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INVESTIGATION ON GROWTH RATE AND FOOD CONVERSION RATIO OF WELS (*SILURUS GLANIS* L.) IN CONTROLLED CONDITIONS

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Abstract

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The aim of this study was to establish the growth rate and food conversion ratio of wels (*Silurus glanis*) when fed with carp (*Cyprinus carpio*). The experiment was carried out under controlled laboratory conditions for a period of 30 days in two variants, by two replicas each, differing by the initial weight of the wels. For each variant 7 wels were used, at initial ratio between the biomass of the predator and the prey 1:3. The preys had an average body weight of 5-7 g. As a result of the experiment, the growth rate of *S. glanis* was established for the investigated period, which for the first variant is 25.43 g or 25.56%, and for the second – 9.56 g or 19.2%. (The linear growth rate for the first variant is 0.52 cm or 2.25% and for the second variant 0.46 cm or 2.45%). The food conversion ratio of wels when fed with carp was 4.3 for variant 1 and 4.7 for variant 2.

Key words: Silurus glanis, food conversion ratio, growth rate

Introduction

The wels (*Silurus glanis* L.) is one of the most highly preferred predatory fish for cultivation, which possesses an exceptional growth potential when sufficient quantity of food is available. Its meat has high flavor qualities, a pleasant consistency, white color and no bones. In aquaculture it is reared in monoculture or in polyculture. In the first case, high protein granulated food is used for wels feeding (Filipiak et al., 1993; 1995; 1997; Mares et al., 1996; Haffray et al., 1998; Linhart et al., 2002), while in the second case, its growth rate is based on natural food (Linhart et al., 2002; Jankowska et al., 2007; Zaikov, 2006).

Rearing of wels in polyculture with carp fish in Central and Eastern Europe is a common practice for more than 100 years now (Linhart et al., 2002). As compared to pike and pike-perch, the wels is considerably unassuming towards environmental factors. In the fish farms it can be used successfully as a regulator of quantity of weed fish species (Linhart et al., 2002; Zaikov, 2006), as well as the unwanted progeny, produced as a result of three-summer carp rearing.

When reared in polyculture, the number of wels in ponds is determined either by the quantity of weed fish species in them, or by how efficiently they can utilize it, turning it into valuable meat, i.e., by the food conversion ratio (kg of food per kg of growth rate). The food conversion ratio and the growth rate of fish, wels included, are a complex influence function of the different abiotic and biotic environmental factors, among which of great significance are: the tempera-

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ture and quantity of dissolved oxygen in water, the type of food, the age of fish, etc.

There are many data in the literature for the food conversion ratio when feeding wels on granulated food (Filipiak et al., 1995; Filipiak et al., 1997; Linhart et al., 2002; Ulikowski et al., 2003), however references concerning its values when feeding wels on live fish are limited and insufficient. Food conversion ratio differs in one degree or another depending on the specific experimental conditions. According to Kozlov and Abramovich (1980), from experiments carried out in Poland for growing wels in net cages at water temperature of 20-31°C, a food conversion ratio of 5.58 was obtained. Adamek et al. (1999) investigated the selectivity of wels feeding on different fish species in a recirculating system, at water temperature of 25°C and they have reported a considerably lower food conversion ratio - 2.36-2.72.

In natural ponds, the wels feeds on a wide range of fish species. In the fish farms, its choice is limited and is reduced to a few weed and cultivated fish species. In relation to this, the question for the efficient utilization of the unwanted carp generation as food by the wels is of a big interest.

The aim of this study is on the basis of the experiment carried out under controlled conditions, to establish the growth rate and the food conversion ratio of one-summer-old wels, fed with carp.

Materials and Methods

The experiment was carried out by using 28 one-summer-old fish, for 30 days period. For the purpose of the experiment tanks with volume of 1.5 m^3 were used at constant water flowing mode and additional aeration by means of micro-compressors. With regard to the strongly expressed negative photo-taxis of wels, an artificial substrate was used as a hiding place in the tanks. For the whole period of the experiment, the main water parameters were monitored, as follows: T°C, quantity of dissolved oxygen – O_2 mg.l^{-1}, oxygen saturation of water - % and pH (Table 1).

Two variants were experimented, which differ by the different initial weight of the wels (Table 2). In the first variant (tanks 1 and 2) it was 79.64-80.09 g respectively at variation rate (Cv,%) of 41.59 and 44.49, and in the second variant (tanks 3 and 4) – 40.71 g and 39.28 g at (Cv,%) 18.67 and 18.88. The wels in the first variant had 2 times higher average initial body weight as compared to those in the second variant.

