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Short communications

**INITIAL REPORTS OF A LIGHT-COLORED FORM OF CHUB,
LEUCISCUS CEPHALUS (L.)**

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ABSTRACT. During experimental rearing of larval chub, *Leuciscus cephalus* (L.), individuals were noted with substantially lighter coloring than that which is generally observed. These fish were segregated in order to compare their growth and survival rates to those of the group of larvae with “wild” coloring. Light-colored larvae had slower growth rates in comparison to the individuals with dark coloring. Image analysis indicated light-colored individuals had a threefold lower occurrence of melanophore cells with a smaller diameter than did fish with normal coloring.

Key words: *LEUCISCUS*, LIGHT-COLORED, FORM, MUTATION

The culture and trade of ornamental fish species is an important and profitable branch of fisheries. The most popular species cultured include koi carp, *Cyprinus carpio* (L.), goldfish, *Carassius auratus auratus* (L.), and orfe, *Leuciscus idus* (L.) (Korwin-Kossakowski 1999, Gouveia et al. 2003). However, light-colored or albino forms or individuals with elongated fins do occur sometimes during the intensive aquaculture of other species. Such forms are noted among commercial species that are cultured on a wide scale including rainbow trout, *Oncorhynchus mykiss* (Walbaum), (Dobosz et al. 2000, Dobosz 2007), or tench, *Tinca tinca* (L.). Forms whose coloring differs from wild coloring also occur in species that are new to aquaculture such as Japanese flounder, *Paralichthys olivaceus* (Temminck and Schlegel), among which albino individuals have been noted (Shikano et al. 2007, Shimada and Seikai 2008).

Chub, *Leuciscus cephalus* (L.), is one of the most widely-distributed species in Europe. Although it is of little economic consequence, it is valued by anglers in many countries. Interest in the culture of this species has increased in recent years (Kucharczyk 2002, Krejszeff et al. 2008), and in Poland it is one of the most commonly

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bred and reared rheophilic cyprinid species (Krejszeff et al. 2008). Most of the juveniles produced from breeding in hatcheries are used to stock rivers, while only a small portion is reared as decorative fish for small ponds. The current work presents a brief characterization of light-colored juvenile chub individuals. The survival and growth rates of two forms of chub were evaluated during a short-term rearing period.

Chub larvae were obtained from spawners reared in the ponds at the Knieja Fish Farm near Częstochowa (southern Poland). After 10 days of initial rearing, light-colored individuals were caught and stocked into a separate glass aquarium (with a volume of 1.5 dm³) that was part of a recirculating system. The larvae of both forms of chub were reared at a stocking density of 50 indiv. dm⁻³ for 20 days. Water temperature during the rearing period was 25°C, and the photoperiod was set at 12 h (12L:12D). The larvae were fed three times daily *ad libitum* with live stages of *Artemia* nauplii. Bottoms of the aquaria were cleaned twice daily. The number of dead larvae was noted daily and total length was measured on days 10 and 20 of the study. Microscopic images were used to count the number of melanophore cells and to measure their diameters at three locations above the lateral line in ten fish from each color form. The number and diameter of melanophore cells in each color form were compared with the t-test ($P < 0.05$).

The light-colored chub grew more slowly than the dark ones. On day 10 of rearing, they were an average of 37% smaller in comparison to the individuals with normal coloring (Table 1). Similar observations were reported by, among others, Dobosz et al. (2000) and Shimada and Seikai (2008), who confirmed that albino fish exhibited a slower growth rate. The survival of the light-colored chub individuals was fivefold lower than that of the individuals with normal coloring (Table 1). The chromatophores had a lower content of dark pigment centrally-located in the cell than did the darker form of chub occurring in the wild (Photo 1a). The quantity of melanophores in the dark-colored fish was 71 mm⁻², which was significantly different from the larvae with light coloration ($P < 0.05$). The same was noted with regard to mean melanophore cell diameter. Light-colored fish had substantially smaller cells (0.04 mm in diameter), while the diameter of the melanophore cells in larvae with normal coloring was 0.14 mm. This is why the light-colored spots on the body surfaces were smaller and much less variegated, the backs were lighter, and the sides had visible yellow stripes. The tops of the heads had a yellow color (Photo 1b).

