Utilization of Silk Waste as Fishmeal Replacement: Growth Performance of Cyprinus carpio Juveniles Fed with Bombyx mori Pupae

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Abstract : According to the circular economy model, resource productivity should be maximized and wastes should be reduced. Since earth's natural resources are continuously depleted, resource recovery has gained great interest in recent years. As part of our research study on the recovery and reuse of silk wastes, this paper focuses on the utilization of silkworm pupae as fishmeal replacement, which would replace the original fishmeal raw material, namely the fish itself. This, in turn, would contribute to sustainable management of wild fish resources. Silk fibre is secreted by the silkworm Bombyx mori in order to construct a 'room' for itself during its transformation process from pupae to an adult moth. When the cocoons are boiled in hot water, silk fibre becomes loose and the silk yarn is produced by combining thin silk fibres. The remaining wastes are 1) sericin protein, which is dissolved in water, 2) remaining part of cocoon, including the dead body of B. mori pupae. In this study, an eight weeks trial was carried out to determine the growth performance of common carp juveniles fed with waste silkworm pupae meal (SWPM) as a replacement for fishmeal (FM). Four isonitrogenous diets (40% CP) were prepared replacing 0%, 33%, 50%, and 100% of the dietary FM with non-defatted silkworm pupae meal as a dietary protein source for experiments in C. carpio. Triplicate groups comprising of 20 fish (0.92±0.29 g) were fed twice/day with one of the four diets. Over a period of 8 weeks, results showed that the diet containing 50% of its protein from SWPM had significantly higher ($p \leq 0.05$) growth rates in all groups. The increasing levels of SWPM were resulted in a decrease in growth performance and significantly lower growth ($p \leq 0.05$) was observed with diets having 100% SWPM. The study demonstrates that it is practical to replace 50% of the FM protein with SWPM with a significantly better utilization of the diet but higher SWPM levels are not recommended for juvenile carp. Further experiments are under study to have more detailed results on the possible effects of this alternative diet on the growth performance of juvenile carp.

Keywords : Bombyx mori, Cyprinus carpio, fish meal, silk, waste pupae
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