

Genetic parameters of weight productivity traits of D'Man ewes in Tunisia

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Summary

Data on weight productivity of 1023 ewes of the D'Man breed calculated using an original file on growth performances of 2026 lambs of the same breed were used in this study. All the lambs were born and raised in Tunisia between 1994 and 1999 in the north of the country (Mateur, Kef) and in the south under an oasis environment (Gabès). The studied variables included weights of the litter at 10, 30, 70 and 90 days of age and respectively designated LW₁₀, LW₃₀, LW₇₀ and LW₉₀. Average calculated figures were 8.22 kg (± 2.91), 13.72 kg (± 4.64), 24.51 kg (± 8.79) and 29.46 kg (± 11.11) respectively for LW₁₀, LW₃₀, LW₇₀ and LW₉₀. Analysis of the non genetic sources of variation revealed a highly significant effects ($P < 0.001$) of the factors rank of lambing within station, age of the dam, and type of lambing-rearing on all the studied traits. Heritability coefficients estimated using the REML method of variance analysis, were 0.17, 0.23, 0.08 and 0.08 for respectively LW₁₀, LW₃₀, LW₇₀ and LW₉₀. Genetic and Phenotypic correlations between all the studied traits were high and positive respectively varying between 0.81 and 0.94 and between 0.82 and 0.96.

Keywords: Weight productivity, Litter weight, D'Man, Heritability, Genetic correlations

Introduction

The D'man breed originates from the oasis in the south of Morocco and is well known for its high prolificacy and its accelerated lambing rhythm (Lahlou-Kassi et al, 1989). Introduced in Tunisia in 1994, the D'man is being diffused in the south as pure breed and is a potential candidate for cross breeding with local breeds in other favorable areas (Lassoued & Rekik, 2001). In either case, the genetic characterization of the breed is a prerequisite step.

So far, work in this area has focused on the individual growth of lambs (Aloulou et al, 2002) as well as the reproductive performances of the ewes namely litter traits and frequency of lambing (Bedhiaf et al, 2002). However, traits related to the overall productivity of the ewes, important in the case of a meat-producing prolific breed, which combine the lambs growth performances and the ewes litter sizes have not been studied. This study therefore aims at assessing levels of the weight productivity of D'Man ewes raised in Tunisia, at determining its main sources of variation and at estimating its genetic parameters.

Material and Methods

Database description

Data on weight productivity of 1023 ewes of the D'Man breed calculated using an original file on growth performances of 2026 lambs of the same breed, collected for 6 consecutive years (1994 to 1999), were used in this study. The records were obtained from three flocks for the multiplication of the breed in Tunisia; in Mateur and in Kef located in the north (average annual rain fall > 450 mm) and in Gabes in the south under an oasis environment (average annual rain fall < 150 mm). In the three stations, ewes were kept permanently indoor. After being bred for the first time at approximately 8 to 10 months of age, the females were managed in an accelerated lambing rhythm of three lambing every two years. Ewes were managed to lamb in spring (March and April, 43%), summer (July and August, 29.2%) and autumn (October, November and December, 27.8%). The studied variables included weights of the litter at 10, 30, 70 and 90 days of age and respectively designated LW_{10} , LW_{30} , LW_{70} and LW_{90} .

Statistical analyses

Statistical analysis using least-squares techniques of the GLM procedure of SAS was performed to assess non-genetic effects affecting weight productivity traits to be included in the final model. The mixed model applied included fixed effects of rank of lambing within station (7 levels within 3 stations), age of the ewe (16 levels: younger than 16 months, 17 to 20 months, 21 to 24 months,...and older than 72 months) and type of lambing-rearing (7 levels: single; twin or greater raised as single; twin; triplet or greater raised as twin; triplet; quadruplet or greater raised as triplet; and quadruplet or greater raised as quadruplet or greater). Heritability coefficients were estimated using the REML method of variance analysis. The linear mixed model for any trait included the random effects of dam, sire and the residual error. Heritabilities were estimated using half-sib analysis of variance while phenotypic and genetic correlations were estimated through a covariance analysis.