Table 1

Temperature and amount of oxygen dissolved in the water

Tank	Temperature, ^{0}C min-max	pH	O_2, mg.l^{-1}	O_2, % of saturation
1	21.0 – 21.5	7.2	6.51	70.53
2	19.5 – 20.5	7.5	6.10	66.05
3	21.2 – 21.5	7.5	6.67	72.26
4	19.5 – 21.0	7.2	5.47	59.26

Seven wels were placed in each tank (n=7), at initial ratio between predator and prey biomass 1:3. The preys – one-summer-old carp fish had a body weight of 5-7 g. The data for body weight and body length of the wels is shown in Table 2. The survivability (%) of the wels was reported at the end of the experiment.

The daily growth rate of fish (DGR, g.day^{-1}) during the experimental period was calculated according to the formula: $DGR = (Wf - Wi).t^{-1}$, where Wf and Wi are the final and the initial body weight, and t - is the duration of the experimental period, which is equal to 30 days. When calculating the specific growth rate (SGR, %.day^{-1}) the following formula was used: $SGR = \{[\exp(\ln Wf - \ln Wi) - 1].t^{-1}\}.100$.

Results and Discussion

During the experimental period, the monitored hydrochemical parameters of water were relatively constant and no significant differences or variations in the separate tanks were established. The water temperature fluctuated within considerably narrow limits (19.5-21.5°C) and was below the optimum values for wels (22-28°C). The pH for the whole period was relatively constant (7.2-7.5), and the quantity of dis-

solved oxygen in the water fluctuated slightly – 5.47-6.67 mg.l^{-1}. The reported survivability of wels, at the end of the experiment was 100% in all tanks.

The data for the weight and linear growth rate of wels during the one-month experimental period at the specific rearing conditions are shown in Table 2 and on Figure 1. In the first variant, the average body weight growth rate for the period was 25.43 g or 25.56%, respectively 23.94 g or 23.11% for the wels in the first tank and 26.92 g or 25.15% in the second tank. The absolute growth rate in the first tank was lower than that in the second tank, but their values were very similar. The fish from second variant realized a considerably lower growth rate compared to those of the first variant – the average growth rate in both tanks was 9.56 g, in the first tank – 8.06 g or 16.5% and in the second – 11.06 g or 21.9%. Data shows that the average growth rate of fish from the first variant is by 15.87 g higher than those of the second variant.

The average linear growth rate of the wels from the first variant was 0.52 cm or 2.25% and for the wels from variant two 0.46 cm or 2.45%, respectively.

The daily growth rate (DGR, %.day) and the specific growth rate (SGR, g.day^{-1}) for both variants are shown in Figure 2. The values for both parameters were higher for the fish from the first variant compared to those in variant 2.

The average food conversion ratio in the first variant was 4.3, and in the second variant – 4.7. The average values from both variants were comparatively

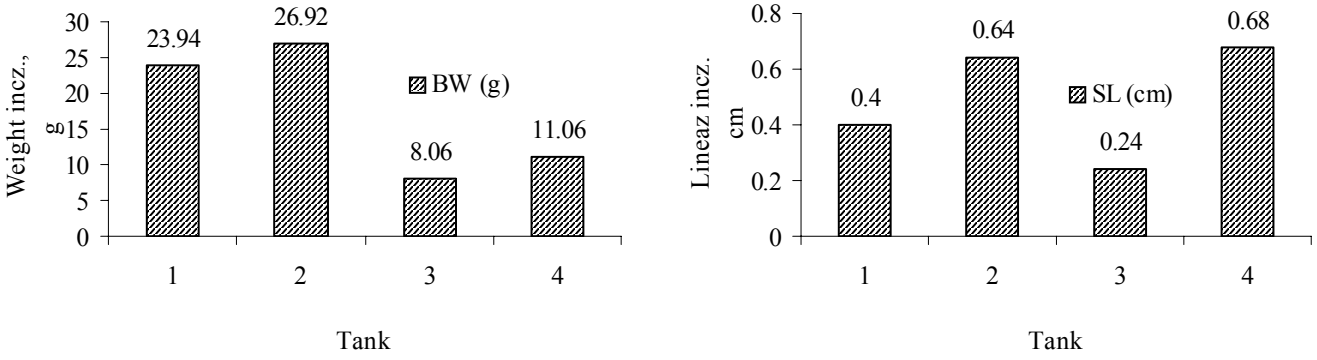

Fig. 1. Weight and linear increment of one-summer-old wels fed with carp for variant I (Tank 1 and 2) and variant II (Tank 3 andf 4) for 30 day period

