SEX-RATIO IN POLWARTH AND CORRIEDALE LAMBS[1]

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SUMMARY: The sex-ratio was determined for samples of Polwarth (2,347 individuals) and Corriedale (1,346 individuals) lambs born and reared at the Posto de Ovinos e Caprinos, Instituto de Zootecnia, Secretaria de Agricultura do Estado de São Paulo (Itapetininga, São Paulo) from 1972 to 1987. For Polwarth lambs the secondary sex-ratio (expressed as proportion of males) was 0.497, the corresponding figure for Corriedale lambs being 0.479. These figures do not differ significantly from each other or from the expected proportion of males of 0.5. The annual values observed, which ranged from 0.406 to 0.568 for Polwarth and from 0.370 to 0.569 for Corriedale lambs, can be ascribed to random sample fluctuations.

Index terms: Corriedale lambs, Polwarth and Sex-ratio.

RAZÃO SEXUAL EM CORDEIROS IDEAL E CORRIEDALE

RESUMO: Determinou-se a razão ou proporção sexual (sex-ratio) em amostras de ovinos das raças ideal e corriedale criados no Posto de Ovinos e Caprinos do Instituto de Zootecnia da Secretaria de Agricultura do Estado de São Paulo de 1972 a 1987. As amostras de ovinos das duas raças, estudadas retrospectivamente por meio de consulta aos livros de registros dessa instituição, eram compostas respectivamente por 2.347 e 1.346 indivíduos. Para os cordeiros de raça ideal a proporção sexual (expressa como percentagem de machos) foi de 0,497. O valor do parâmetro entre cordeiros corriedale foi de 0,479. Esses dois valores não diferiram (P>0,05) entre si ou da proporção teórica esperada de 0,50. Os valores do parâmetro para cada ano variaram de 0,406 a 0,568 para a raça ideal e de 0,370 a 0,569 para a raça corriedale. Essas variações podem ser atribuídas a flutuações amostrais de natureza aleatória.

Termos para indexação: cordeiros ideal e corriedale , razão sexual

INTRODUCTION

The secondary sex-ratio (that is, the sex-ratio observed at birth) has been studied in detail in several species of domesticated animals, but the bibliography on the subject concerning sheep is scarce. To our knowledge, this is the first study concerning this aspect performed with sheep born and raised in Brazil.

DARWIN (1871), in his book *The descent of man, and selection in relation to sex*, was the first to study this subject, verifying the proportion of males in a total of 8,965 lambs of Leicester stock. The proportion found by DARWIN (m = 0.441), however, is quite different from the findings of the authors listed below, that show typical average values ranging from 0.49 to 0.51. The theme was revisited more than 60 years later by CHAPMAN and LUSH (1932) in the United States, followed by the reports of HENNING (1939), JOHANNSSON and HANSON (1945), KARAM (1957), MARAI (1972), NAPIER and MULLANEY (1974), SKJERVOLD (1979) and JOSHI and SAHNI (1983). The pertinent findings (sex-ratio data) described in all these works are summarized and discussed in the section *Results and discussion*.

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MATERIAL AND METHODS

We analyzed the secondary sex-ratio retrospectively, by consulting books of birth records kept at the Instituto de Zootecnia (1972-1987) and which included data on 2,347 Polwarth ('Ideal') and 1,346 Corriedale lambs. The lambs whose data we used were born and raised at the Itapetininga Lamb and Goat Station, in the State of Sao Paulo, Brazil; the soil of the region (23°35'S, 48°02'W) is classified as dark red ortho latosoil; the climate is sub-tropical temperate, savanna type, with an average annual rainfall of 1,150 mm; the average annual temperature is around 18° C, ranging from 8°C in winter to 23°C in summer.

For most samples from 1972 to 1984 the ewes had remained, during their pregnancy, in conditions of continuous grazing on 'pangola' grass (*Digitaria decumbens* Stent) with mineral salt supplementation in troughs. The mothers of lambs born during the year of 1985 received, prior to mating, food supplementation (flushing) in the form of 500g/animal/day of a ration consisting of 50% of rough maize flour, 29% of soybean bran, 20% of wheat bran and 1% of an admixture of mineral components. The mothers of lambs born in 1986 and 1987 were divided into two subsamples, one receiving the above-described ration in the amount of 1,000 g/animal/day, the other receiving no supplementation.

The statistical treatment included a two-factor analysis of variance, without replications, applied to the data transformed after the usual arc-sine transformation ($X' = \text{arc-sine } \sqrt{X}$).

RESULTS AND DISCUSSION

The observed 1972-1987 annual sex-ratios, expressed as the percentage of males, of the lambs raised at the Itapetininga Lamb and Goat Station are shown in Table I. The analysis of variance of the transformed arc-sine data has shown that there are no differences in the secondary sex-ratio between sheep belonging to the two races [$F(1,15) = 0.64$; $P = 0.44$] and that the observed annual fluctuations are due to random factors [$F(15,15) = 0.87$; $P >> 0.40$]. Using the totals shown at the bottom of Table 1 we verify that the overall sex-ratios in both races do not differ significantly from 0.5 [χ^2 figures of 0.08 ($P = 0.7$) and 2.33 ($P = 0.14$) for 1 d.f., respectively for Polwarth and Corriedale lambs] and that the observed data are homogeneous under the hypothesis $m = f = 0.5$ when both races are compared ($\chi^2 = 0.08 + 2.33 - 1.33 = 1.08$; 1 d.f.; $P = 0.30$).

