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Body Weights of a Closed Population of Cornich Fowl. II. Heritabilities

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HERITABILITIES for hatch, 4-week, 8-week, and 12-week body weights were measured on a closed flock of Cornish fowl in Egypt. These heritability estimates were measured for high 8-week body weight on a randombred flock and on a flock that was under selection for 2 generations. The heritabilities were calculated using the following methods : regression of offspring on sire, dam, and midparent; the variance component heritabilities (stre, dam, and combined); and the realized heritabilities.

Since the early fifties, many estimates of heritability have been reported for the body weight of chickens .Jaap and Smith (1959) selected 3 generations of broiler-type chickens for large body weight at 8 weeks of age. They reported that the best estimate of the heritability for 8-week body weight of females was 0.49. This was only slightly in excess of the realized heritability. Maloney and Gillbreath (1962) reported that the realized heritability obtained after 10 generations of individual selection for high and low 12-week body weight in Silver Oklabar chickens was 0.34 for the high line and 0.07 for the low line. Siegel (1962b) reported that the realized heritability for 8-week body weight for White Rock males was 0.31; for females 0.27; and for the combined sexes 0.29. Amer (1965) reported that the estimates of heritability of body weight in Fayoumis became higher as chickens advanced in age. He reported the heritabilities to be 0.36, 0.54, and 0.76 on the basis of dam plus size component at hatching, 4 weeks, and 8 weeks of age respectively.

In a randombred control strain of meat-type chickens, Merritt (1966) obtained data for 6 generations in order to estimate heritabilities of 42 and 63-day body weights. He reported that the heritability for 42-day body weight (combined sexes) was 0.40 for the sire component, 0.72 for the dam component, and 0.46 for the regression of offspring on their the sire or dam. The heritability for 63-day weight (combined sexes) was 0.40 for the sire component, 0.62 for the dam component, 0.51 for the regression of offspring on sire, and 0.54 for the regression of offspring on dam.

The purpose of this study was to estimate the heritabilities for the body weight of the Cornish fowl by using different methods. These heritability estimates were then compared to the realized heritabilities.

Material and Methods

The data represent 2 generations of selection for high body weight at 8 weeks of age. The Cornish breed used in this study was maintained at the Dokki Experiment Station for 20 years as a closed flock with no attempted selection. The sole criterion for selection was individual body weight at 8 weeks of age (See Stino *et al.*, 1981, for complete selection and management practices).

All chicks were weighed to the nearest gram at hatch and to the nearest 5 g at 4 weeks, 8 weeks, and 12 weeks of age.

The heritability of body weight at hatch, 4, 8, and 12 weeks of age was estimated using the following methods :

1. The regression of offspring on sire, dam, or midparent.
2. Variance component heritability (sire, dam, and combined components) according to Becker (1967).

The realized heritability was calculated from the cumulative effects of selection and the regression of response on cumulative selection differential as described by Dickerson and Grimes (1947).

Results and Discussion

Heritability estimates for 8-week body weight for each line and generation are shown in Tables 1 through 4. In obtaining the

TABLE 1. Heritability estimates for the cornish fowl body weights at different ages in the selected line obtained by the regression of offspring on sire, dam and midparent.

Generation	Method	Trait			
		Hatch Weight	4-Week Body Weight	8-Week Body Weight	12-Week Body Weight
S_1	Sire	-0.11±0.15	0.17±0.15	0.77±0.38	0.12±0.14
	Dam	0.06±0.12	-0.20±0.17	0.06±0.22	0.04±0.15
	Midparent	-0.12±0.17	-0.19±0.29	0.16±0.28	0.05±0.23
S_2	Sire	0.16±0.21	0.03±0.39	-0.05±0.54	-0.40±0.32
	Dam	-0.15±0.11	0.01±0.18	-0.15±0.26	-0.19±0.27
	Midparent	-0.21±0.17	0.14±0.28	-0.12±0.31	-0.74±0.29

realized heritability estimates (R/R = response/selection differential), the randombred controls were used to adjust for environmental fluctuation (Table 5).

Table 2. Heritability estimates for the Cornish fowl body weight at different ages in the randombred line obtained by the regression of offspring on sire, dam, and midparent.

Generation	Method	Trait			
		Hatch Weight	4-Week Body Weight	8-Week Body Weight	12-Week Body Weight
R_1	Sire	0.28±0.19	0.16±0.15	-0.12±0.09	-0.07±0.09
	Dam	-0.07±0.17	0.33±0.29	0.08±0.22	0.20±0.20
	Midparent	0.30±0.22	0.14±0.34	-0.01±0.26	-0.02±0.23
R_2	Sire	0.13±0.13	-0.06±0.13	-0.14±0.11	-0.15±0.09
	Dam	0.92±0.11	0.27±0.23	0.51±0.29	0.28±0.31
	Midparent	1.20±0.11	0.45±0.26	0.63±0.30	0.51±0.31

The realized R/S, the sire component, the dam component, the sire plus dam component, and the regression of offspring on sire, dam, and midparent heritability estimates show considerable variation between lines and generations. It may be noted (Tables 1 through 4) that selection yielded, with few exceptions, consistently lower heritability estimates in the selected line regardless of the method of estimation. Goodman and Godfrey (1956) and Maloney and Gilbreath (1962) reported contradicting results when selecting for 9 and 12-week body weight in chickens.

