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Breeding of Adult Quail, *Coturnix coturnix japonica*, Temminck and Schlegel, 1842 in Captivity, Mingalardon Township, Yangon Region

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Abstract

The present research was carried out in the quail farm of Ballonkwin quarter which is situated in Htaukkyant, Mingalardon Township, 33.8 km away from Yangon. The breeding and production of Japanese quail, *Coturnix coturnix japonica* Temminck and Schlegel, 1842 in captive condition was studied in the quail farm during June 2005 to September 2008. Quail belong to the family Phasianidae which is by far the largest and most varied of the gallinaceous birds. The external morphology of adult male and female was studied and found that the sexes differ slightly in coloration.

The cage system is used for laying quail. Quail eggs were characterized by a variety of colour patterns. They ranged from snow white to completely brown. Mean weight was 10 g and approximately 200-300 eggs were laid per year per quail. During breeding, relative optimum humidity (55- 65%) and temperature (28˚C - 37˚C) were needed. The growth and development patterns of quail were also recorded. About age and sex of quail forms, weekly weight gain of adult quail, growth and feed conversion were also detected. The nutritional contents of quail egg and meat were also investigated. Quail meat contains energy, water, protein, fat, carbohydrate, ash and vitamins, and of panthothenic acid as well as minerals and fatty acid.

The fecal analysis was conducted by energy dispersive X-ray fluorescence (EDXRF) method in Universities' Research Centre and experiment on mustard plants as fertilizer was also undertaken. The present work indicated that the faeces of quail can be utilized as fertilizer.

Key words : Nutritional contents, faecal analysis, fertilizer

Introduction

Quail are the largest and most varied of the gallinaceous birds. Quail has been familiar with human since ancient times. They are beautiful birds and their behavior is very interesting. The *Coturnix* species is considered to be the most common type breed in captivity worldwide. For commercial egg production, the *Coturnix coturnix japonica* or Japanese quail is widely used. The Japanese quail is the only species of quail farming because of its small size, short incubation period and relative ease of handling. They are robust, disease resistant and easy to keep. They belong to the family Phasianidae of order Galliformes which includes 7 families and 259 species. The family Phasianidae contains more than 12 subspecies (Shanaway, 1994).

The Japanese quail have created a big impact in recent years and many quail farms have been established throughout the country both for egg and meat production. It is of great importance to select the quality quail due to increasing consumer awareness for quality meat. More people raise quail hens for pleasure and profit. They were raised to provide eggs and “pin money” for the family (Florea, 1944).

The most successful large poultry farms today have grown from a small flock. Quail production has been increasing and increasing and has become popular in Myanmar. Having small body sizes, quail attain early sexual maturity and thus farming cost is low. It needs small space and relatively small amount of feed. They can produce a considerable number of eggs within a relatively short period (Shanaway, 1994).

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The present research aims not only to study breeding in captivity but also to provide information on the egg production in quail farming. The objectives of the present study are to categorize the morphological and behavioural patterns, to analyze the effect of cage space in relation to optimum temperature and humidity, to determine the growth rate, survival rate, mortality rate, food conversion ratio, and to assess the economic importance of quail products.

Materials and Method

Study site and study period

The present research was conducted at a quail farm located in Mingalardon Township, Yangon Region. The farm's total area is approximately 223 square meters (Figure 1 and 2A).

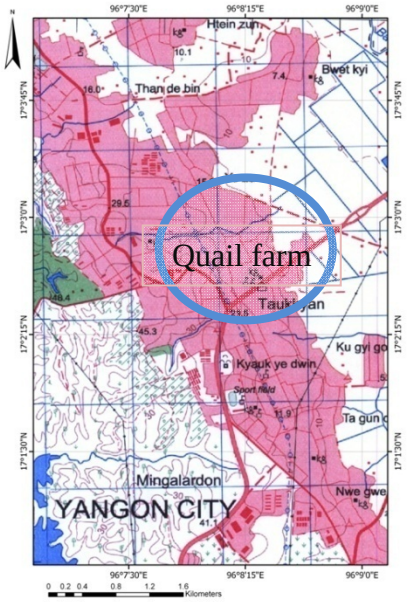


Figure 1. Map of study area
(Source: Yangon city map)

Figure 2 (A) External view of quail house

Figure 2 (B) Inside of quail house

Identification, sex determination and methods of determination on population sizes

Different sexes of quail were studied following Baker (1928), Shim (1985), Shanaway (1994) and Smythies (2001).

To assess the suitable space for housing quail, two trials were conducted in the Mingalardon quail farm. In each cage, two different population sizes (120 and 100 birds per square centimeter) were bred and the data were recorded.

