

CORRELATED RESPONSE OF FITNESS TO SELECTION FOR 5-WEEK BODY WEIGHT IN  
JAPANESE QUAILS (COTURNIX COTURNIX JAPONICA) I. EARLY RESULTS<sup>1)</sup>

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SUMMARY

Correlated response of fitness to selection for 5-week body weight is studied in a mixed quail population. Three groups are selected at random from this population. Selection is applied for 5-week body weight in the group C, and for fitness, i.e. number of offspring surviving up to 5th week, in the group D. The third one(K) is used as control.

The data obtained in the initial generation showed that the selection for fitness in the group D resulted in rather high indirect selection differentials for its components, such as the number of hatching and fertilized eggs, and the number of offspring hatched while the 5-week body weight of the selected parents remained unchanged. In the selected parents of the group C, on the other hand, the traits other than the body weight itself kept their original values. A rather high genetic improvement in weight was observed in the first generation of the group C, the realized heritabilities being .62 in females and .38 in males.

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## INTRODUCTION

Relationship between artificial selection for an economic trait and natural selection for fitness is an important problem of population genetics. It is assumed that genetic homeostasis is an agent of natural selection responsible for the resistance of the population to the artificial selection pressure (Lerner, 1968). In some theoretical studies (Carmelli and Karlin, 1975; Karlin and Carmelli, 1975; Sved, 1977) equilibria conditions of genetic systems under the coexistence of natural and artificial selection were investigated. The effect of natural selection on an economic trait, i.e. the correlated response of the trait to the selection for fitness was also studied (Falconer, 1981; Robertson 1966).

The main interest of this study, on the contrary, is the correlated response of the fitness to the artificial selection. In other words, it is aimed to throw some light on the problem whether the individuals with moderate phenotypes have higher fitness than those with highest phenotypes. 5-week body weight is chosen as the economic trait for which artificial selection is applied. The other aim of the study is to find out whether the genes controlling the body weight in quails are neutral, and whether there exists a stable part of genetic correlation which may be attributed to the pleiotropic genes, a case which may be demonstrated by the increase in genetic correlation through the generations of selection.

The project will also enable us to compare some methods for estimating heritability and the components of genetic variance of each trait recorded, and those for the genetic correlations among them. Another feature of this work is that it will be possible to see which of the components of fitness will be affected more by natural selection.

In this paper only the initial populations are described and the

phenotypic correlations between the 5-week body weight and the fitness of the parents of the first generations are given in three groups described below because the experiment has been initiated only a short time ago.

#### MATERIAL AND METHODS

The quail stock used in the experiment is originally a mixed population of four different lines. Individuals from some new lines were also introduced occasionally. No selection had been applied and the matings had been performed at random for six years. Three groups were sampled from the stock, each consisting of 80 females and 40 males. One of the groups was assigned as the control(K), the other as selection group for body weight(C), and the third one as the selection group for fitness.

The initial groups were believed to be in Hardy Weinberg equilibrium. In the following generations a change in the genetic variances of the traits studied in the K group may be accepted as the indication of a linkage disequilibrium.

In the group C the birds having the highest 5-week body weight and in the group D the birds having the highest number of offspring surviving up to 5th week were selected as parents. In the group K no selection was applied. Selection intensity was planned to be 40 percent for females and 20 percent for males.

In addition to the body weight at 5 weeks of age and the number of surviving birds(fitness), the components of fitness like the number of hatching eggs, the number of fertilized eggs, and the number of birds hatched are also being recorded and evaluated.

## RESULTS AND DISCUSSION

The means and their standard errors of 5-week body weight, and the fitness including the number of hatching eggs, fertilized eggs, and offspring in all groups sampled from the population are given in table 1, and those of the selected parents in table 2. In group D, the parents selected according to the number of surviving offspring showed also important selection differentials for the components of fitness. They had an average number of offspring which was 74% higher than that of the original group (an increase from 6.9 to 12.0). They have also showed rather high indirect selection differentials for the other components of fitness (40% in hatching eggs, 62% in fertilized eggs). In the same group the indirect selection differential for 5-week body weight was trivial. In group C in which selection was applied for 5-week body weight, the indirect selection differentials in fitness and its components were not important, either, i.e. the averages of these traits in the C parents were not higher than those in K group.

Correlation coefficients between body weight of the female parents and the number of their surviving offspring were trivial in all the groups (-.05 in C, .10 in D, and -.06 in K).

In the group C, the statistics for the first generation have very recently been obtained. The average 5-week body weight is 133.1 gr. in 89 females and 123.1 gr. in 101 males. So the realized heritabilities for body weight in the first generation of selection were .62 in females and .38 in males. These results indicate a rather high genetic variation in this group. In the difference in heritability estimates for two sexes sex linkage and maternal effects may have some parts along with the chance. The trend of realized heritabilities in generations will, hopefully, give some information about this.

## REFERENCES

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Table:1- Means and Standard Errors of the Traits Studied in Initial Groups

group	n	5-week body weight fem.(gr.)	number of hatching eggs	number of fertilized eggs	number of offspring hatched	fitness	n	5-week body weight males(gr.)
	(fem.)						(males)	
C	106	127.2-1.07	-	-	-	-	69	120.1-1.20
K	90	128.8-1.33	11.8-.57	9.6-.53	8.0-.49	5.4-.39	43	119.5-1.41
D	90	129.0-1.11	11.1-.83	8.7-.55	6.9-.49	4.6-.37	46	119.5-1.37

Table:2- Means and Standard Errors of the Traits Studied in the Parents Selected from Initial Groups.

group	n	5-week body weight fem.(gr.)	number of hatching eggs	number of fertilized eggs	number of offspring hatched	fitness	n	5-week body weight males(gr.)
	(fem.)						(males)	
C	35	136.7-1.36	11.7-.86	9.4-.78	8.0-.72	5.4-.59	20	129.5-1.20
K	56	128.3-1.67	12.8-.65	10.8-.63	9.2-.58	6.4-.45	27	118.2-1.65
D	22	128.7-2.28	15.5-.74	14.1-.68	12.0-.59	9.1-.42	12	121.9-2.86