ESTIMATION OF GENETIC PARAMETER OF PRODUCTION TRAIT ON JAPANESE QUAIL (COTURNIX COTURNIX JAPONICUM) USING REPEATED MEASUREMENT

By:

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ABSTRACT

An experiment was conducted to estimate the genetic parameter for production trait of Japanese Quail (Coturnix coturnix japonica) for basic of Selection Program at Laboratory of Biometrical and Animal Breeding, Faculty of Animal Husbandry, Padjadjaran University, from September 2000 to May 2001.

Research used 786 young Javanese Quails, produced from 63 Sires and 126 Dams, with the age of 9 weeks, in ratio of mating 1:2.

The computer program of Multiple Trait Model (MTM) for repeated measurement was used to analyze data of fertile egg weight (FEW), 4 weeks of body weight (BW4). From first (M1) to fourth (M4) month eggs production and total eggs productions (TEP) and total egg weight (TEW). Variance components were estimated using animal model with REML (VCE 42, *Groneveld*, 1998).

The heritability value for FEW (0.67 ± 0.34) was high category, h^2 for BW4 (0.68± 0.25) was high category too, the h^2 for M1 to M4 were 0.3 ± 0.08; 0.47 ± 0.08; 0.54 ± 0.09; 0.56 ± 0.09. The genetic correlation among FEW and BW4 was 0.93 ± 0.23. The response of correlation is about 6.68 (*Falconer*, 1983)

The genetic correlation between M1 and TEP (0.49) was lower than genetic correlation between M2 and TEP (0.92).

The result shows that selection on egg weight possibly correlates with 4 weeks body weight. According to this research, selection of egg production could be carried out based on second month egg production.

Key Words: Quail, Heritability Value, Genetic Correlation, Animal Model of Repeated Measurement.

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INTRODUCTION

Japanese Quails belong to genus Tunix, family Phasianidae. First Japanese Quail (Strain Coturnix coturnix japonica) was imported to Indonesia in 1970. The origin country is Japan. It is widely bred as meat and eggs production.

Coturnix is relatively cheap to breed and they become good commodities in the smallholder farmer. Coturnix has also a short life cycle (generation interval).

The coturnix mature is about 6 weeks and the quail hen begin to lay about 50 days of age, they lay five or seven eggs per week or about 250 eggs during their life.

The adult quail feed about 20 grams per day and the egg weight is between 9 and 11 grams or about 8 percent of body weight of the quail hen. There is an opportunity to improve the feed conversion.

Since the animal arrived in Indonesia to date, they were crossed with another strain, for example with quail from Taiwan or Hong Kong origin. They may also be mated closely between related animal for inbreeding purpose. The genetic capacities of the inbreeding quail were not evaluated. Fertility and hatchability percentages decrease due to in breeding. The effect of in breeding stimulates the abnormality and reduces the productive and reproductive performances.

The productivity and reproduction are quantitative trait as expression of the combination between genetic factor and environment. For these reasons, it may be of advantage to record daily gain during growth and lay.

Based on the record of genetic parameter heritability (h^2), repeatability (r), variance can be evaluated *Anang*; et al (2001) published the use of monthly egg production record for genetic evaluation of laying hens.

Correlation between two characters can be used for do selection. Correlation between fertile egg weight and 4 weeks body weight was positively high (*Kuswahyuni*, 1983).

Genetic parameter can be estimated by using half sib correlation with nested experimental design, full sib and offspring-parent regression (*Falconer*, 1983). In year 2001 *Anang* et al have developed computer program for Cumulative Model (CM), Multiple Trait Model (MTM), Fixed Regression Model (FRM) and Random Regression Model (RRM) using statistical analysis animal model for REML to estimate genetic parameter. They needed the pedigree information without to design experiment before.

Correlation between two traits is of interest for three reasons. *Firstly*, in connection with genetic reason of correlation through the pleitropic action of gen. *Secondly*, in connection with the changes brought about by selection and *thirdly*, in connection with natural selection.

Correlation between two traits causes a correlated respond to selection. If selection is applied to, one trait, other trait changes. Correlation is not only between two traits, but it can be also between repeated measurements in the different period of production. The monthly egg production record can be used for genetic evaluation (*Anang* et al, 2001).

The objective of research is to study the genetic parameter of production trait on Japanese Quail (Coturnix coturnix japonica) using Multiple Trait Model (MTM).

MATERIALS AND METHODS

Research was used 786 young Japanese Quails, produce from 63 Sires and 126 Dams, with the age of 9 weeks in ratio of mating 1:2.

The computer programs of animal model for repeated measurement (Multiple Trait Model - MTM) were used to evaluate genetic parameter of fertile egg weight (FEW) and 4 weeks of weight (BW4). From first (M1) to fourth month eggs production (M4) and total eggs production (TEP). Variance components were estimated using animal model with REML (VCE 42, *Groneveld*, 1998).