There was little agreement between the heritability estimates obtained from the sire component of variance and those obtained from the regression of offspring on midparent. Since both of these heritability estimates should include only the additive genetic variance (Falconer, 1967), close agreement was expected. However, this agreement is usually difficult to obtain under real selection experimental conditions.

The dam component heritability estimates were considerably larger than the sire component (Tables 3 and 4). This would in-

Table 3. Sire, dam, and combined estimates of heritability for the Cornish fowl body weights at different ages in the selected line.

Generation	Method	Trait			
		Hatch Weight	4-Week Body Weight	8-Week Body Weight	12-Week Body Weight
P	Sire	0.30±0.24	0.37±0.19	0.17±0.11	0.22±0.14
	Dam	1.97±0.33	0.44±0.18	0.12±0.16	0.28±0.19
	Combined	1.13±0.16	0.41±0.09	0.15±0.05	0.25±0.19
S_1	Sire	0.48±0.22	0.11±0.08	0.14±0.10	0.19±0.11
	Dam	1.30±0.22	0.36±0.15	0.57±0.17	0.39±0.16
	Combined	0.90±0.09	0.24±0.07	0.35±0.07	0.29±0.02
S_2	Sire	0.13±0.12	0.23±0.12	0.35±0.08	0.33±0.16
	Dam	1.10±0.22	0.29±0.17	0.52±0.22	0.33±0.21
	Combined	0.62±0.13	0.26±0.04	0.43±0.25	0.33±0.12

dicate that this character is influenced by dominant and non-additive genes in addition to the additive ones. These results are in agreement with those reported by Merritt (1966) for 63-day broiler weight.

Table 4. Sire, dam, and combined estimates of heritability for the Cornish fowl body weights at different ages in the random-bred line.

Generation	Method	Trait			
		Hatch Weight	4-Week Body Weight	8-Week Body Weight	12-Week Body Weight
P	Sire	0.12±0.15	0.11±0.15	0.14±0.16	0.23±0.20
	Dam	2.00±0.39	0.84±0.27	0.69±0.28	0.93±0.30
	Combined	0.95±0.24	0.47±0.01	0.41±0.19	0.58±0.13
R_1	Sire	0.43±0.23	0.11±0.11	-0.08±0.07	-0.04±0.07
	Dam	1.20±0.25	0.54±0.23	0.56±0.26	0.37±0.24
	Combined	0.81±0.03	0.33±0.04	0.24±0.09	0.16±0.20
R_2	Sire	0.02±0.19	-0.07±0.10	-0.01±0.17	-0.06±0.14
	Dam	2.80±0.42	1.40±0.33	2.30±0.42	1.50±0.42
	Combined	1.40±0.27	0.67±0.11	1.10±0.19	0.76±0.15

The realized heritability estimates (b) obtained by the regression of the population mean (cumulative response) on cumulative selection differentials are likely to be the most valid heritability estimates (Falconer, 1967). These estimates (b) are in close agreement with those obtained from the values of response over selection differential (Table 5). The high b values in Table 5 are due to the lower selection differential in the S_2 generation and to the higher response. Similar observations were reported earlier by Marks and Lepore (1968).

Table 5. Realized heritabilities of the different traits studied in the selected line of the Cornish fowl.

Generation	Method	Trait			
		Hatch Weight	4-Week Body Weight	8-Week Body Weight	12-Week Body Weight
S_1	R/S*	0.80	0.30	0.12	0.32
S_2	R/S	1.57	2.08	1.76	0.85
S_2	b**	1.56	2.19	1.76	0.87

*Response over selection differential.

**Regression of cumulative response on cumulative selection differential.

In general, the realized heritabilities for 8-week body weight (Table 5) were somewhat lower in the S_1 generation than those reported for 59-day live weight in broilers by Siegel and Essary (1959) for 8-week body weight in White Rocks (Siegel, 1962a); for high and low 8-week body weight in White Wyandottes (Gyles and Thomas, 1963), and for 6 to 12-week body weight in chickens (Siegel, 1962b). The realized heritabilities in the S_2 generation became higher. Similar results were reported by Stino and Washburn (1973) who observed a higher realized heritability following a lower estimate in the previous generation.

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وزن الجسم لقطيع مقفول من الدجاج الكورنش

٢ ـ العمق الوراثى

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تم تقدير العمق الوراثى لوزن الجسم عند عمر الفقس ـ ٤ أسابيع ـ ٨ أسابيع ـ ١٢ اسبوع فى قطيع من الدجاج الكورنش .

وتم تقدير العمق الوراثى فى السلالة المنتخبة (لزيادة وزن الجسم على عمر ٨ أسابيع) وفى قطيع المقارنة لمدة جيلين .. وقد تم تقدير العمق الوراثى بالطرق الاتية :

انحدار الابناء على كل من الاباء ، والامهات ، على متوسط الابوين ، وكذلك تم بطريقة تحليل التباين لكل من الاب والام ومتوسط الابوين ، وكذلك تم تقدير العمق الوراثى الحقيقى .