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Short Communication

A comparison of the survival and growth performance in rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta fario*) fry

Volkan Kizak[1]*, Yusuf Guner[2], Murat Turel[2], Erkan Can[1] and Murathan Kayim[1]

[1]Tunceli University, Fisheries Faculty, Tunceli, Turkey.
[2]Ege University, Fisheries Faculty, Izmir, Turkey.

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The rainbow trout is an intensively cultured species because of its more cultivatable character than the brown trout. In this experiment, the brown trout culture did not expand due to low growth performance compared to that of the rainbow trout. This experiment was conducted in a commercial trout farm, Aegean Area (Turkey). Growth performances and survivals of rainbow and brown trouts from fry to fingerling were observed for 155 days. Growth performances, feed conversion rates and survivals were determined. The initial weights of the rainbow and brown trouts were 0.1 ± 0.01 g. Final weights were 26.5 ± 5.19 g and 12.97 ± 2.74 g, respectively at the end of experiment. Survival and FCR of rainbow and brown trouts were 83.9 and 80% ; 0.59 and 0.61 respectively. As a result, there is a similarity between these two trout species in point of survivals and FCR's although growth performance of the rainbow trout was significantly better than that of the brown trout.

Key words: Rainbow trout, brown trout, fry, growth, survival.

INTRODUCTION

The cultivation of rainbow trout is easy when compared to the cultivation of other trout species. Advantages such as its ability of adaptation to the environmental conditions, resistance to low oxygen values and high temperature, easy acclimation to the commercial feed, and its ability to actively eat feed at a high consumption rate while also having a shorter hatching period than brown trout (*Salmo trutta fario*) and brook trout (*Salvelinus fontinalis*). Since the market share cannot be increased in parallel to the production rate, it is necessary to develop alternative cultures.

European hatcheries have produced brown trout stock for several decades, mostly for the purpose of producing fry and fingerlings for stocking depleted populations, due largely to its popularity in sport fishing (Quillet et al., 1992). Brown trout is not endemic in Turkey, but is produced in some farms in the Eastern Black Sea (Serezli et al., 2003). Its most important advantage is that the fry can begin feeding directly with starter feed. However, the propagation of brown trout is not as much as that of the rainbow trout under culture conditions due to some of their sensitive characteristics. Although the slower develop-ment of brown trout than the rainbow trout restricts its production, stocking and market demands and the development of cultivation techniques has enabled the development of brown trout to gain momentum.

In this study, the survival and growth performances of brown trout and rainbow trout with consumed vitellus were observed for 155 days. Growth performances, feed consumption and survival rates were determined and cultivation characteristics of two trout species were compared.

MATERIALS AND METHODS

This experiment was conducted at a private trout farm (Izmir – Kemalpasa) and lasted for 155 days (January to June, 2008). Growth, feed conversion and survival of fry were compared between two species. Initial weights of rainbow and brown trouts were 0.1 ± 0.01 g. Hatchery troughs (180 × 40 × 40 cm) were used for on-growing and around 250 $ml^{-1}s$ of freshwater was supplied initially. Stocking densities of rainbow and brown trout fry were 2.16 ± 0.08

*Corresponding author. E-mail: volkankizak@hotmail.com.

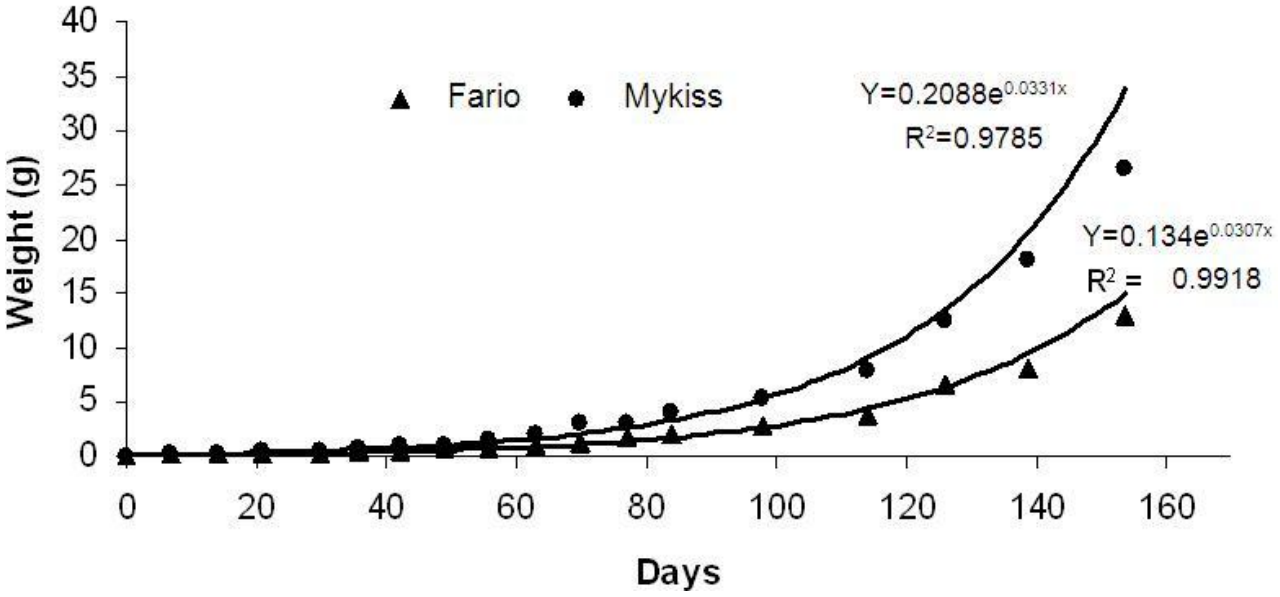

Figure 1. Growths of fry and relationship to time (days).

