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EFFECTS OF LEAF EXTRACT AND LEAF MEAL OF *CALAPOGONIUM MUCUNOIDES* DESV. AND *EREMOMASTAX POLYSPEMA* (BENTH.) DANDY ON THE GROWTH OF *HETEROBRANCHUS LONGIFILIS* (VALENCIENNES).

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ABSTRACT

To determine the effect of leaf extract and unprocessed leaf meal of *Calapogonium mucunoides* Desv. and *Eremomastax polyspema* (Benth.) Dandy on the growth of *Heterobranchus longifilis* (Valenciennes), feeds containing the leaf meal and ethanol extract of the leaves were fed separately to 10 *H. longifilis* fingerlings in different aquaria. The feed used in the control experiment did not contain the extract or leaf meal. Ethanol extracts stimulated greater growth than unprocessed leaf meal. The best daily weight gain, percentage weight gain and specific growth rate were obtained from fish fed with *C. mucunoides* leaves extract. This treatment also gave the best feed conversion rate and condition factor. Extract from *E. polyspema* leaves was next in stimulating growth, but its leaf meal was inferior to *C. mucunoides* leaf meal and was not found to enhance the growth of this species. The result of this study indicates that extract of *C. mucunoides* leaves can be incorporated into *H. longifilis* feed to stimulate its growth.

KEY WORDS: *Calapogomium mucunoides, Eremomastax polyspema,* meals, extracts, *Heterobranchus longifilis* growth.

INTRODUCTION

Heterobranchus longifilis (Valenciennes), the African catfish, is the fastest growing local fish species. Its maximum size is greater than that of all other indigenous freshwater fish species of Africa (Bruton *et al.* 1982). This species provides a fast turnover of animal protein which can further be enhanced by feeding. Of prime importance in fish feed is animal protein which is usually provided by fish meal, but fish meal is expensive and scarce. As pointed out by Guardia (1972), the greatest challenge posed to food scientists is to source for economical and abundant protein that can sustain the need of increasing world population. Pirie (1986), in his contribution, suggested that one way to increase protein is to supplement animal protein with plant protein. Since plant protein, in most cases, are deficient in some amino acids (Udedibie, 1990), it is therefore necessary to convert plant protein first into animal protein using a fast growing edible organism such as *H. longifilis*.

Many scientists have responded to the challenge above by experimenting on plant products as protein source for fish feed. Stanley and Jones (1976) studied the efficiency of utilizing unicellular algae as protein source by various fish species. Similar studies carried out by Hepher *et al* (1976) and Murray and Mitsui (1982) led the authors to conclude that algal meal is probably the only plant protein that can replace fish meal in fish feed. This conclusion was debunked from studies on Ipil-ipil (a multicellular plant leaf). Pantastico and Baldia (1979) discovered that the growth of *Tilapia mossambica* (Peters) increased proportionally with increasing level of ipil-ipil leaf meal, in their diet. Analysis of the leaf showed that it contained 24.5% protein (Castello and Gerpacio 1976).

The method of incorporating plant product into fish feed influences its efficiency. Guardia (1972) pointed out that a basic technology must be developed for incorporating plant products into feed to enhance efficiency. Such technology, the author added, should consider the separation of pigment, removal of undesirable flavour and toxins.

One method of incorporating plant product into feed is the use of extract. Chlorella-extract supplement fed to ayu, *Plecoglosus altivelis,* did not only suppress

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lipid accumulation in the muscle, liver and intraperitoneal fat body of the fish, but also encouraged retention of protein in the muscle. (Nematipour *et al* 1987). Johansson *et al* (1991) reported improved eating quality and greater growth of rainbow trout fed with different mixtures of leaf nutrient concentrate. Extract or concentrate may not be an economical way of incorporating plant product into feed, instead dried and ground plant product in the form of meal, despite its bulkiness, may be more economical. Ekanem (1992) reported greater growth of *Chrysichthys nigrodigitatus* (Lecépéde) fed with feed which contained 19% *Calapogonium mucunoides* Desv. leaf meal.

The raw leaf of *Calapogonium mucunoides* is widely used in feeding rabbit and as supplement in poultry feed. The leaf of *Eremomastax polyspema* (Benth.) Dandy is used locally in fattening women. Various investigators gave different reports about the use of alcoholic extract. Chukwuji (1985) reported retardation of growth in rats which received alcoholic extract of *Aidia rubens* Hiern and *Anacardium occidentale* Linn., Whereas Ekwere (1987) reported that alcoholic extract of *Newbouldia laevis* Seemannex Bureau stimulated the growth of Hyperco white broiler chicks. This study was conducted to determine the effect of alcoholic extract compared to unprocessed leaf meals of *Calapogonium mucunoides and Eremomastax polyspema* on the growth of *Heterobranchus longifilis.*

MATERIALS AND METHODS

Calapogonium mucunoides leaves used in this study were collected near the Botanical Garden in the University of Calabar, Nigeria while *Eremomastax polyspema* was obtained from a private compound at Akim Town within the Calabar Municipality in Nigeria. The leaves were washed and dried in the sun before they were ground into leaf meal. Equal quantities of leaf meal which was incorporated into a known weight of feed was subjected to ethanolic extraction for 6 hours using Soxhlet apparatus and the extract so obtained was incorporated into a known weight of feed.

