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HERITABILITY ESTIMATES OF BODY WEIGHT AND GROWTH RATE IN A FLOCK OF OSSIMI SHEEP

By

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SUMMARY

This study was carried out using the records of the Ossimi flock belonging to the Faculty of Agriculture, Giza, Egypt which covered a period of 17 years from 1940 to 1956. This flock has been closed since its establishment in 1934.

The heritability estimates for body weights estimated by the intra-sire regression of daughters on dams were 0.470 ± 0.022, 0.138 ± 002, 0.376 ± 0.043, and 0.444 ± 0.074 at birth, 4, 9 and 12 months respectively, while after correction for inbreeding they were 0.537 ± 0.022, 0.173 ± 0.002, 0.441 ± .043 and 0.511 ± 0.074 in the same order. Using the regression of offerspring on mid-parents, the estimates arrived at were 0.400 ± 0.012, 0.037 ± 0.010, 0.300 ± 030 and 0.340 ± 0.054 for the above mentioned weights respectively.

The heritability estimates of relative growth rates when using the intra-sire regression of daughters on dams were 0.080 ± 0.003, 0.130 ± 0.003 and 0.542 ± 0.030 for the periods from birth to 4 months, 4 to 9 months and 9 to 12 months of age respectively, while they were 0.102 ± 0.003, to 0.163 ±0.003 and 0.607 ± 0.030 respectively for the 3 sucessive periods after correction for inbreeding. When using the regression of offsping on mid—parents method the estimates were 0.069 ± 0.012, 0.108 ± 0.029 and 0.389 ± 0.134 for the 3 successive periods respectively.

INTRODUCTION

The heritability of a metric character is one of the most important parameters in any scheme for its genetic improvement. Many studies have been carried out to estimate the heritabilities of body weight in different breeds of sheep at different ages.

Using the intra-sire regression of daughter on dam; the heritability estimates of birth weights for Corriedales, Hampshires and Southdowns were –0.22, 0.13 and 0.08 respectively (Butcher et al, 1959). Applying the same method Nelson and Ventachalam (1949) found that the heritability estimates of birth and weaning weights were 0.72 and 0.29 respectively. While, the heritability estimates of weaning weights for Range Columbia, Corriedale and Targhee sheep were 0.21, 0.45 and –0.01 respectively as found by Hazel and Terrill (1946 a). Moreover, the heritability estimate of yearling body weight of Range Rambouillet ewes was found to be 0.4 (Terrill and Hazel, 1943).

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Using the regression of offspring on mid-parent method the heritability estimates for birth, weaning weights of the Rahmani sheep were -0.344 and -0.586 respectively, whereas those of the Ossimi sheep were 0.136 and -0.166 respectively (Kady, 1952).

MATERIAL AND METHOD

Records of the Ossimi flock which belong to the Faculty of Agriculture, Giza, Egypt were used in this study. Only animals born in the autumn season which is the most common lambing season were included in this study. The data comprised weights of animals at birth, 4, 9, and 12 months of age, They covered a period of 17 years (1940-1956) except the data of the year 1948 which were not available. The flock under investigation is a closed one as no animals were introduced since its establishment in 1934. Sheep were fed on Egyptian Berseem (Trifolium Alexandrinum) from November till May, while the rest of the year, they were fed on Berseem hay suplemented by some concentrates. The lambs were weighed within 12 hours from birth and at monthly intervals thereafter.

The data were corrected for sex but not for year effect since calculations were carried out within years.

Two methods were used in estimating the heritability estimates of body weights and growth rates at the different ages, i.e., the intra-sire regression of daughters on dams, and the regression of offspring on mid-parents (Lush, 1948). The standard errors of these estimates were calculated using the formula given by Falconer (1960).

The heritability estimates calculated by intra-sire regression of daughters on dams were corrected for the effect of inbreeding using the formula given by Lerner (1950). The average coefficient of inbreeding for this flock estimated as 36.7%, was used for correction.