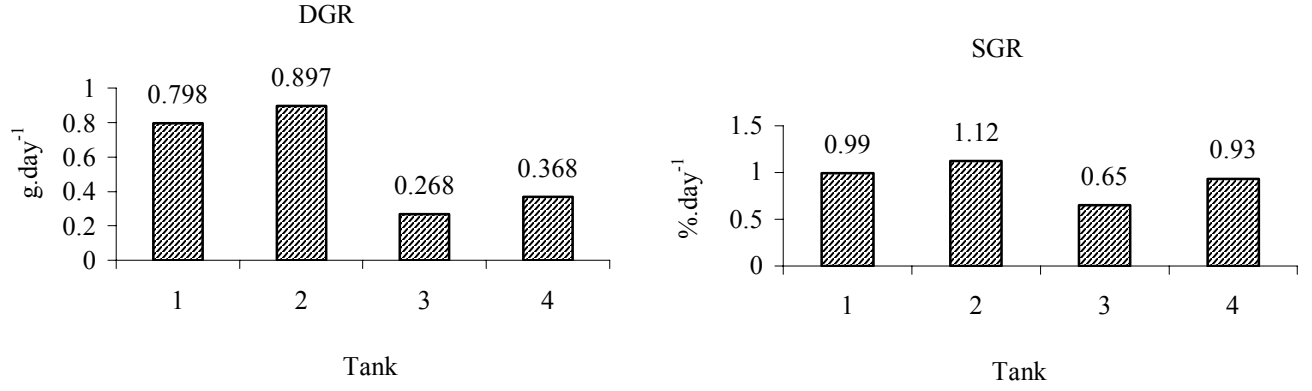

Fig. 2. Daily growth rate (DGR) and specific growth rate (SGR) of the two weight groups one-summer-old wels, fed with carp for a 30 day period

Table 2
Growth and food conversion ratio of the european catfish fed with carp

Variants	Body weight, g		TL,cm Body length, cm		Average weight increment		Food conversion ratio
	Initial	Final	Initial	Final	Weight, g	Linear, cm	
Variant I							
Tank 1							
X	79.64	103.6	22.51	22.91			
SD	33.13	46.94	3.27	3.22	23.94	0.4	4.7
Cv,%	41.59	45.32	14.52	14.06			
Tank 2							
X	80.09	107	22.7	23.34			
SD	35.64	38.82	2.99	3	26.92	0.64	3.9
Cv,%	44.5	36.28	13.1	12.86			
Average I variant							
X	79.85	105.29	22.6	23.12			
SD	34.38	42.88	3.13	3.11	25.43	0.52	4.3
Cv,%	43.04	40.83	13.81	13.46			
Variant II							
Tank 3							
X	40.71	48.77	18.34	18.58			
SD	7.6	10.92	1.37	1.26	8.06	0.24	5.1
Cv,%	18.67	22.4	7.46	6.77			
Tank 4							
X	39.28	50.34	18.22	18.58			
SD	7.41	9.13	1.23	1.27	11.06	0.68	4.3
Cv,%	18.88	18.15	6.76	6.75			
Average II variant							
X	40	49.56	18.28	18.74			
SD	7.5	10.02	1.3	1.26	9.56	0.46	4.7
Cv,%	18.77	20.27	14.22	6.76			

similar, regardless of the fact that in the first one the initial body weight of wels was two times higher. Despite the identical conditions, in which fish were reared, the food conversion ratio reported in the separate tanks was different, having in mind that the fish with a higher initial body weight have a lower food conversion ratio.

The values obtained for the food conversion ratio in all tanks of both variants were higher than those reported by Adamek et al. (1999), but in the experiment carried out by them, the wels were grown at the temperature optimum for them – 25°C.

Conclusions

For the period of 30 days, the one-summer-old wels, in the conditions of the experiment (temperature of 19.5-21.5°C; quantity of oxygen dissolved in

water 5.47-6.67 mg.1^{-1}) gained an average body weight of 25.43 g for the first variant and 9.56 g for the second variant. Fish having a higher initial body weight increased it by 31.84% and those with a lower one – by 23.9%.

The food conversion ratio reported for the first variant is 4.3 and for the second – 4.7, i.e., the fish with a higher initial body weight have by 0.4 lower food conversion ratio.

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