The feed used for this study was compounded with 43% rice bran, 21.5% palm kernel cake, 21.5% soybean meal, 6.5% bone meal, 6.5% palm oil and 1.0% vitamin/mineral premix. This feed was used in the control experiment. For other treatments 1kg of this feed was mixed with 100g of ground leaves or leaf meal extract. Equal quantities of boiled water (0.75l/kg of feed) was added to each feed and the dough was thoroughly mixed and dried in the sun before they were fed to the fish. Proximate analysis of the control feed showed that it contained 30.3% protein, 9.83% ether extract, 17.12% ash and 24.20% fibre. Similar analysis showed that *C. mucunoides* leaves contained 19.6% protein, 4.99% ether extract, 6.34% ash and 4.04% fibre while *E. polyspema* leaves contained 19.42% protein, 3.24% ether extract, 18.48% ash and 5.36% fibre. No attempt was made to balance the energy contents of the feeds.

Fifty *H. longifilis* fingerlings used in the study were bought from the Institute of Oceanography hatchery in the University of Calabar. The study was carried out in the same hatchery after two weeks of acclimation. During acclimation, the fish were fed to satiation once daily. The fish were then divided into five groups of ten fingerlings each. Each group was stocked in a separate aquarium (95cm x 50cm x 30cm) filled to one third its total capacity with freshwater. The study was conducted in freshwater of temperature 27°C, pH of 7.0 and dissolved oxygen content of 6.4mg/l. The mean weight of each fish stocked for the experiment was 1.1g and had a mean total length of 4.5 cm.

The experiment commenced a day after stocking and continued for 27 days. Each group of fish was fed twice daily with a total of 10% of their body weight using different feed treatments while fish in one aquarium were fed with the control feed. The fish were weighed weekly and the weight of the feeds were adjusted to match the fish weight.

At the end of the experiment the total length and weight of each fish were measured. The following indices were calculated: condition factor, weight gain, daily weight gain, specific growth rate and feed conversion rates. The formulae were:

(a) Fulton's condition factor

$$(F) = \frac{100w}{L^3}$$ (after Ricker 1975)

Where W and L are weight (g) and length (cm) of the fish respectively.

(b) Percentage weight gain

$$= \frac{\text{Weight gain}}{\text{Initial weight}} \times 100$$

(c) Daily weight gain (DW)

$$= \frac{Wt - Wo}{Wo\ (t)}$$

Where DW is the average daily weight gain in live weight per gram of fish. Wt and Wo are final and initial live weights of fish.

(d) Specific growth rate (SGR%)

$$= \frac{LnWt - LnWo}{t} \times 100$$ (After Viola *et al* 1988),

Where Ln is the natural logarithm, Wt and Wo are final and initial weights respectively and t was the 27 days the study lasted.

(e) Feed conversion rate (FCR)

$$= \frac{\text{Total weight of dry feed offered (g)}}{\text{Total weight gained by fish (g)}}$$

Analysis of variance was conducted on daily weight gains to determine if there were significant differences in growth among treatments at 5% level.

RESULTS

The fish which had ethanol extract of *Calapogonium mucunoides* incorporated into their feed had the highest condition factor, the greatest weight gain, the best feed conversion rate as well as the highest specific growth rate (Table 1). The group fed with feed which contained leaf meal of *E. polyspema* had the lowest condition factor, the least weight gain, the worst feed conversion rate as well as the lowest specific growth rate. The control feed was superior to feed which contained leaf meal of *E. polyspema* in all aspects. However, analysis of variance found no significant difference in the growth among treatments at 5% level.

Table 1: Condition, growth parameters and feed conversion rates of *Heterobranchus longifilis* fed control feed and with feeds containing leaf extracts and leaf meals.

Feed type:	Condition factor(F)	Weight gain (%)	Daily weight gain (gg-1)	Feed conversion rate	Specific Growth rate (%)
Feed with *Calapogonium mucunoides extract*	1.5	600	0.25	1.07	3.129
Feed with *Eremomastax polyspema* extract	1.40	587	0.20	1.15	3.099
Feed with *Calapogonium mucunoides* leaf meal	1.13	468	0.16	1.19	2.798
Feed with *Eremomastax polyspema* leaf meal	1.09	410	0.14	1.27	2.617
Control feed	1.12	445	0.15	1.23	2.755

DISCUSSION

C. mucunoides incorporated into the feed, in whatever form, stimulated more growth than that obtained from the control but greater growth was obtained from the group which had *C. mucunoides* extract in their feed. This leaf, with 4.99% ether extract and 19.6% protein content obviously increased the energy content of the feed and enhanced the growth of *H. longifilis*. The difference in growth between fish fed with extract and those fed with leaf meal suggests that extraction has refined the growth enhancing agents by removing anti-nutritional factors such as lectins which might be present in the leaf. Lectins are reported to affect nutrient utilization by binding to glycoproteins and glycolipids of the digestive tract mucus and by inhibing enzyme activities (Jaffe 1980, Udedibie 1990).

Greater growth was obtained from the group of fish fed with feed which contained the leaf meal of *C. mucunoides* and the control than from feed which contained the leaf meal of *E. polyspema* (Table 1). This shows that *E. polyspema* leaf meal does not enhance growth of this species. *E. polyspema* leaf contains 19.42% protein and 3.42% ether extract (as analysed in this study) which should increase the energy content of the feed and stimulate more growth than was obtained from the control feed; instead the reverse was the case. This could be caused by the concentration of anti-nutritional factors or high content of fibre in the leaf meal which might have hindered digestion and absorption. This suggests that *E. polyspema* leaf meal should not be included in the diet of *H. longifilis*. Also it is likely that *E. polyspema* contains anti-nutritional factors which must have been removed by extraction thereby enhancing greater growth in fish that received extract of this leaf.

The fast growth of this species as noted in this study could be attributed to the components used in compounding the feed. The control feed in this study contained 30.3% crude protein and stimulated 2.76% specific growth rate which is comparable with 2.80% specific growth rate obtained by Ndome (1998) for the same species using feed which contained 45% crude protein. This study has therefore shown that the combination of

feed components as presented here with lower protein level and a high feeding rate of 10% body weight could be used to achieve excellent growth.

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