Results and Discussion

Average weight productivity performances

Mean litter weights of the D'Man in Tunisia at 10, 30 70 and 90 days after lambing are respectively 8.22 kg (± 2.91), 13.72 kg (± 4.64), 24.51 kg (± 8.79) and 29.46 kg (± 11.11) (Table 1). These figures are much higher than corresponding figures for individual lambs (Aloulou et al, 2002) and the difference is mainly due to the large size of the litter (Bedhief et al, 2002). The calculated figures are also higher than those reported for the Barbarine, the main meat-producing breed in the country (Jmal, 1995). Our results at 90 days of age are similar to the 29.7 kg at weaning figure reported by Boujenane et al, (1991) for the D'Man in Morocco. However, in the latter study, weaning occurred at about 70 days of age. It is also worth mentioning that the 29.46 kg achieved by the D'Man ewe at 90 days of age corresponds to a production cycle of 8 months. On an annual base, a D'Man ewe would produce approximately 45 kg which would represent more than twice the weight productivity of the Barbarine at 90 days of age (Jmal, 1995).

Table 1: Average weights of the litter at 10, 30, 70 and 90 days of age of the D'man ewes in Tunisia.

Traits	Number	Mean	s.e.
LW ₁₀ (Kg)	1023	8.22	2.91
LW ₃₀ (Kg)	1022	13.72	4.64
LW ₇₀ (Kg)	973	24.51	8.79
LW ₉₀ (Kg)	877	29.46	11.11

Sources of variation

All effects retained in the model significantly affected weight productivity traits “Table 2” and the models determination coefficients (R^2) varied from 68 to 73%.

Table 2: Test of significance (F) for weight productivity traits of D'man ewes in Tunisia

Sources of variation	df	LW ₁₀	LW ₃₀	LW ₇₀	LW ₉₀
Rank of lambing within station	18	***	***	***	***
Age of the ewe	15	***	***	***	***
Type of lambing-rearing	6	***	***	***	***
R^2 (%)		70	68	71	73

*** $P < 0.001$

The rank of lambing within station is somewhat similar to the more conventional year–season of lambing effect, which is reported by most authors (Jmal, 1995; Ben Gara, 2000) to considerably influence growth of the lambs and productivity of the ewes particularly under the prevalent highly variable arid and semi-arid conditions. The effects age of ewe and type of lambing–rearing, through the quantity of milk available (Berny, 1979), are an important determinant of the individual lamb growth hence of the ewe weight productivity.

Estimation of genetic parameters

A summary of estimates of the genetic parameters is reported in “Table 3”. Estimated figures of the heritability are 0.17, 0.23, 0.08 and 0.08 for LW10, LW30, LW70 and LW90 respectively. These figures are within the range of reported values in the case of meat–producing breeds (Bonaïti et al, 1976). The obtained figures are higher (in the case of LW10 and LW30) and very similar (in the case of LW70) in comparison to those reported for the Barbarine breed (Jmal, 1995; Ben Gara, 2000). This trend in the variation of heritability figures is inversed in the case of the individual lamb growth performances with higher heritability estimates at older ages (Ben Hamouda, 1985; Djemali et al, 1994) most likely as a result of a weaker maternal effect.

Phenotypic and genetic correlations amongst all traits of weight productivity are positive and very high “Table 7”. These correlations varied between 0.81 and 0.94 and between 0.82 and 0.86 respectively for the genetic and the phenotypic correlations. Similar results are also reported by Jmal (1995) and Ben Gara (200) for the Barbarine breed. Therefore selection of D'Man ewes on LW30 would probably improve litter weight at others ages.

Table 3: Estimates of heritabilities (h^2), genetic and phenotypic correlation for weight productivity traits of D'man ewes in Tunisia

Traits	LW ₁₀	LW ₃₀	LW ₇₀	LW ₉₀
LW ₁₀	0.17	0.94	0.87	0.81
LW ₃₀	0.94	0.23	0.91	0.84
LW ₇₀	0.85	0.93	0.08	0.94
LW ₉₀	0.82	0.89	0.96	0.08

Diagonal: heritability coefficients, above diagonal: genetic correlations, below diagonal: phenotypic correlations

Conclusion

Litter weights of D'Man ewes raised in Tunisia are not very different from the performances of the breed in its native country Morocco indicating a good adaptation of the breed to its new environment. These performances are higher than those recorded for the autochthonous meat-producing breeds as a result of the exceptional reproductive characteristics of the D'Man mainly its high litter size and its accelerated lambing rhythm. Our results related to litter weights in addition to those by Aloulou et al, (2002) related to lambs growth and those by Bedhiaf et al, (2002) addressing reproductive traits could serve as useful tools when designing a genetic improvement scheme of this breed in Tunisia.

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