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A PANACEA TO ECONOMIC STABILITY
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SUSTAINABLE PRODUCTION OF HOUSEFLY LARVAE (*Musca domestica*) AS A POTENTIAL NON-CONVENTIONAL PROTEIN SOURCE IN FISH FEED

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Abstract

*The common housefly, *Musca domestica*, is a considerable component of nutrient recycling in the environment. Housefly maggots were cultured on various organic wastes through fresh poultry dropping, pig manure, kitchen waste, and poultry offal using developed culture units. A total of 2kg of each substrate were mixed with 0.10kg of fly attractant (blood and rotten egg) and placed randomly in triplicates in culture units. The culture units were opened and exposed for eight (8) hours to attract houseflies to naturally lay those eggs (oviposition). The substrates were then covered with the lid screened with net and also with black polythene sheet to provide darkness. The suitability of developed culture units and the effects of type of substrate of culture and length of culture on wet yield of maggots were assessed.*

There was significant difference in wet yield between the substrates, the values being 58.5, 38.5, 12.47, and 61.3 g/kg for fresh poultry dropping, pig manure, kitchen waste, and poultry offal, respectively. Further studies to enable commercial availability of maggot meal with subsequently extensive use in fish nutrition by small scale farmers are recommended.

Key words: *Housefly maggot, substrates, length of culture, sustainability, wet yield*

Introduction

Aquaculture has contributed significantly to food security, employment, income generation, and foreign exchange in many countries (Ayoola, 2010). Fish is one of the major sources of cheap protein consumed by Nigeria because of its high nutritional value and rich amino acids, vitamins and minerals (Agbam, 2006). Therefore, for increase intensification, feeding is important. Natural and artificial feed are important in aquaculture to promote body building and high yield of fish particularly under intensive culture. Also, the provision of supplementary feed in production will improve the yield (Falaye, 2008).

Fish consume more protein than terrestrial animals such as poultry and other livestock therefore adequate protein should be supplied into their diet. Fishmeal is an essential feed ingredient in fish diet due to its superior protein availability, its high price in the world market have necessitated the need for alternative replacement from both plant and animal sources (Ogunji & Wirth 2001; Medale and Kaushik, 2009). Heavy reliance on fishmeal as protein source in fish feed is not sustainable. The use of insects as animal feed is increasingly promoted as a replacement for other less sustainable animal protein sources such as fishmeal (Henry *et al.*, 2015; Makkar *et al.*, 2014; Van Huis, 2013; Van Huis *et al.*, 2013).

Among insects, fly larvae are particularly promising because they can be produced cheaply and rapidly on organic waste material (Pastor *et al.*, 2015). The housefly, *Musca domestica* larvae is considered for waste management and as a replacement for fishmeal in fish diet (Roffeis *et al.*, 2015; Pieterse and Pretorius, 2014). The uses of insect larvae meal as a protein source have been widely reported for pigs, poultry and fish (Awoniyi *et al.*, 2004). This creates the research on the sustainable availability of the larvae as a potential protein source. The objectives of this study are to investigate the yield of (*Musca domestica* L) using different substrates and to assess the influence of length of culture on the yield (*Musca domestica* L).

Materials and Methods

The study was conducted at the Fish farm unit of the Department of Fisheries Technology, Oyo State College of Agriculture and Technology, Igbo-ora. The culture facility was plastic containers and wooden vats. A total of twelve plastic containers were placed in each compartments of the vat of dimension 50 by 30cm. Four fresh organic substrate (fresh poultry dropping, pig manure, kitchen waste, and poultry offal) were collected from the vicinity of the college and neighboring environment, and placed differently in an air tight container overnight to neutralize any fly eggs or larvae that could be present at the time of collection. A total of 2kg of each substrate were mixed with 0.10kg of fly attractant (blood and rotten egg) and placed randomly in triplicates in culture units. The culture units were opened and exposed for eight (8) hours to attract houseflies, after 8hours the substrates were then covered with mosquito net and polythene sheet to provide darkness. The substrates were wet daily with water to keep moist.

The cultured units were observed daily to assess and record the production of maggots. During harvesting the wooden vats were gently turned to the position of intensive sunlight. In an attempt to escape from traces of sunlight the maggots moved from the plastic containers to the base of the wooden vats where they were easily collected, washed, blanched with hot water and weighed. The collected data were statistically analyzed using SPSS version 20. The means were separated and tested for the significant difference using Analysis of Variance, ANOVA at $P < 0.05$.

Results and Discussion

The type of substrates used had significant effect on yield of maggots. Poultry offals (PO) gave the highest ($61.3 \pm 4.28 \text{g/kg}$) after 5 days of Oviposit, while the lowest wet yield was recorded in kitchen waste (KW) with 37.8g/kg after 5 days of oviposit. The length of culture significantly influenced wet yield of maggots. The yield increased with increase in days in all culture substrates. The highest was recorded in poultry offal ($154.2 \pm 3.16 \text{g/kg}$) while statistical analysis revealed that the yield from poultry droppings ($124.5 \pm 2.05 \text{g/kg}$) and kitchen waste ($120.7 \pm 2.44 \text{g/kg}$) after 8 days of oviposition were not significantly different ($P > 0.05$) while the yield from poultry droppings and pig manure were significantly different ($P < 0.05$)

Table 1: Maggot wet yield from different culture substrates

Substrate	PD	PM	Kitchen waste	PO
Wet yield	58.5 ± 3.14	38.5 ± 5.12	37.8 ± 3.52	61.3 ± 4.28

*Values in the same row with different superscript are significantly different ($p < 0.05$)

