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EFFECT OF RHINOCEROS BEETLE (*ORYCTES RHINOCEROS* L.) LARVA MEAL ON PRODUCTION PERFORMANCE OF LAYING QUAILS (*COTURNIX COTURNIX JAPONICA*)

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Abstract

A three-month study was conducted at Surigao del Sur State University – Tagbina Campus, Poblacion, Tagbina, Surigao del Sur to evaluate the production performance of laying quails fed with commercial ration added with Rhinoceros Beetle larva meal. A total of 150 fifteen-week old laying Japanese Quails were randomly distributed into five treatments (T_1 - 100% commercial feeds + 0% RBLM, T_2 - 99% commercial feeds + 1% RBLM, T_3 - 98% commercial feeds + 2% RBLM, T_4 - 97% commercial feeds + 3% RBLM and T_5 - 96% commercial feeds + 4% RBLM) with three replications following the Completely Randomized Design (CRD). Each replication was composed of 10 quails. The analysis of variance (ANOVA) in Completely Randomized Design (CRD) was used in analyzing all pertinent data. Significant differences between treatment means were compared using Tukey's Honest Significant Difference (HSD) Test. Results revealed that 1 to 4% RBLM inclusion rates in ration have no significant effect on total and average feed consumption, percentage and total egg production, average egg weight, and feed conversion efficiency (Kg feed to Kg egg and feed to 1 egg) but significantly depressed final bodyweights of laying quails. Moreover, a further study with >4% RBLM inclusion rates in the ration is recommended.

Keywords: *Oryctes rhinoceros*, Coconut Rhinoceros Beetle larva, laying quails.

1.0 INTRODUCTION

Poultry production entails the raising of poultry species for meat and egg production. Poultry is the primary source of meat and eggs in developing countries (FAO, 2008). Chickens are the major species of poultry for meat and eggs. Alternative poultry species are to be considered to reduce pressure on chicken production.

An alternative poultry species is quail. Quail is a poultry species that are smaller in size but matures much earlier compared to chickens. Quails are grown for their meat and eggs. Quails lay bigger eggs relative to bodyweight compared with other poultry species. Nonetheless, a restrictive factor in quail production is feed.

Feed approximately accounts for three-fourths of the cost in poultry production. Prohibitive costs of conventional feedstuffs stem the need to finding other feed sources. Alternative sources should contain quality nutrients such as protein and minerals. High-quality nutrients in feed consumed by poultry could lead to high-quality meat and eggs that help minimize problems of nutrient malnutrition, especially in developing countries.

Insects could offer as an alternative source. Among the most promising insect species intended for feed production are flies, silkworms, and mealworms (van Huis *et al*., 2015). However, other insect species could be suited as feed, such as the beetles (Coleoptera). Beetles currently are raised for ornamental purposes. Ramos-Elorduy *et al.* (2009) mentioned 78 edible beetle

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species fit for human consumption and as feed. A beetle species that is worth mentioning for feed production and found mainly in coconut-producing areas is the Coconut Rhinoceros Beetle (*Oryctes rhinoceros* L.).

Oryctes rhinoceros is an insect pest species distributed throughout the tropical regions of the world. Adults cause damage to wild and plantation palms such as that of Coconut and Oil Palm. Adults eat the foliage and burrow into crowns restraining plant development. Larvae recycle nutrients by feeding on decomposing organic matter. There are several studies done on *O. rhinoceros* on potential as animal feed (Rumpold and Schluter, 2013; van Huis, 2013; Adil *et al*., 2014; Amarachi *et al*., 2014; Finke, 2015; Kelemu *et al*., 2015; Doloriel, 2018) but scarce or none as a feedstuff for production performance in laying quails, thus this study.

2.0 MATERIALS AND METHODS

Time and Place of the Study

The study was conducted from June to August 2019 at the Surigao del Sur State University – Tagbina Campus, Poblacion, Tagbina, Surigao del Sur. Temperature and humidity in the poultry house averaged 29.24 ºC and 76.9%, respectively, for the three-month study.

Meal Preparation

Live Rhinoceros Beetle larvae (L_3) were collected from decaying trunks of palm families in Tagbina, Barobo, and Bislig City, Surigao del Sur. Gathered larvae were placed in containers with decaying coconut fiber as substrates and stored and fattened for two weeks. Larvae that were covered in body fat (yellow colored) were collected, washed with running water, and rinsed. These larvae were then immersed in hot water to instantly kill them, gut emptied, pan-fried for eight minutes, and cut into smaller pieces. Table 1 shows the proximate and mineral analysis of RBLM.

Table 1: Proximate and mineral analysis of RBLM

PARAMETER	PROXIMATE ANALYSIS[1]
Dry Matter, %	37.70
Crude Protein, %	1.42
Crude Fiber, %	20.70
Crude Fat, %	6.50
Moisture, %	7.71
Ash, %	200.00
Calcium, mg/Kg	250.00
Phosphorus, mg/Kg	51.10
Iron, mg/Kg	37.70

[1]First Analytical Services and Technical Cooperative (FAST) Laboratories (2019)

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Experimental Animals and Design

A total of 150 fifteen-week old laying Japanese Quails were used in the study. These were randomly distributed into five treatments with three replications following the Completely Randomized Design (CRD). Each replication was composed of 10 quails.

Feeding and Experimental Treatments

No light restriction was observed, and water was offered *ad libitum*. *Ad libitum* quail layer mash was given to the quails for six weeks for adaptability. After the adaptation period, different levels of RBLM were added to commercial layer mash. The following were the experimental rations of the quails:

T1 = 100% commercial feeds + 0% RBLM

T2 = 99% commercial feeds + 1% RBLM

T3 = 98% commercial feeds + 2% RBLM

T4 = 97% commercial feeds + 3% RBLM

T5 = 96% commercial feeds + 4% RBLM

Table 2 shows the composition and calculated analysis of the experimental layer mash. The amount of feed given and left-over feed were weighed and recorded daily.

