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Proximate and Mineral Analysis of Coconutrhinoceros Beetle (*Oryctesrhinoceros* Linnaeus 1758) Larva Meal

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Abstract**—** *Insects are an important resource in an ecosystem needed for crop pollination, nutrient recycling, natural selection and nutrition for other animals. Edible insects such as coconut Rhinoceros Beetle can be utilized as a feed resource. Its larva consumes decomposing organic matter and can be converted into meal form for ease of handling, prolonging shelf-life and elimination of harmful microorganisms.*

This study aimed to determine the proximate and mineral analysis of coconut Rhinoceros Beetle larva meal. Results revealed that coconut Rhinoceros Beetle larvae are very efficient in converting low nutrient coconut fiber into a nutrient-dense larva meal. Its rate of recovery from fresh larva to meal form is 50%. Coconut RBLM could be incorporated in swine and poultry rations with developmental stage/s that needed low protein and high calcium and phosphorus mineral requirements.

It is recommended, however, that future studies involving coconut Rhinoceros Beetle larva should include emptying and cleaning of its gut before processing into meal form.

Keywords**— *proximate analysis, Coconut Rhinoceros Beetle Larva Meal.***

I. INTRODUCTION

Insects are an important resource in an ecosystem. Insects are vital in the pollination of most crops, nutrient recycling, natural selection, nutrition for other animals, etc. Insects are a natural source of food of other insects, birds, reptiles and some mammals. The study attempted to explore the nutritional value of an insect species.

Edible insects in their fresh form are a complete food. They contain water, protein, carbohydrates, fats, vitamins, minerals and fiber. Converting them into a meal form results in the absence of water but is still packed with life-sustaining nutrients. However, transforming insects into a meal has some practical and favourable applications such as the elimination of harmful microorganisms that can be vectored by these insects, prolonging its shelf life, ease in handling and packaging, etc.

An insect species that is abundant but neglected in coconut-producing areas is the Coconut Rhinoceros Beetle. This insect species is under the order Coleoptera and family Scarabaeidae. Contrasting portrayalscan be said of the adult and immature stages of coconut Rhinoceros Beetle. Adults have a hand in destroying standing coconut palms by burrowing into the crown to feed on its sap. Resulting burrows will resultto damaged unopened leaves and can attract other beetle species and harmful microorganisms that are destructive to palms (Catley, 1969; Barlow and Chew, 1970; Young, 1975; and Giblin-Davis, 2001). Its larvae, however, feed only on rotting or decomposing organic matter (Bedford, 1980; Giblin-Davis, 2001; Muniappan, 2002) and are beneficial in nutrient recycling. In times of along rainy season, drought or scarcity of food, rodents consume theselarvae for sustenance or nutrient supplementation. This study aimed to determine the proximate and mineral analysis of coconut Rhinoceros Beetle larva meal.

Knowledge of proximate and mineral analysis of coconut Rhinoceros Beetle larva meal (RBLM) will advance its use on food and feed. It could then be used either as a sole or a supplemental nutrient source for certain domestic farm animals.

II. MATERIALS AND METHODS

A. Meal Preparation

Live coconut Rhinoceros Beetle larvae were gathered from decaying/decomposing coconut trunks in coastal communities in Barangay Poblacion, Bislig City, Surigaodel Sur. Gathered larvae were placed in a container having substrates of decaying coconut fiber where larva were found and fattenedfor a week. 3rd instar larvae from the container were collected, washed, rinsed, and weighed. A kilogram of these larvae were 'pan-fried' and cut into pieces.

The rate of recovery regarding percentage (%) was computed using the formula:

$$\text{RR} = \frac{Weight\ of\ Rhino\ Beetle\ Larva\ Meal}{Fresh\ Weight\ of\ Rhino\ Beetle\ Larvae} X100$$

Samples of decaying coconut fiber where larvae were found and coconut Rhinoceros Beetle larva meal were freeze-dried for chemical analysis.

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B. Chemical Analysis

Freeze-dried samples of coconut fiber and coconut Rhinoceros Beetle larva meal were submitted to F.A.S.T. Laboratories in Cagayan de Oro City for chemical analysis.

Proximate analysis was done using Standard AOAC Method (AOAC, 2012). Calcium and Phosphorus were analyzed using Atomic Absorption Spectrophotometer and Colorimetric Method, respectively.

III. RESULTS AND DISCUSSION

Results revealed that rate of recovery of coconut Rhinoceros Beetle larvae was 50%. A kilogram of fresh larvae yielded half a kilogram (0.5 Kg) of larva meal.