Table I - Sex-ratio of Pollwart and Corriedale lambs.

	Polwarth			Corriedale		
Year	Males/Tot.	Mean	St. Err.	Males/Tot.	Mean	St. Err.
1972	31/61	0.508	0.064	37/83	0.446	0.055
1973	50/104	0.481	0.049	62/135	0.459	0.043
1974	65/128	0.508	0.044	84/158	0.532	0.040
1975	67/136	0.493	0.043	53/129	0.411	0.043
1976	54/116	0.466	0.046	68/127	0.535	0.044
1977	63/155	0.406	0.039	53/111	0.477	0.047
1978	101/194	0.521	0.036	34/92	0.370	0.050
1979	77/165	0.467	0.039	33/58	0.569	0.065
1980	113/210	0.538	0.034	22/52	0.423	0.069
1981	84/169	0.497	0.038	28/69	0.406	0.059
1982	92/162	0.568	0.039	41/74	0.554	0.058
1983	66/131	0.504	0.044	23/53	0.434	0.068
1984	80/166	0.482	0.039	24/46	0.522	0.074
1985	63/120	0.525	0.046	28/50	0.560	0.070
1986	76/153	0.496	0.041	18/37	0.486	0.082
1987	85/178	0.478	0.037	37/72	0.514	0.059
Total	1167/2348	0.497	0.010	645/1346	0.479	0.014

The main data on sex-ratio found in the literature and those observed here are grouped in Table II. In this table, it is easy to see that Darwin's data are heterogeneous in relation to the other samples. Many of these, especially the larger ones, are mixed, being composed of animals belonging to different races, and probably with a high degree of heterogeneity. Excluding from the table Darwin's data and all samples formed by several races of sheep, we applied to the rest of them chi-squared tests to verify the hypothesis $m = f = 0.5$. In no sample the hypothesis was rejected at the 1% level; only in the Australian Merino sample the difference was significant at the 5% level. Adding the eight individual chi-squared values obtained from the testing of $f = m =$

0.5 in each sample, we obtained a sum chi-squared figure of 14.36 (P = 0.07), that is not significant even at the 5% level for eight degrees of freedom. Then a pooled chi-squared value of 0.24 (1 d.f.; P = 0.63) was obtained by applying the test to the total numbers of males and females of all samples pooled together (10,015 males and 9,946 females). Finally, a heterogeneity chi-squared value of 14.36 - 0.24 = 14.12 (7 d.f.; P = 0.05) was obtained, thus indicating that the sex-ratio in all races of sheep tested is not different from 0.5 at the 1% significance level.

Table II - Secondary sex-ratio of lambs (percentage of males at birth)

Race (Place)	Nº of Animals	Nº of Males	% of Males	Ref	X^2
Leicester (England)	8,965	3,951	44.07	1	-
Hampshire (USA)	1,019	493	48.38	2	1.07
Several (USA)	127,587	62,466	48.96	3a	-
Several (USA)	1,742	875	50.23	3b	-
Several (Sweden)	58,381	28,945	49.58	4	-
Rahmani (Egypt)	1,109	535	48.24	5	1.37
Ossoni (Egypt)	678	318	46.90	6	2.60
Corriedale (Australia)	4,122	2,061	50.00	7	0.00
Merino (Australia)	7,840	4,022	51.30	8	5.31
Several (Norway)	467,959	228,832	48.90	9	-
Muzaffarnagari (India)	1,499	774	51.63	10	1.60
Polwarth (Brazil)	2,347	1,167	49.70	11	0.08
Corriedale (Brazil)	1,346	645	47.92	11	2.33

1. Darwin (1871), 2. Chapman and Lush (1932), 3. Henning (1939) - a: literature data; b: own data, 4. Johansson and Hansson (1945), 5. Karam (1957), 6. Marai (1972), 7, 8. Napier and Mullaney (1974), 9. Skjervold (1979), 10. Joshi and Sahni (1983) and 11. Present work

TRIVERS and WILLARD (1973) suggested the existence of the following evolutively selected mechanism that maximizes the chance of perpetuation of descendance: undernourished females would have a tendency to produce an excess of female offspring, whereas well-nourished females would tend to have an excess of males. Comparing the sex-ratio in the offspring of females with and without flushing (Table III), we obtained non-significant results; since there is a clear correlation between the rate of twin births and the nutrition level of ewes (RODA and OTTO, 1990), we have tested the idea also in an indirect manner, comparing the secondary sex-ratios of single and twin lambs of our sample (Table IV); the results were again non-significant [chi-squared figures with 1 d. f. respectively equal to 2.31 (P=0.13) and 0.77 (P = 0.38) for the races Polwarth and Corriedale] and do not support the idea of TRIVERS and WILLARD (1973). It should be pointed out, however, that our comparisons involved the gestation products of ewes in normal conditions against those of exceptionally well-fed ewes.

Table III - Analysis of the influence of flushing on lamb sex-ratio.

Flushing	Polwarth			Corriedale		
	M	F	X^2	M	F	X^2
With	83	79	1.08	27	27	0.01
Without	77	91	(P = 0.30)	28	27	(P = 0.92)

M: number of males
F: number of females

Table IV - Sex distribution of lambs according to the type of birth

Race	Birth	Males	Females
Pollwart	Twin	92	114
	Single	929	920
Corriedale	Twin	19	27
	Single	443	481

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