Cage and feeding system for laying quail

Single or multistage systems were used for egg production. Twenty eight days to 1 year old chicks were reared in cages or pens which were arranged in three rows. The quail house was 30.45 m of length and 6.09 m in width. Thirty two cages were placed in one row (Figure 2B). The feed and water were provided for the whole day. Birds were provided with adequate fresh clean water and replenished twice a day (early morning and afternoon). Feed includes basic diet and supplementary food.

Temperature and humidity, and egg production

Daily temperature and humidity were recorded. Where the breeding place got excessive sunshine, the roof and walls were well insulated to reflect radiation energy. Shade was provided around the houses by evergreen trees.

Egg weight, physical characteristics of eggs, egg production and survival rates were recorded.

Meat, egg and faecal analysis

Chemical composition of quail meat and egg were analyzed at the laboratory of Department of Medical Research Centre (DMR), Lower Myanmar. Contents of the feces of quail chicks and adults fed with different diets were analyzed by energy dispersive X-ray fluorescence (EDXRF**)** method at Universities' Research Centre (URC).

Beneficial effect of faeces in plant production

Mustard (*Brassica* spp.) plants were sown in control plot, and experiment site I and II. These plots were 91.37 cm in length and 60.91 cm in width. In control plot, quail faeces were not provided whereas 2lbs of faeces was given at plot I and 4lbs at plot II. Plants were watered twice a day; in the morning and in the evening. The growth rates and yields of the plants from the experimental plots and control plot were examined.

Results

Adult male and female characters

Adult females are slightly heavier than males, weighing from 110 to 150 grams and also generally larger than the males. The body coloration of the female bird is the cinnamon or rusty brown coloured similar to the male except that the feather on the throat and upper breast are long, pointed and has much lighter cinnamon. The yellowish brown breast feathers are also characteristically black stippled or flecking (Ba-yet-quet). Mature age is about 35 to 42 days. The distinctive character of male quail is a point protuberance with a deep furrow (or fissure) at its dorsal side (Figure 3).

(A) Female (B) Male

Figure 3. Quail, *Coturnix coturnix japonica*

Breeding and caring of adult quail

Quail reached sexual maturation more quickly than any other domesticated birds. Females were heavier than males, and the weight difference increased with age. Large, medium and small sizes of male and female quails were recorded. The female laid her first egg from as early as five to six weeks of age. However, peak production was not reached until three to five weeks later (Table 1).

Table 1. Body weight in relation to sex and age in quail

Size Range (g)	Sex	Weight(g) / Age (weeks)			
		Within one week (g)	2 weeks	4 weeks	6 weeks
7.9 to 187.5 (Large)	Male	7.9	58.2	142	187.5
8 to 208.7 (Large)	Female	8	62.2	150	208.7
5.9 to 92.5 (Medium)	Male	5.9	37	79	92.5
6 to 102 (Medium)	Female	6	38.5	81	102
4.4 to 50.9 (Small, below 5g)	Male	4.4	22.6	41.1	50.9
4.5 to 55.8 (Small)	Female	4.5	23.6	44.9	55.8

The results of two different population sizes (120 and 100 birds per square centimeter) bred in each cage showed that stocking density (space allowance per bird) in cages affected the growth rate of quail. A delay in sexual maturity was the result of an increase in stocking density of the birds. Overcrowding caused reduction of movement, and also feeding and drinking spaces which in turn lead to reduce body growth (Table 2 and Figure 4).

Table 2. Weekly weight gain of adult laying quail

Age (week)	Weight (g) for 100bird /cm^2	Weight (g) for 120bird /cm^2
(28 days) 4 week	81	73
5 week	96	87
6 week	102	95
7 week	107	98
8 week	115	105
9 week	121	110
10 week	122	113
11 week	123	115
12 week	125	118

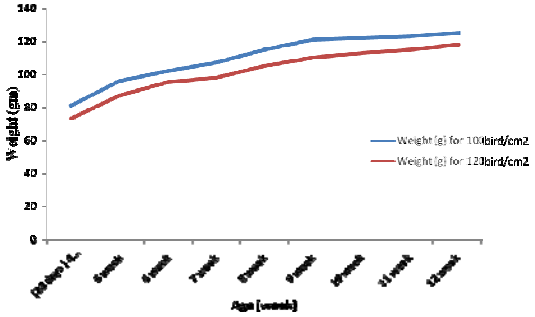


Figure 4. Weekly weight gain of laying quail

After the first two weeks of brooding period, it was found that increasing the space allowance in cage from (100 cm^2) to (400 cm^2) per bird profoundly increased feed consumption and reduced the quail's efficiency of feed conversion by 23 percent in male and by 7 percent in females. Feed intake was mainly associated with degree of competition for feed (Table 3).