RESULTS AND DISCUSSION

1.—*Heritability Estimates of Body Weights:*

The heritability estimates for birth weight arrived at using daughter-dam regression and mid-parent methods were higher than those for 4, 9 and 12 months weights (Table 1).

This agrees partially with the findings of Nelson and Venkatachalam (1949) and Kady (1952) who reported that the heritability estimate for birth weight was higher than that for weaning weight. The higher heritability estimate of birth weight is expected since the former performance is mostly affected by maternal influences while the latter includes less maternal effects together with all the other possible environmental sources of variation which exist from birth to weaning. This also holds true when the heritability estimates of birth weights are compared to those of 9 and 12

TABLE 1.—**Heritability of Body Weights at Different Ages**

Method Age	Regression of Daughters on Dams			Regressian of offspring or midparents	
	Number of Pairs	h^2 estimate not corrected for inbreedjng	h^2 estimate corrected for inbreeding	Number of Pairs	h^2 estimate
Birth	488	0.470 ± 0.022	0.537 ± 0.022	369	$0.400 + 0.012$
4 Months .	353	0.138 ± 0.002	0.173 ± 0.002	312	$0.037 + 0.010$
9 Months .	207	0.376 ± 0.043	0.441 ± 0.043	173	$0.300 + 0.030$
12 Months .	93	0.444 ± 0.074	0.511 ± 0.074	92	$0.340 + 0.054$

months weights. Moreover, the heritability estimates of weaning weight were the lowest of all estimates because, at this age, the environmental effect is supposed to be at its highest as lambs undergo the most drastic changes in feeding and management, i.e. the shifting from suckling to grazing which is unequally reflected on the growth of different lambs as ewes are different in their suckling abilities and lambs are also different in their response to weaning time and age. This is confirmed by the findings of Blunn (1944) who stated that the coefficient of variability for weaning weight in Navajo sheep was more than that of birth weight. However, Ensminger et al (1943), Butcher et al (1959), and Karam (1959) found that the heritability estimates of birth weights were lower than those of weaning weights which could be due to either sampling errors or the insufficient data used.

The heritability estimates of body weight at 9 months of age were lower than those at birth because of the relatively higher environmental variance included in the former estimates, which could be due to that lambs at the age of 9 months shift in their feeding system from green fodder to concentrates and lambs respond differently to these changes. Moreover, most lambs reach puberty at this age, and this will affect their body weights and consequently their phenotypic variance.

The heritability estimates of body weight at the age of 12 months arrived at using both methods were higher than those at 4 and 9 months of age (Table 1) which could be discussed on account of the fact that body weights at this age are less affected by the fluctuations in management. This is confirmed by the findings of Hazel and Terrill (1945).

The heritability estimates of body weight at all ages computed by the regression of daughters on dams, when corrected for inbreeding were higher than their corresponding ones before correction. This is expected, since

inbreeding decreases the genetic variance within lines and hence lowers the heritability estimates. This correction was not carried out with the estimates of the mid-parents method as the individuals dealt with were adequately randomized (Lush, 1948).

The heritability estimates calculated by intra-sire regression of daughters on dams were higher than those estimated by mid-parent methods. This could be due to that the former method includes sampling errors, due to correction to sex, which is doubled when multiplying by 2 to give the heritability estimates out of the regression coefficient.

2.—*Heritability Estimates of Relative Growth Rates* :

Comparing the heritability estimates obtained for relative growth rate during the period of the study, it was observed that using both methods of estimation, the heritabilities were low at birth then increased as age advanced reaching the maximum at the period from 9 to 12 months (Table 2).

