

USING WHITE WORM (*Enchytraeus* spp.) AS A LIVE FEED IN AQUARIUM FISH CULTURE

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ABSTRACT

White worm (*Enchytraeus* spp.) belongs to Enchytraeidae family. In live feed culture, important criteria are high nutritional value, sterile, easy, economic and sustainable production. In comparison with lots of live feed species collected from nature or produced under controlled conditions, white worms have a great value thanks to their high food quality in particular, easy, uninterrupted and economic production in large quantities in sterilized culture conditions. White worms produced under controlled conditions will expand its usage area as a qualified live feed not only in edible fish sector but also in aquarium fish sector.

Key words: White worm, *Enchytraeus* spp., livefeed, aquariumfish

AKVARYUM BALIKLARI YETİŞTİRİCİLİĞİNDE CANLI YEM OLARAK BEYAZ KURT (*Enchytraeus* spp.) KULLANIMI

ÖZET

Beyaz kurt (*Enchytraeus* spp.), Enchytraeidae familyasındandır. Canlı yem üretiminde, besleme değerinin yüksek olması, steril olarak üretilebilmesi, yetiştiriciliğinin kolay, ekonomik ve sürekli olması gibi kriterler önemlidir. Doğadan toplanan veya kontrollü koşullarda üretilebilen birçok canlı yem türüne kıyasla beyaz kurt, steril ortamlarda kolaylıkla, bol miktarda, kesintisiz ve ekonomik olarak yetiştirilebilme olanaklarının yanı sıra özellikle besin kalitesi ile önemli bir değere sahiptir. Kontrollü koşullar altında üretilmiş olan beyaz kurtların, gerek yemeklik balık gerekse akvaryum canlıları sektöründe kaliteli bir canlı yem olarak kullanım alanı genişleyecektir.

Anahtar kelimeler: Beyaz kurt, *Enchytraeus* spp., canlı yem, akvaryum balıkları

INTRODUCTION

The main for a successful culture of an aquarium fish species is to form the conditions as close as possible to those of the natural habitat. The most important environmental conditions are water parameters and nutritional conditions. Many aquarium species consume live feed in their natural environments. Although several studies have attempt to produce artificial feed which are nutritionally equivalent the live feed and

made a great progress, there are still some problems resulting from unbalanced artificial diets. Scientific studies have shown that live feeds increase production success during the first feeding, juvenile and conditioning broodstock fish, especially for species which are carnivorous in feeding habit (Farahi et al. 2010, Mandal et al. 2010, Kasiri et al. 2012, Mahfuj et al. 2012, Jimenez-Rojaz et al. 2012, Şahin et al. 2014).

Main live feeds used in aquarium fish culture are *Artemia* spp. (brine shrimp), *Daphnia* spp. (water flea), *Tubifex* spp., *Enchytraeus* spp., *Eisenia* spp. (aquatic and terrestrial worms), *Gammarus* spp. and *Chironomus* spp. larvae (Bell 1958, Astong et al. 1982, Bouguenec and Giani 1989, Somsiri et al. 2005).

White Worm (*Enchytraeus* spp.)

White worm (*Enchytraeus* spp.) belongs to Enchytraeidae family, Oligochaeta class of Annelida (ringed worms) phylum. Widely produced white worms for aquarium living organisms are *Enchytraeus albidus* and *Enchytraeus buchholzi* species. They are round-bodied, thin, tall and segmented worms. Most of Oligochaeta live in moist soil and fresh water while some of them live in the sea. They are white and 15-40 mm long and 0.5-1.0 mm in diameter. Without a distinctive head, they have a mouth at anterior and an anus at posterior. In segments, the chaetae exist in different numbers and shapes changing according to species (Figure 1).



Figure 1. Adult white worm (original)

They have a part called the clitellum which can be observed in adult individuals. Most of species are hermaphrodite. Although hermaphrodite individuals have both male and female reproductive systems, they cannot fertilize themselves. During mating, sperms are transferred from one worm to another. A sac named cocoon, which includes nutrients for hatched baby worms, is left to the external environment by the adult individuals (Myohara et al. 1999, Maraldo 2009, Tappin 2010) (Figure 2).