Table 2: Composition and calculated analysis of the experimental quail layer mash

INGREDIENT	TREATMENT				
	1[a]	2	3	4	5
Quail Layer Mash, %	100.00	99.00	98.00	97.00	96.00
RBLM, %	0.00	1.00	2.00	3.00	4.00
Total, %	100.00	100.00	100.00	100.00	100.00
Calculated Analysis:					
Crude Protein, %	17.20	17.24	17.27	17.31	17.34
Crude Fat, %	7.98	7.98	7.97	7.97	7.97
Crude Fiber, %	4.06	4.08	4.11	4.13	4.16
Calcium, %	3.66	3.62	3.59	3.55	3.51
Phosphorus, %	0.65	0.65	0.64	0.64	0.63
Iron, mg/Kg	120.00	119.31	118.62	117.93	117.24

[a]First Analytical Services and Technical Cooperative (FAST) Laboratories (2019)

Parameters and Statistical Analysis

The parameters of production performance measured in this study were initial and final bodyweights, total and average feed consumption, percentage and total egg production, average egg weight and feed conversion efficiency (Kg feed to Kg egg and feed to 1 egg).

The analysis of variance (ANOVA) in Completely Randomized Design (CRD) was used in analyzing all pertinent data. Significant differences between treatment means were compared using Tukey's Honest Significant Difference (HSD) Test.

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3.0 RESULTS AND DISCUSSION

Results revealed that 1 t 4% RBLM inclusion rates have no significant effect on total and average feed consumption, percentage and total egg production, average egg weight, and feed conversion efficiency (Kg feed to Kg egg and feed to 1 egg) of laying quails. Nevertheless, significant differences (P<.01) were observed among treatment means on final bodyweights of laying quails, as shown in Table 3.

Highly significant differences were observed among treatment means. Quails fed without RBLM addition obtained heaviest final weights (171.41 grams). RBLM supplementation tends to decrease the final weights of laying quails. 2% and 4% RBLM supplementation to commercial layer mash produced quails having no statistical difference in weights compared to the control. 1% and 3% RBLM supplementation produced statistically ($HSD_{.05}$) lighter laying quails compared to the control group but were not significantly different compared with 2% and 4% RBLM supplementation.

Higher final bodyweights of quails in the control group compared to other treatments could be due to higher accumulation of body fat. Laying quails given 1 to 4% RBLM ration inclusion more efficiently metabolized their body fat into other life processes.

Table 3: Production performance of laying quails fed commercial ration added with Rhinoceros Beetle larva meal

Treatment	Initial BW^{ns} (g)	Final BW** (g)	Total FC^{ns} (g)	Ave. FC^{ns} (g)	% Egg Prod'n^{ns} (%)	Total Egg Prod'n^{ns} (pcs)	Egg Weight^{ns} (g)	FCE (Kg Feed to Kg Egg)^{ns}	FCE (Feed to 1 Egg)^{ns}
1 – 100% commercial layer mash	160.33	171.41^{a}	20,502.67	25.37	94.05	783.00	11.19	2.34	26.26
2 – 99% CLM + 1% RBLM	156.93	159.12^{b}	22,124.33	26.72	89.94	761.33	10.77	2.70	29.05
3 – 98% CLM + 2% RBLM	158.33	163.53^{ab}	22,396.67	26.66	94.52	794.00	10.90	2.60	28.26
4 – 97% CLM + 3% RBLM	156.73	159.53^{b}	23,129.33	27.53	96.15	807.67	10.87	2.64	28.63
5 – 96% CLM + 4% RBLM	161.70	164.80^{ab}	22,735.00	27.07	92.62	778.00	10.79	2.71	29.23
CV (%)	2.30	1.81	1.81	4.47	3.96	4.22	2.61	6.52	5.59

The efficient metabolism of fat could be due to the crude fiber in RBLM. It is not the amount of fiber present in RBLM inclusion in ration as this resulted in only small variations in its calculated analysis (Table 2) but the form of fiber present in RBLM. RBLM's fiber is chitin, an insoluble fiber derived from an insect's exoskeleton (FAO, 2014). Approximately 20% of chitin can be digested in the gastrointestinal tract of broilers (Khempaka *et al*., 2006). Han *et al*. (1997) mentioned that chitinase is secreted in the proventriculus and gizzard of birds. Khempaka *et al*. (2011) stated that in the neutral pH of the small intestine (mainly the ceca),

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microbes release enzymes to hydrolyze ingested chitin. Enzymatic hydrolysis of chitin produces chitosan. Razdan *et al*. (1997) stated that chitosan reduces the concentration of bile acid in the small intestine and the total plasma cholesterol concentration in broiler chickens. They added that chitosan also had hypolipidemic potencies. Arslan and Tufan (2018) reported that chitosan oligosaccharides supplementation decreased abdominal fat in broilers. Chitosan binds to lipids in the gastrointestinal tract, thereby decreasing their absorption that results to depressed body weight (Shields *et al*., 2003).

4.0 CONCLUSION AND RECOMMENDATION

One to 4% RBLM inclusion rates in ration have no significant effect on total and average feed consumption, percentage and total egg production, average egg weight, and feed conversion efficiency (Kg feed to Kg egg and feed to 1 egg) but significantly depressed final bodyweights of laying quails. Moreover, a further study with >4% RBLM inclusion rates in the ration is recommended.

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