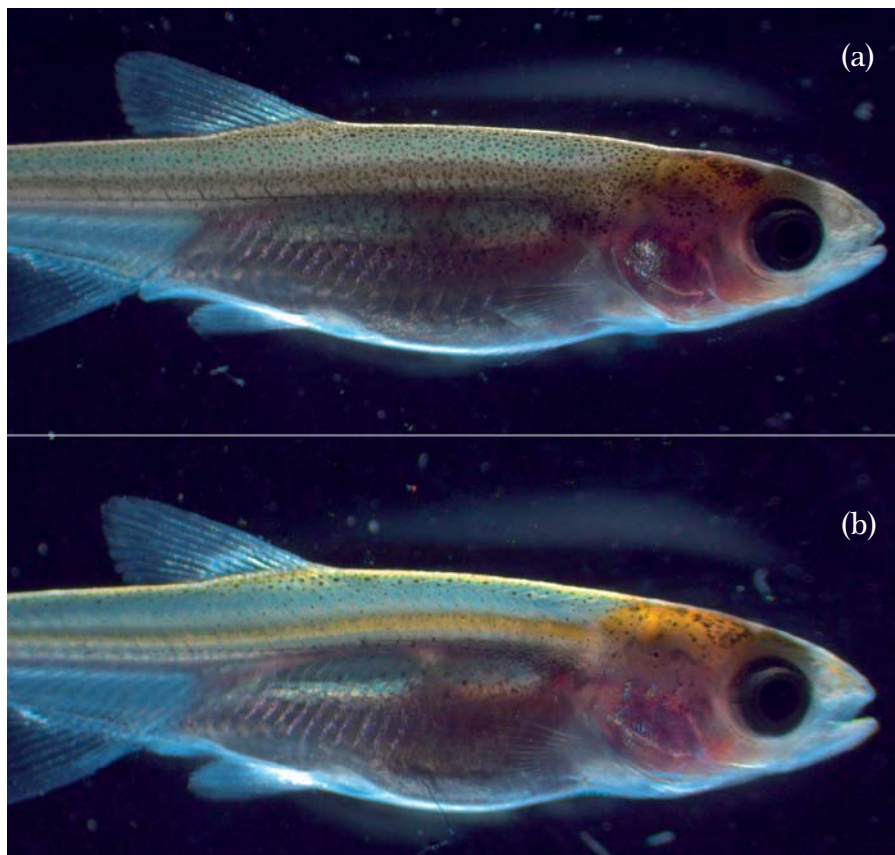


Photo 1. Normal (a) and light (b) colored forms of chub, *Leuciscus cephalus* larvae.

TABLE 1

Comparison of growth rate, survival, and quantity and diameter of melanophores in two chub forms with different coloring

Parameter tested	Dark coloring form	Light coloring form
Total length after 10 days of rearing (mm)*	21.3 ± 1.1^b	13.4 ± 0.9^a
Number of melanophore cells (cells mm ⁻²)*	71 ± 3^b	23 ± 5^a
Mean melanophore diameter (mm)*	0.14 ± 0.02^b	0.04 ± 0.01^a
Survival after 20 days of rearing (%)	90.2	16.8

*Values in rows with different letter indices differ significantly statistically (*t*-test, $P < 0.05$)

The results indicate that chub with lighter body coloring should not be selected for the production of stocking material. If the alternate coloration was to be genetically sta-

bilized and the light coloring passed to the next generation, then this form could be successfully reared as an ornamental fish. Along with orfe, it could fill in the gap among species recommended for flow-through ponds that are unsuitable for carp and or basses with temperature regimes that are inappropriate for rainbow trout. This does, however, require rearing light colored individuals until they have reached sexual maturity in order to confirm that this was not just a temporary mutation, and possibly to determine the manner in which this character is inherited.

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STRESZCZENIE

PIERWSZE DONIESIENIE O JASNEJ FORMIE BARWNEJ KLENIA, *LEUCISCUS*
CEPHALUS (L.)

W trakcie eksperymentalnego, masowego podchowu larw klenia stwierdzono występowanie osobników o ubarwieniu znacznie jaśniejszym od powszechnie występującego. Ryby te odseparowano celem porównania tempa ich wzrostu i przeżywalności w porównaniu do grupy larw o ubarwieniu „dzikim”. Obie grupy ryb podchowywano przez 20 dni od 10 dnia po wykluciu. Jasno ubarwione larwy wykazały niższe tempo wzrostu i przeżywalność w porównaniu z osobnikami o ciemnym ubarwieniu ciała. Analiza zdjęć wykazała znacznie mniej liczne występowanie komórek melanoforowych u osobników o jasnym ubarwieniu. Wyniki wskazują na możliwość hodowli kleni o jasnym ubarwieniu jako ryby ozdobne. Wymaga to jednak podchowania osobników jasno ubarwionych do osiągnięcia przez nie dojrzałości płciowej.