Table 1. Growth and survival data of rainbow and brown trouts.

Species	Rainbow trout	Brown trout
Initial weight (g)	0.1±0.01	0.1±0.01
Final weight (g)	26.59±5.2[a]	12.97±2.74[b]
FCR	0.59±0.03	0.61±0.01
SGR (%)	3.63[a]	3.18[b]
Survival (%)	83.9±0.7	80±1.1

*With in the same rows, values with different superscripts are significantly different ($p<0.05$).

$kg \cdot m^{-3}$, respectively. The fry were transferred to nursery ponds (6 × 1 × 0.5 m) after reaching about 1 g (around 60 day after hatching) after which the experiment was carried out in three replicates.

Water temperature and dissolved oxygen were measured weekly with an oxygenmeter (Oxyguard). Fish were weighed to the nearest 0.001 g and measured 1 mm after anaesthetization with clove oil (SIGMA). Fry were fed by hand a commercial extruded diet of 55% protein, 10% fat *ad libitum* and the amount of feed was recorded. Growth performances and specific growth rates [(SGR) ($\%day^{-1}$) = ln (final mean weight) - ln (initial mean weight) / experimental days × 100)] (Korkut et al., 2007) were determined periodically.

All the means of data are expressed with their standard errors. Survival rates were compared using the Chi Square test. Analysis of data was carried out using SPSS. One-way ANOVA followed by the LSD test used to determine significant differences among means. Statistically significant differences were expressed as $P < 0.05$. The relationships between average weights and days were tested by regression and correlation analyses.

RESULTS

Water temperatures and dissolved oxygens in culture circumstances for brown and rainbow trouts were measured between 10.3 to 12.9°C and 6.2 to 8.2 ppm throughout the experiment, respectively.

Initial weights of rainbow and brown trouts were 0.1 ± 0.01 g. Final weights were 26.5 ± 5.19 g and 12.97 ± 2.74 g, respectively, at the end of experiment ($p<0.05$) (Figure 1).

Due to *ad libitum* feeding, the feeding rates varied by period within the growing process of trouts. The daily feeding rates in brown trout fry ranged from 0.39 to 5.26% by period whereas this rate ranged from 0.71 to 14.29% in rainbow trout. It can therefore be speculated that the brown trout grew less because they ingested less food. At the end of the growing study, the survival rates of brown trout and rainbow trout were 80.0 and 83.9%, respectively with no statistical significanses between these species ($p>0.05$) (Table 1).

DISCUSSION

Water temperature is a key factor in the rate of growth. In this study, water temperatures were between 10.3 to 12.9°C for both species. McCauley and Casselman (1980)

suggested a range between 12n to 15°C for optimal growth; the temperatures while Quillet et al. (1992) suggested 15 to 17°C.

It was observed that the rainbow trout grew significantly more rapidly than the brown trout. Similar results were obtained when compared with Yanik et al. (2002), Kurtoglu et al. (1998) and Shepherd and Bromage (1988) for rainbow trout. According to Quillet et al. (1992), brown trout is not a competitive species when compared with rainbow trout. Serezli et al. (2003) cited that the survival, weight gain, specific growth rate and feed conversion rate of brown trouts were significantly lower than rainbow trouts. In our study, no significant differences were observed between species with regard to feed conversion or survival of fry at the end of the 155 day trial, but weight gain and specific growth rate differed significantly ($p<0.05$). The specific growth rates in this study (3.63% for rainbow trout and 3.18% for brown trout) were in accordance with the findings of Hisar et al. (2003) for brown trout (3.13%), but higher than reported by Yanik et al. (2002) (1.67%), Uysal and Alpbaz (2002) (1.87 to 2.01%) for rainbow trout.

Brown trouts are more sensitive to environmental factors, and do not exhibit aggressive feeding behavior. During feeding times, they retreated to the bottom of the troughs, unlike the more aggressive rainbow trout. It seems essential to allow the feed to sink slowly in an elicoidal movement in order to make it available for the fry and fingerlings during a long period (Quillet et al., 1992). In spite of this, their feed consumption rates and needs are not as large as those of the rainbow trout. In connection to this, the extension of feeding time also appears as another disadvantage. The effects of feeding frequency upon the food intake and growth of salmonids appear to be highly dependent upon rearing conditions (Jobling, 1995).

There was a difference even between individuals among brown trouts in terms of the desire and rate of feed consumption during feeding. Chevassus et al. (1991) also indicates that growth performance during the fresh water phase varies widely among the different populations. Although making changes now may not induce significant results immediately, it is both possible to shorten the improvement time by putting molecular genetic methods into action and by developing brown trout that have the feed consumption rates of rainbow trout.

Application of selective breeding techniques may lead to a rapid and substantial improvement of the rearing performances (Quillet et al., 1992). Moreover, intraspecific cross-breeding of selected salmonid populations may produce a faster growing breed with a higher survival rate for aquaculture (Hisar et al., 2003).

Finally, despite the fact that the growth performance of rainbow trout fry was better than that of brown trout fry in the early stages, a similarity was found between both species in terms of survival and feed consumption rates. The results of this study point to the value of including the brown trout in the sector of trout cultivation as an alternative species. In addition, selective breeding with other trout species will also contribute to the enlargement of the range of alternative species.

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