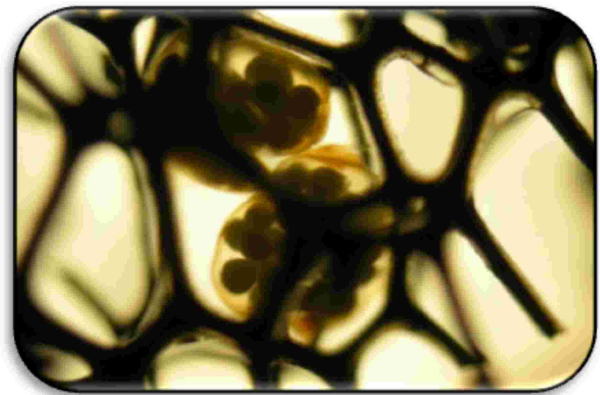


Figure 2. Eggs of white worm in cocoons (original)

White worm which is an ideal live feed animal can be produced under controlled conditions. For their production, wood, polystyrene or plastic boxes can be used after covering with a breathable way. Materials such as garden mold, forest soil, peat, barks and wood fiber are mixed and then used as production soil. Organic soils that are not a mixture of chemicals and fertilizer are preferred. Various nutrients such as oatmeal, bread, boiled vegetables, fish feed etc. can be used as feed (Bell 1958, Memiş et al. 2004, Howarth 2008) (Figure 3).



Figure 3. White worm and white worm culture boxes (original)

In live feed culture, important criteria are high nutritional value, sterile, easy, economic and sustainable production. In this sense, it has been determined that white worm of *Enchytraeus* spp. species, also called pot worms, have a great advantage in many ways for aquarium fish culture as well as larval culture of sturgeon, an endangered species. Nutrient compositions of white worm are reported as 80.2% water, 58.58% protein, 27.7% fat, 8.58% ash on dry matter basis. These values have been reported as 81.22% water, 58.68% protein, 11.39% fat, 9.74% ash for *Tubifex*;

89.09% water, 57.20% protein, 12.85% fat, 9.34% ash for *Artemia salina*; 87.2% water, 72.13% protein, 23.7% fat for *Moina* sp.(cultured with yeast); 88.1% water, 71.42% protein, 10.92% fat, 17.6% ash for *Acartia clausi* (natural); 86.1% water, 39.8% protein, 11.7% fat, 8.8% ash for *Brachionus plicatilis* (natural); 89.3% water, 70.09% protein, 13.08% fat, 6.54% ash for *Daphnia* spp. (Watanabe et al. 1983, Greco 2001, Yanar 2003). Most researches on worms of *Enchytraeus* spp. species have investigated their anatomy, physiology, biology and tolerance to harmful chemicals, yet efforts on their breeding and use for fish feeding remain limited. Memiş et al. (2004), who investigated feasibility of various diets for white worm culture, reported that *E. albidus* species can be produced easily for commercial fish breeding. Rezvani et al. (2011) examined development of gonad by feeding aquarium fish *Astronotus ocellatus* with earth worm of *Eisenia foetida* species. Kaisiri et al. (2012) fed Angelfish (*Pterophyllum scalare*) species with live earth worm and dried Tubifex. Mandal et al. (2010) fed aquarium fish (*Poecilia reticulata* species) with dried and live *Tubifex* and dried *Daphnia*, Mahfuj et al. (2012) searched administration of tubificid worm to koi carp larvae *Cyprinus carpio*. Şahin et al. (2014), who studied effects of frozen white worm on growth of platy fish (*Xiphophorus maculatus*), reported that the best growth, survival rate and feed conversion rates were achieved in a group fed with white worm and commercial aquarium fish feed. As can be figured out from the researches above, studies about using earth worms in fish feeding cover a limited number of fish species and they focus on specific worm species (*Tubifex tubifex* and earth worm (*Eisenia fetida*)). As known, live feeds such as water flea, tubifex worms (*Tubifex tubifex*) and mosquito larvae are used as fish feed after they are collected from sewage discharge points into brooks and rivers and natural environments like puddles. But this approach can cause various disease problems (Somsiri et al. 2005).

CONCLUSION

Studies about large scale production of white worms were first made by Soviet Union (Anonymous 2013). White worm production rate under culture conditions can reach 750 g/m² (FAO 2013). But today *Enchytraeus* spp. is produced in small amounts by amateur aquarists in many countries mostly to meet

their own needs. Stringent and detailed examination of production conditions using scientific methods will positively affect commercial production. White worm produced under controlled conditions will expand its usage area as a qualified live feed not only in edible fish but also in aquarium fish sectors.

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