TABLE 2.—**Heritability of Relative Growth Rates at Different Periods**

Method Age	Regression of Daughters on Dams			Regression of offspring on midparents	
	Number of Pairs	h^2 estimate not corrected for inbreeding	h^2 estimate corrected for inbreeding	Number of pairs	h^2 estimate
From birth to months (R_1)	341	0.080±0.003	0.102±0.003	321	0.069±0.012
From 4 to 9 months (R_2)	185	0.130±0.003	0.163±0.003	141	0.108±0.029
From 9 to 12 months (R_3)	43	0.542±0.030	0.607±0.030	39	0.389±0.134

Since heritability is the ratio between the genetic variance and the total variance, factors affecting each would consequently affect this ratio. During the first period, the non genetical factors affecting growth rate played their part in a pronouced way, since the newly born lambs were subject to the maternal influences of their dams during the pre-natal period. The lambs were then subject to changes in the milking abilities of their dams which also affected their growth rate; thus ending in a relatively more non-genetical variance and a lower estimate of heritability.

When lambs were weaned, the environmental circumastances in regards to feeding tended to be more stabilized, the matter that caused relatively less amount of non-genetical varience and higher estimates of heritability.

However, such environmental factors which affect the growth rate of lambs from birth till waening were previously stated by Hammond (1932); Bonsma (1939); Wallace (1948); Sirry and El-Sokkary (1950); Povlinic (1950)' Hamada (1954); and Hamada and Badawi (1956).

The heritability estimates for the relative growth rate differed in the case of regression of dauters on dams from regression of offspring on mid--parants. The magnitude of the heritability estimates also changed when the data were corrected for inbreeding (Table 2). The reasons of such differences are not differnet from those previously given in the case of herita bility of body weight.

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القيمة الوراثية لوزن الجسم ومعدل النمو في قطيع من الأغنام الأوسيمى

الملخص

أجريت هذه الدراسة على قطيع الأغنام الأوسيمى الخاص بكلية الزراعة جامعة القاهرة وهو قطيع مقفول منذ عام ١٩٣٤

وقد تبين من الدراسة أن القيمة الوراثية لوزن الجسم محسوبة على أساس انحدار النبات على الأمهات داخل مجموعات الآباء كانت ٤٧٠ ± ٠٢٢ر ، ١٣٨ر ± ٠٠٢ر ، ٣٧٦ر ± ٠٤٣ر ، ٤٤٤ ± ٠٧٤ر لكل من الوزن عند الميلاد وأربعة شهور وتسعة شهور واثنى عشر شهرا على التوالى . كما كانت هذه القيم للأوزان السابقة وفى نفس الأعمار بعد التصحيح لأثر تربية الأقارب ٥٣٧ر ± ٠٢٢ر ، ١٧٣ ± ٠٠٢ر ± ٠٤٣ر ، ٥١١ر ± ٤٤١ر ± ٠٧٤ر بنفس الترتيب السابق . هذا كما يتبين أن القيمة الوراثية لنفس الصفات السابقة وباستعمال طريقة انحدار النسل على متوسط الآباء كانت ٤٠٠ر ± ٠١٢ر ، ٠٣٧ر ± ٠١٠ر ٣٠٠ر ± ٠٣٠ر ، ± ٣٤٠ ± ٠٥٤ر على التوالى بنفس الأوزان والأعمار السابق ذكرهـــا .

أما بالنسبة لمعدل النمو فقد كانت ٠٨٠ر ± ٠٠٣ر ، ١٣٠ر ± ٠٠٣ر ، ٥٤٢ ± ٠٣٠ر للفترات بين الميلاد و ٤ شهور ، ٤ الى ٩شهور ، ٩ الى ١٢ شهرا على الترتيب باستعمال طريقة : انحدار النبات على الأمهات . وعند التصحيح لأثر تربية الأقارب فقد كانت ١٠٢ ± ٠٠٣ر ، ١٦٣ ± ٠٠٣ر ، ٦٠٧ ± ٠٣٠ر لنفس الفترات السابقة وبنفس الترتيب مقابل ٠٦٩ر ± ٠١٢ر ، ١٠٨ ± ٠٢٩ر ، ٣٨٩ ± ١٣٤ر لنفس الفترات السابقة وبنفس الترتيب باستعمال طريقة انحدار النسل على متوسط الآباء .