The data were collected at the **Laboratory of Poultry Production, Faculty of Animal Husbandry, Padjadjaran University**, from September 2000 to May 2001. The structure of data is represented in Table 1.

Table 1. STRUCTURE OF DATA

NO.	CHARACTER		Average (0)	Sd	CV (%)
1.	Fertile egg weight	FEW	10.59	1.32	12.49
2.	Body weight of DOQ	BW0	6.89	1.21	12.05
3.	Four weeks body weight	BW4	76.70	10.74	14.00
4.	1^{st} month egg production	M1	21.50	7.77	36.17
5.	2^{nd} month egg production	M2	21.50	4.95	23.02
6.	3^{rd} month egg production	M3	23.00	1.41	6.14
7.	4^{th} month egg production	M4	20.50	0.70	10.60
8.	Total eggs production	TEP	86.50	10.14	12.26
9.	Total eggs weight:	TEW	947.72	51.01	9.31

Where: X = Average; Sd = Standard Error; CV = Coefficient of Variation

The data were evaluated by using *Multiple Trait Model* (MTM), with the following model:

$$\boxed{Yi_{jk} = P_{jk} + a_{jk} + e_{ijk}}$$

Where:
Y_{ijk} = *Record of hen in month k of hatch-cage i sire j*
P_{ik} = *Effect of hatch-cage i in month k*
a_{jk} = *Effect of sire j in month k*
e_{ijk} = *Residual effect*

RESULTS AND DISCUSSION

The estimates of heritabilities for the observed traits are presented in Table 2.

Table 2. Heritability Value (h^2) and Correlation Value (r)

NO.	CHARACTER		(h^2)	Sd
1.	Fertile egg weight	FEW	0.67	0.34
2.	Four weeks body weight	BW4	0.68	0.25
3.	1st month egg production	M1	0.30	0.08
4.	2nd month egg production	M2	0.48	0.88
5.	3rd month egg production	M3	0.55	0.09
6.	4th month egg production	M4	0.56	0.09
7.	Total egg production	TEP	0.21	0.10
8.	Total egg weight	TEW	0.26	0.12

The heritability estimates of those above traits were generally high. The BW4 has highest (0.68 ± 0.25) followed by FEW (0.67 ± 0.34). The ratio of additive genetic variance to phenotypic variance was 0.67. The FEW was influenced by maternal genetic capacity.

The heritability of total egg production (0.21 ± 0.10) was smaller than the estimate of monthly egg production. The estimation of heritability is difficult to obtain a good precision, in generally, the closer the relationship, the estimate is more precision (*Falconer*, 1983). The estimation of variance components with REML may result in good precision.

Multi Trait Model (MTM) can be used to estimate breeding value from various traits or in the same period of productions for monthly records (*Anang* et al, 2001). The changes of environmental condition and economic values can be considered in these genetic evaluation models. Heritability estimate changes referring to of translation of observed data. The heritabilities of M1, M2, M3, M4 and TEP have deferent (0.30 ± 0.08; 0.48 ± 0.88; 0.55 ± 0.09; 0.56 ± 0.09; 0.21 ± 0.10 and 0.26 ± 0.12). The M2 gave higher estimate than M1 and TEP, but these values were lower than those M3 and M4.

The estimates of Genetic correlation between the observed traits are given in Table 3.

Table 3.		FEW	BW4	M1	M2	M3	M4	TEP	TEW
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1	FEW	1	0.93	-	-	-	-	-	-
2	BW4	-	1	-	-	-	-	0.29	0.46
3	M1	-	-	1	0.31	0.31	0.05	0.49	-
4	M2	-	-	-	1	0.99	0.59	0.92	-
5	M3	-	-	-	-	1	0.67	0.95	-
6	M4	-	-	-	-	-	1	0.76	-
7	TEP	-	-	-	-	-	-	1	-
8	TEW	-	-	-	-	-	-	-	1

The FEW has a positive high genetic correlation with BW4 and TEW (0.93 ± 0.23). The selection for FEW possibly gives response to BW4. The response of correlation is about 6.68 (*Falconer*, 1983).

The M1 has positive correlations with to second, third, fourth and total eggs production (0.31 ± 0.16; 0.31 ± 0.16; 0.05 ± 0.16 and 0.49). This correlation value between first month egg production and total egg production (0.49) is respectably lower than the correlation between second month egg production and total egg production (0.92).

The genetic values resulting from second month egg production represents the total genetic value of total egg production. The Multiple Trait Model (MTM) can be used to estimate heritability of egg production from monthly production in the beginning and the end of laying period.

CONCLUSION

The result shows that selection on egg weight possibly correlated with advantage respond to BW4. According to this research, selection of egg production could be carried out based on M2.

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