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EFFECT OF FROZEN WHITE WORM (*Enchytraeus* sp.) ON GROWTH OF PLATY (*Xiphophorus maculatus* Günther, 1866)

Dilek ŞAHİN¹, Meryem ÖZ², Zafer KARSLI¹, Orhan ARAL²,
Mehmet BAHTİYAR²

¹ Vocational School, Sinop University, Turkey

² Fisheries Faculty, Sinop University, Turkey

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Corresponding author:

Dilek ŞAHİN, Vocational School, Sinop University, 57000, Sinop-Turkey

E-mail: dilek_shn@hotmail.com

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Abstract

In this study, for the first time, effects of live food on platy (*Xiphophorus maculatus* Günther, 1866), were investigated by using frozen white worm (*Enchytraeus* sp.). Aquarium fish used in this study were fry with an average weight of 0.177-0.180 ±0.005 g in different groups. In the experiment, 135 fry *Xiphophorus maculatus* were used. Fish weights were determined, and they later were put as 15 individual in aquariums in order to breed with three different experimental feed treatments (frozen white worm, frozen white worm combined with traditional aquarium fish feed and traditional aquarium fish feed). Water temperature was determined as 23.7 ±0.05 °C in during of experiment. The fish were fed with three diet to satiation twice daily (09:00, 15:00) in during two months. In the end of the experiment average final weight was determined 0.257 ±0.01 g, 0.258 ±0.01 g and 0.211 ±0.01 g, fed on with frozen white worm, frozen white worm combined with aquarium fish feed and aquarium fish feed groups, respectively and there were significant differences between T2 (frozen white worm+combined with aquarium traditional fish feed) and T3 (aquarium traditional fish feed) groups of average final weight (p<0.05).

INTRODUCTION

Ensuring ideal environmental conditions and providing a suitable type of feed for the fish forms the basis of aquarium fish breeding practices. The composition of the feed, and hence its nutrient quality and content (crude protein, fat, carbohydrates, etc.), is one of the most important aspects that need to be considered in the feeding of aquarium fish. As live feed has superior nutrient content than dry feed, it occupies an important place in the diet of aquarium fish. Owing to its ideal protein and fat content, *Artemia salina* ranks among the best types of live feed. Since it is more common for *Artemia salina* to be obtained from natural sources than to be raised, both the quality and quantity of this live feed are highly variable. For this reason, many aquarium fish keepers are currently seeking alternatives sources of live feed. White worms, on the other hand, are similar to fish meal in terms of protein quality (Dynes 2003; Vielma-Rondon et al 2003). Traditionally, hatchery-produced sturgeon larvae and fingerlings have been raised on live food organisms e.g. oligochaetes (*Enchytraeus* sp. and *Tubifex* sp.) (Gisbert & Williot 2002).

In addition, both the use of white worms in aquarium fish breeding, and the number of studies being conducted on the use of white worms, have increased in recent years. This is due to the fact that, in addition to being easy and economical to grow, white worms also possess a high nutrient quality. In this study, the effects of live feed on the growth of *Xiphophorus maculatus* (Günther, 1866) were investigated for the first time by using frozen white worm (*Enchytraeus* sp.).

MATERIAL AND METHODS

In the experiment carried out at Sinop University Faculty of Aquaculture Aquarium Unit, 5 glass aquariums separated each other in three dimensions (60x45x50 cm) were used. The volume of water used in the experiment aquariums was 30 liters, and an internal filter (280 liter/hour) was used in all experiment aquariums.

Aquarium fish used in this study were fry with an average weight of $0.177-0.180 \pm 0.005$ g. In the experiment, 135 fry *Xiphophorus maculatus* were used and all fish were weighted.

Fish weights were determined, they were put as 15 individual in aquariums in order to feed with three different experimental feed treatments (frozen white worm (Treatment T1), 50% frozen white

worm combined with 50% aquarium traditional fish feed [(Treatment T2) and aquarium traditional fish feed (Treatment T3)]. Polystyrene (49x39x17cm) and plastic (26x19x8 cm) boxes used for culture of *Enchytraeus* sp. in this study. The soil depth and amount were 8 cm and 1.5kg in polystyrene boxes. Ingredient of the experimental soil was coconut fiber (without artificial fertilizer and chemicals). Some parameters of the soil were determined as temperature 13 °C, pH 7 and moisture 40-60%. The top of the culture boxes was covered with a flat board to prevent the soil surface from drying out, to protect against incoming light, and to keep predators out (Memiş et al 2004). *Enchytraeus* sp. was fed once in four days with traditional fish feed (crude protein 31%, crude lipid 5% and crude fibre 2%). (Figure 1).



Figure 1. White worm (*Enchytraeus* sp.)

The fish were fed with three diet to satiation twice daily (09:00, 15:00) in during two months. By siphoning water in experiment aquariums once a week, diminished water quantity was filled in with addition of water in same temperature. Water parameters were measured by YSI Professional Plus hand and field measurement units.

Data Analysis

At the conclusion of the growth trial, the mean weight gain and survival of each feed treatment were determined at the end of two month trial. Water temperature, pH and dissolved oxygen of aeration experiment aquariums by initial filter were determined as 23.7 ±0.05 °C, 8.97 ±0.06 and 7.76 ±0.01, respectively. Analyzed parameters included:

Feed Conversion Rate

$$(FCR)=\text{Total food consumption (g)}/\text{Total weight gain (g)} \quad (1)$$

Specific Growth Rate

$$(SGR)=((\ln W_f - \ln W_i) * 100) / T \quad (2)$$

where

W_f=mean final weight,

W_i=mean initial weight and

T=total experiment days

Statistical Analysis

All results are expressed as means ± SE. The statistical significance of differences between measured parameters was computed (Zar 1984). All data were performed using “Minitab Release 15 for Windows” package programme. Parametric

tests were applied when preconditions of one-way analysis of variance (ANOVA) were provided, and nonparametric tests were applied when preconditions were not provided (Kruskal-Wallis). All values were considered significant at 5% level (P<0.05).