Coconut fiber and coconut RBLM samples had high moisture contents of 79.4 and 76.6%, respectively, as shown in Table 1. Water crystals during freeze-drying possibly contributed to its high moisture contents.

Coconut Rhinoceros Beetle larva is very efficient in converting low nutrient coconut fiber into a nutrient-dense meal.

Table.1: Proximate and mineral analysis of coconut fiber and coconut RBLM samples

Parameters	Coconut Fiber	RBLM
1. Moisture, g/100g	79.40	76.60
2. Ash, g/100g	0.94	2.26
3. Crude Fat, g/100g	0.08	2.20
4. Crude Protein, g/100g	2.74	13.70
5. Crude Fiber, g/100g	6.81	4.50
6. Calcium, mg/100 g	42.20	76.00
7. Phosphorus, mg/100 g	17.20	57.30

*F.A.S.T. Laboratories, Cagayan de Oro City

Coconut Rhinoceros Beetle larvae efficiently converted the coconut fibers into body mass such as the ash content by 240% from 0.94 g into 2.26 g, 2,750% or 27.5x increase in fat content, 5x or 500% increase in protein content,180% increase in calcium and 3.33x or 333% increase in phosphorus content. Moreover, crude fiber was decreased by 66% from 6.81% in coconut fiber to 4.5% in coconut RBLM.

The efficiency of the larvae from converting low nutrient substrates into nutrient-rich body mass is by the findings of Taylor (1979). Efficiency in converting fibrous organic matter is due to the larva's presence of cellulytic and hemicellulolytic bacteria in its gut (Sari et al., 2016). These bacteria can digest cellulose and hemicellulose and hydrolyze them into fermentable sugars as an energy source (Shi et al., 2011).

Cellulolytic and hemicellulolytic bacteria can be found in phytophagous or herbivorous insects (Anand et al., 2010; Zhou et al., 2008; Geib et al., 2010; Ferreira et al., 2001; Cazemier et al., 2003). These insects degrade and digest plant biomass with the aid of these microorganisms in their gut.

However, in this study, coconut RBLM had low crude protein (CP) content (13.7%) compared to that of findings of Egba et al. (2014) having 33.97%, Xiaoming et al. (2010) with 23-66%, and Oluwu et al. (2012) having 48%. Low CP content of coconut RBLM was realized possibly due to processing. Preparation and processing methods applied influence nutritional composition of edible insects (FAO, 2013). In this study, processing of Rhinoceros Beetle larvae into meal form involved only in the killing and pan-frying of the larvae without emptying and cleaning its gut before pan-frying. The undigested fiber in its gut possibly contributed to low CP content of RBLM.

With regards to protein, calcium and phosphorus contents, coconut RBLM in this study could be incorporated into poultry and swine rations, as shown in Table 2. It could safely be included in rations of animals having low protein and high Ca and P requirements such as in swine (growers - ≥50Kgs, gestating and lactating sows and breeder boars) and in poultry (grower, breeder and layer turkeys, breeder ducks, grower and layer chickens, meat-type breeder chickens, breeder ducks and grower - ≥6 wk old and layer quails).

Table.2: Nutrient requirements of swine and selected poultry species

Nutrient	Nutrient Requirements											
	Swine				Poultry*							
					Turkey			Duck	Quail**	Chicken		
	Growers (≥50Kgs)	Gestating	Lactating	Breeder Boars	Growers (20-30 wks)	Breeders	Laying Hens	Breeders	≥ 6 wks	6 wks to 1st egg	Laying	Meat-type breeders
Protein	13.20-15.50	12.0-12.9	16.3-19.2	13.0	14.00	12.00	14.00	15.00	19.00	15.0-17.0	12.5-18.8	12.0-15.0
Calcium	12.28-13.84	13.9	39.4	15.0	0.55	0.50	2.25	2.75	3.00	0.8-2.0	2.7-4.06	0.90

Phosphorus	4.89-4.61	11.1	31.5	12.0	0.28	0.25	0.35	-	0.45	0.3-0.35	0.21-0.31	0.45

Source: National Research Council (1998)
*National Research Council (1994)
**FAO (2013)

IV. CONCLUSION AND RECOMMENDATION

In this study, coconut Rhinoceros Beetle larvaeare very efficient in converting low nutrient coconut fiber into a nutrient-dense larva meal. Its rate of recovery from fresh larvae to meal form is 50%. Coconut RBLM having low protein and high calcium and phosphorus contents could be incorporated in swine and poultry rations with developmental stage/s that needed low protein and high mineral requirements such as calcium and phosphorus.

It is recommended, however, that future studies involving coconut Rhinoceros Beetle larva should include emptying and cleaning of its gut before processing into meal form.

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