Keys: PD = Poultry Dropping, PM = Pig Manure, PO = Poultry Offal

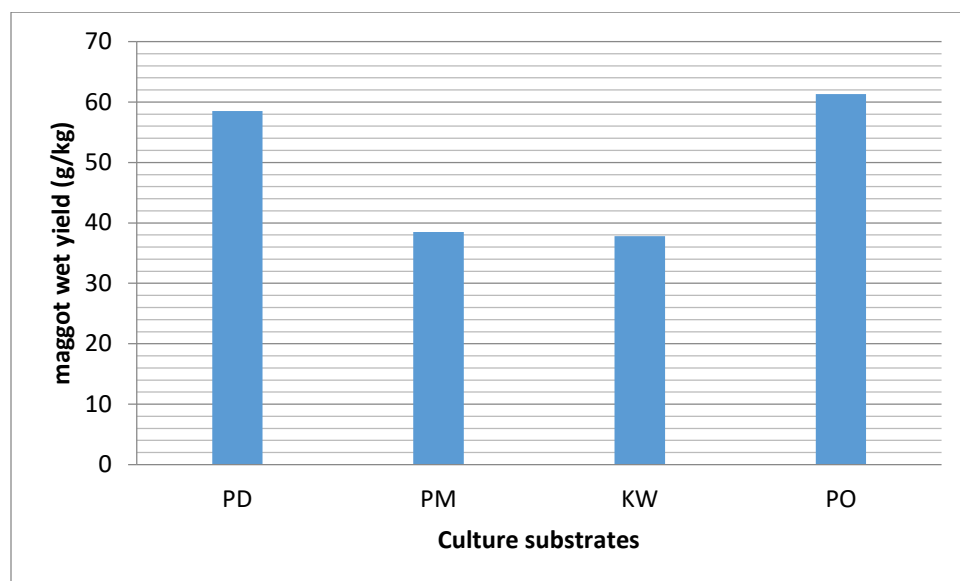


Figure 1: Maggot wet yield using different culture substrates

Table 2: Effect of length of culture on maggot wet yield

substrates	4 th day	6 th day	8 th day
PD(g/kg)	60.7±2.70 ^b	92.1±3.11 ^b	124.5±2.05 ^b
PM(g/kg)	28.5±1.48 ^d	53.7±2.12 ^d	81.4±1.32 ^c
KW(g/kg)	37.8±3.17 ^c	61.3±1.87 ^c	120.7±2.44 ^b
PO(g/kg)	72.1±2.02 ^a	101.4±2.11 ^a	154.2±3.16 ^a

*Values in the same column with different superscript are significantly different(P<0.05)

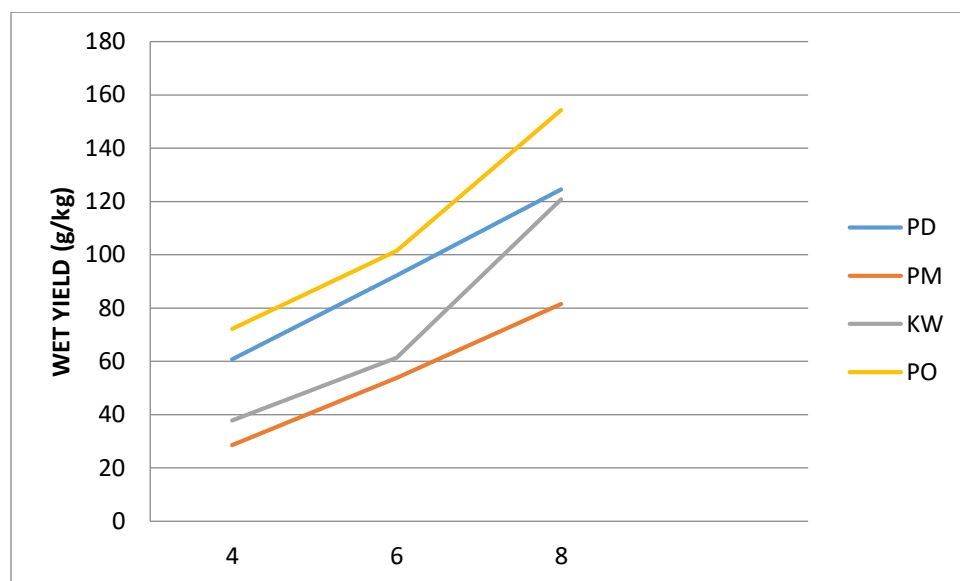


Figure 2: Effect of length of culture on maggot yield from different substrates

The wet weight obtained from this study is similar to that of Hezron *et al.*, (2019) who recorded highest production of 128g/kg using different organic substrates. The significantly high yield of maggots using poultry offal could be attributed to nutritional quality of the substrate (Newton *et al.*, 2014) which support the survival and growth of the larvae. Culture media of animal origin passes marked by higher nutrient content in terms of protein, minerals and vitamin which can be easily be assimilated by larvae (Newton *et al.*, 2014), this support the result obtained from this study. However, increasing maggot wet weight obtained from increasing length is similar to the substantial increase in larval on decaying organic matter observed by Hussein *et al.* (2017), which may express biomass over time (Lock *et al.*, 2015).

Conclusion and Recommendation

Maggots are one of the sources of animal protein of high nutritional value that can be well incorporated into the diet of fish. The development of maggot production techniques is one of the solutions to many problems that limit farmer to the use of maggots. The study showed that poultry offal is good substrate for supporting high wet yield of housefly larva and extending the length of harvest is also desirable for large volume of housefly maggot.

It is therefore recommended that further studies be conducted to enable commercial production and availability of housefly maggot meal in order to widen its use in efforts to improve nutritive value of fish diets. This will also assist in reducing the exorbitant cost of production due to high cost of protein source feed.

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