spermatogenesis was impaired.

### References

1. In press. (S. Afr. Jour. of Sci.)
2. HÖLCÍK, J. 1959: Probl. d. Ichthyol., Moskwa, xiii, 39-50.
3. A detailed description of this specimen will appear elsewhere.



Fig. 1.

Fig. 2.

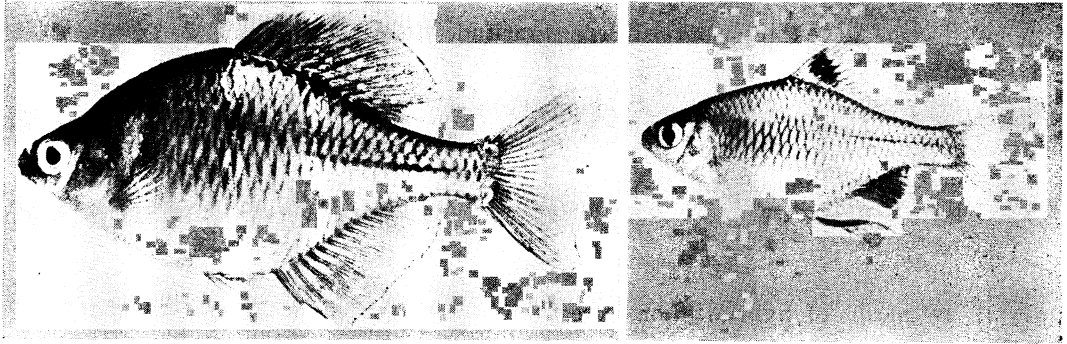


Fig. 3.

Fig. 4.

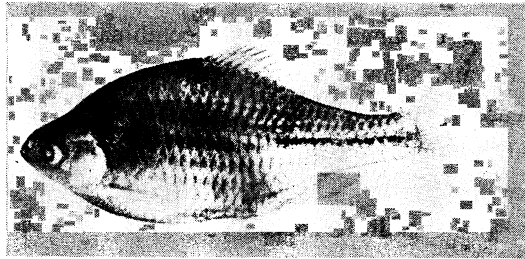


Fig. 5.

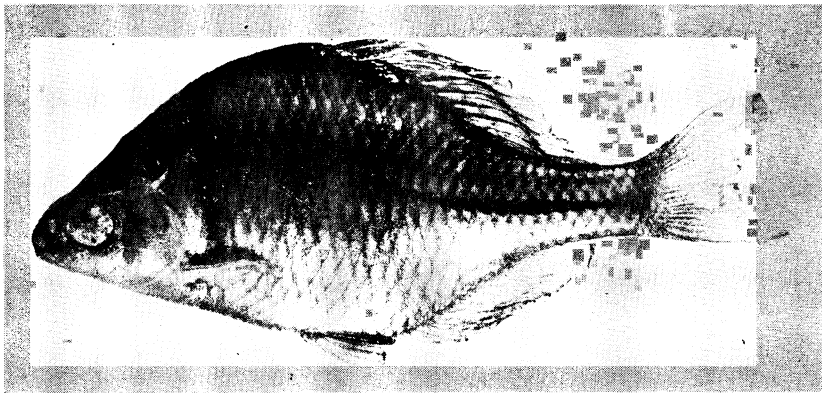


Fig. 6.

- Fig. 1. Specimen of an adult female of *Rhodeus sericeus amarus amarus*.  
 Fig. 2. Specimen of a nearly full-grown male of *Rhodeus sericeus amarus amarus*.  
 Fig. 3. Specimen of an adult male of *Rhodeus ocellatus*.  
 Fig. 4. Specimen of a sexually mature but not yet full-grown female of *Rhodeus ocellatus*.  
 Fig. 5. Specimen of a not yet full-grown interspecific hybrid between female of *R. s. a. amarus* and male of *R. ocellatus*.  
 Fig. 6. Specimen of an adult interspecific hybrid between female *R. ocellatus* and male of *R. s. a. amarus*. Standard length 78 mm. The same scale applies to the other specimens.