RESULTS AND DISCUSSION

At the end of the experiment average final weight (± SE) was determined 0.257 ±0.001 g, 0.258 ±0.001 g and 0.211 ±0.001 g, fed on with frozen white worm, frozen white worm combined with aquarium fish feed and aquarium fish feed groups, respectively and there were significant differences between all groups of average final weight (p<0.05). The study data regarding the mean increase in weight, the specific growth rate (SGR), the feed conversion rate (FCR) and the survival rate are shown in Table 1.

Weight gain was determined as 0.078 ±0.02, 0.082 ±0.01 and 0.034 ±0.01, respectively in T1, T2 and T3 (p<0.05). Specific growth rate obtained in T1, T2 and T3, 0.639 ±0.17, 0.675 ±0.06 and 0.313 ±0.05, respectively. Feed conversation rate was determined 1.50 ±0.22, 1.23 ±0.04 and 1.87 ±0.42 respectively in T1, T2 and T3. Survival rate was obtained in T1, T2 and T3, 68.88 ±9.69, 91.11 ±2.22 and 91.11 ±5.88, respectively (p<0.05).

Previous studies on the use of white worms as fish feed have been conducted only on a limited number of fish species. Moreover, studies regarding live feed for fish have generally focused on certain species of worms (*Tubifex tubifex*, and the earthworm *Eisenia foetida*).

Table 1. Growth performance of platy, *Xiphophorus maculatus* larvae of different treatments after 45 days rearing (mean ± SE) (n=45 in the initial experiment)

Parameters	Treatment T1 (frozen white worm) (n=31)	Treatment T2 (frozen white worm+aquarium traditional fish feed) (n=41)	Treatment T3 (aquarium traditional fish feed) (n=41)
Initial weight (g)	0.180±0.01	0.177±0.00	0.177±0.01
Final weight (g)	0.257±0.01	0.258±0.01	0.211±0.01
Weight gain (g)	0.078±0.02 ^a	0.082±0.01 ^a	0.034±0.01 ^b
Specific growth rate (%)	0.639±0.17 ^a	0.675±0.06 ^a	0.313±0.05 ^b
Feed conversation rate	1.50±0.22	1.23±0.04	1.87±0.42
Survival rate (%)	68.88±9.69 ^a	91.11±2.22 ^b	91.11±5.88 ^b

Values with different superscripts in a row are significantly different (p<0.05).

Mandal et al (2010) previously fed guppy fish with dried tubifex, live tubifex, dried daphnia and granule feed, and determined at the end of their study that the best increase in weight and in SGR were observed in the group fed with live tubifex. Mahfuj et al (2012), on the other hand, fed koi fry (*Cyprinus carpio*) with three different types of feed (crushed pellet feed; 50% pellet feed+50% chopped live tubifex; chopped live tubifex) for a period of 56 days. At the end of their study, they identified the best increase in live weight, SGR and survival rate only in the group fed with the chopped tubifex feed. In a study they conducted on angel fish (*Pterophyllum scalare*), Kasiri et al (2012) evaluated the effect of feeding angel fish with earthworms, dried tubifex, dried Gammarus and granule feed on their growth and reproductive performance. Based on the study results, they determined that the increase in weight, the SGR, and the FCR values were the highest in the group fed with granule feed. It is known that tubifex worms are generally collected from areas where sewage mixes with river waters; for this reason, the use of tubifex worms as fish feed is especially problematic with regards to the risk of disease. However, the *Enchytraeus* species of white worms that were used in this study were bred separately from other species under controlled and sterile conditions. In our review of the literature, we identified no previous studies that have been conducted with the *Enchytraeus* species of worms and the Platy (*Xiphophorus maculatus* Günther, 1866) species of aquarium fish. However, Jimenez-Rojas et al. have conducted a study in 2012 with the *Enchytraeus buchholzi* species of worms and angel-fish fry. At that study, the fry were fed with three types of different feeds, which were the commercial feed, the commercial feed+*Enchytraeus buchholzi* mixture, and the *Enchytraeus buchholzi* feed. Following a study period of 28 days, the highest performance in terms of increased weight, the specific growth rate and the survival rate were observed in the group fed with the commercial feed+*Enchytraeus buchholzi* mixture. In a manner similar to Jimenez-Rojas et al's study (2012), the highest increase in weight and the highest SGR and FCR values in our study were observed in the group fed with Frozen white worms+traditional feed.

The potential economic benefits of white worm production for commercial aquaculture might include incorporation into formulated diets or development of alternative organic diets for carnivorous marine fishes. Use of diets that are reared and

harvested easily, thrive with minimal maintenance and survive in salt/brackish water for prolonged periods also may decrease overall costs by reducing feed waste and the need for water quality maintenance (Walsh 2012).

CONCLUSIONS

Based on the data obtained within the context of this study; it was determined that in breeding experiments performed under laboratory conditions, using commercial feed and live feed together provided better results than using either type of feed on its own. In the future potential studies that could be conducted to further investigate and detail this subject.

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