Table 3. Influence of stocking density on growth and feed efficiency in Japanese quail

Space allowance per bird	Age (week)	Weight gain (g)		Feed intake (g)		Feed Conversion Ratio (FCR) (Feed intake/ Weight gain) and (%)	
		Male	Female	Male	Female	Male	Female
100 cm^2	2-6	65.5	72.5	378	406	5.7 (23%)	5.6 (7%)
400 cm^2	2-6	53.2	70.7	397	425	7.4	6.0

FCR = Feed Conversion Ratio

Calculation of FCR (%) = Feed intake / Weight gain

Influence of light and temperature on laying quail

Artificial light was used to induce egg laying. The abilities of the female quail to lay eggs and the male to produce semen in response to the daily duration of light, whether natural or artificial, were observed. The cause results of different uses of a long and short lighting programme were showed in Table 4. Changes in the lighting period (a few hours of power failure) affected maturity and egg production. The highest level of egg production and the best feed efficiency were obtained when the temperature was within the thermo-neutral (comfort) zone of the birds, ranging within 18˚C to 30˚C.

Table 4. Influence of light on egg laying and egg weight

Light programme	Egg-laying age (days)	Rate of egg laying (%)	Egg weight (g)
Short day (8L : 16D)	70	81.7	10.4
Long day (16L : 8D)	55	88.6	10.5
Continuous (24L : 0D)	56	87.2	10.5

L = Light D = Dark

Egg production rate and physical characters

Female starts laying at the age of 42 days with very high laying intensity and reach to peak production by 10 to 12 weeks of age. The onset of laying quail is advanced if the females were stimulated by male vocalizations. Rate of egg production increased gradually from maturity and occurred approximately 85% in each flock. The relative weight of the shell increased sharply after the laying of the first egg, reaching a peak three to four weeks later, then gradually reduced to the end of laying.

The physical characteristics of the eggs change with the age of the hen and the thickness of the shell also reduces with age. In general terms, the egg had three major components: albumen, yolk and shell. The albumen was the greatest component of egg mass, followed by the yolk and, last, the shell (on average they represent 57.5 percent, 32.6 percent and 9.9 percent, respectively). The total egg weight was about ten grams. The relative weight of yolk and albumen changed with egg weight.

Most eggs are almost spheroid in shape with a variety of shell colour patterns, ranging from dark brown to blue to white, with white or buff with patches of brown, black or blue. Dark brown is the dominant colour and recessive stains are almost white shelled eggs. The shell of irregular quail eggs was in various types; soft shell, blue, white and brown with no speckles (Figure 5). Nutritional contents of quail egg result were showed in Table 5.

Meat analysis and economic importance

Sex appeared to have no effect on the variation in the composition of lean meat. The percentages of moisture content in muscles were low. The fat content and total ash differed between breast and thigh. It was observed that most selected studied quail had 69 % breast and 58% thigh muscles. Mortality rate was recorded to be 5 % of mean (3 - 7 %) per year (Table 6).

The breast and leg muscles of quail were considered as a delicacy. Fried quail and roasted quail were common forms of culinary preparation. Quail eggs were similar in taste to chicken eggs and could be used for banquets and other occasions; plain hard-cooked eggs or coloured eggs can be used for decorating salads. They were good appetizers and also consumed as snacks (Figure 6).

Faecal analysis and experiment as fertilizer

Quail chick and adult faeces were analyzed to test the chemical composition. Seven components were detected but Titanium (Ti) was not included in quail chick (Table 7). Then, faeces were tested as fertilizer in cultivation of mustard plants (Figure 5). The growth rate of plants in site II was better than site I and control plot (Table 8).

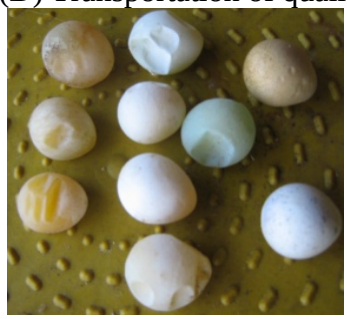
(A) Fried quail meat

(B) Collected quail eggs

(C) Hard boiled fresh quail eggs

(D) Transportation of quail

(E) Selling quail meat



(F) Irregular eggs

Figure 5. Eggs and meat

(A) Control plot

(B) Sample plot No. I

(C) Sample plot No. II

(D) (Outcome) of sample plot No. II

Figure 6. Experiment as fertilizer

Table 5. Nutritional contents (chemical, mineral and vitamins) of quail egg

Composition	Content of egg
Energy	158 kcal
Water	74.35 g
Protein	13.05 g
Fat	11.09 g
Carbohydrates	0.41g
Total ash	1.10 g
Vitamin B- 6	0.15 mg
Vitamin B- 12	1.58 mcg
Vitamin A,IU	543.00 IU
Vitamin A, RAE	156.00 mcg-RAE
Vitamin E (alpha-tocopherol)	1.08 mg
Vitamin K (phylloaquinone)	0.3 mcg
Phosphorus	226 mg
Iron	3.65 mg
Measure: 100 g Gram weight (edible portion): 100.00 g	(Egg) refuse – 8%

Table 6. Nutritional contents of meat

Composition	Raw Meat (without skin)	Raw Meat with skin
Energy (kcal)	134.00	192.00
Water (g)	70.03	69.65
Protein (g)	21.76	19.63
Fat (g)	4.53	12.05
Carbohydrates (g)	0.00	0.00
Total ash (g)	1.32	0.90
Vitamin C, total ascorbic acid (mg)	7.20	6.10
Vitamin B-6 (mg)	0.53	0.60
Vitamin B-12 (mcg)	0.47	0.43
Vitamin A, IU (mcg)	57.00	243.00
Vitamin A, RAE (mcg)	17.00	73.00
Phosphorus (mg)	307.00	275.00
Iron (mg)	4.51	3.97
Measure: 100 g (Meat) refuse – 24 %	Gram weight (edible portion): 100.00g (Meat and skin) refuse – 10 %	

Table 7. Faeces composition of chick and adult

Chemical Composition of feces	Content (%) of chick	Content (%) of adult
Calcium (Ca)	64.46	54.41
Iron (Fe)	15.30	27.15
Strontium (Sr)	3.88	4.12
Potassium (K)	11.95	3.79
Titanium (Ti)	-	2.40
Manganese (Mn)	2.20	1.89
Zinc (Zn)	2.23	1.25

Table 8. Faeces as fertilizer

Day (Week)	Mon Hnyin Plant or Mustard plant (*Brassica* spp.)	Control		Sample plot I		Sample plot II	
		Mean Length (cm)	Mean Width (cm)	Mean Length (cm)	Mean Width (cm)	Mean Length (cm)	Mean Width (cm)
1st week	Large leaf (Whole plant height)	19.5	7.5	22.5	8.5	22.0	11.0
	Middle leaf	16.0	6.5	19.5	7.0	21.0	10.5
	Small leaf	7.0	2.0	5.5	1.5	7.0	5.0
2nd week	Large leaf	24.5	12.5	27.5	12.5	37.0	13.0
	Middle leaf	20.0	9.5	23.0	10.5	33.0	11.5
	Small leaf	9.0	4.0	8.5	4.5	9.0	5.5
3rd week	Large leaf	30.0	15.0	45.0	16.0	51.0	16.5
	Middle leaf	23.5	11.0	29.0	12.0	38.0	14.0
	Small leaf	11.0	5.0	16.0	4.0	17.0	8.0

Discussion

Quail farming is becoming more popular and is being promoted in a number of Asian countries. In developing countries, quail farming offers a viable and practical solution to the problem of animal protein shortage (Shanaway, 1994).

Japanese quails are fit for high density rearing and fast growing hardy bird. Because of low volume, low weight, less feed and low space requirements and being easy to handle, quail farming can be started with much lower capital investment compared to chicken and duck with almost the same profit margin.

In breeding of quail, systematic management is important for production of meat, eggs and quail chick. According to the performance result of cage system of housing it is found that the more space, the better quail body growth and egg production. Fresh food and water was also important factors for quail; good feeding and care result in the quail to lay early and produce many more eggs.

The experiment has proved that light is more important than temperature in stimulating hens to lay. Uses of artificial light induce laying at any season of the year. Continuous lighting of long day light programme at laying time showed the improvement in laying rate.

Female quail can lay her first egg from as early as five to six weeks of age. Their laying prolificacy is very high, being able to produce 200 to 300 eggs per year. Onset of laying quail is advanced if the females can hear male's vocalization.

In terms of nutritional contents, quail meat and eggs have nutritional value like that of domestic chicken. Quail have rapid growth rate and high feed conversion ratios. Quail farming in the tropics is highly profitable. Quail eggs are widely accepted by Asian people and quail meat is treated as a delicacy among Asians.

Seven components: Calcium (Ca), Iron (Fe), Strontium (Sr), Potassium (K), Titanium (Ti), Manganese (Mn) and Znic (Zn) were detected in quail chick faeces but Titanium (Ti) was not included in the faeces of chick. It was found that quail faeces are good fertilizers for mustard plant and other cultivated plants. Thus, this research work revealed that the faeces of quail can also be used as fertilizer.

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