ESTIMATION OF GENETIC PARAMETERS SPECIFIC TO TIGAIE BREED REARED IN NORTH-EAST PART OF ROMANIA

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Abstract

Many research enlightened the fact that heritability of reproduction and production characters at sheep is generally low, making difficult the selection for those characters. Nevertheless, exist also an obvious variation based on which could be improved reproduction and production performances. Lower heritability of characters was interpreted by Hansen in 1983 as a decreasing of additive genetic variation due to natural selection, aspect which gave to artificial selection a limited working margin.

The analysed biological material belonged to Ţigaie breed from private exploitations situated in the North-East part of Romania and represented by different age categories. Working method utilised for determination of characters' heritability was the one of restricted maximum probability (Restricted Maximum Likelihood – REML) because it is based on an iterative procedure and allow the obtaining of values in the normal space of parameters. The obtained results show the fact that at Ţigaie breed, due to the fact that for calving weight the determined heritability was 0.25 meaning that basic selection of those character is not indicated, recommended being taking in consideration, for selection, live weight at 150 days because heritability coefficient increase at 0.36. Also, determination for mean values of heritability for some tissue characteristics of carcasses show that also those ones have a low heritability due to the fact that had h^2 with values between 0.21 for fat quantity in carcass and 0.28 for total mass of carcass. Based on the obtained values for the majority of analysed quantitative characters, due those ones presented high values of variability show the existence of some adequate genetic resources to initiate some breeding programmes which will allow achievement of new reproduction and production performances for Ţigaie breed.

Key words: Tigaie, sheep romanien, meat shep, parameters genetic

INTRODUCTION

Taking into consideration the agricultural surface, Romania is one of the first countries (situated on the 5th place in Europe, with a share of 8% from the total UE-27). Through the labour force engaged in agriculture and food industry, Romania has all the chances to become a net exporter of food produces, especially the animal once obtained from sheep. Although in Romania the objectives for growing sheep are multiple (milk, meat, wool, skins), lately major efforts are being made to increase meat production [1]. The purpose of these concerns is to make Romania an important provider of sheep meat and to satisfy the request made by the countries situated in the Near East (Lebanon, Iran, Syria, Jordan) for meat originated from the exploitation of young and adult sheep, or those of the countries from the European Union for the meat obtained from the slaughtering of fattened young sheep [5], [7]. To provide breeders more information from this domain, during the researches there were organized studies and experiments starting from hybrid lambs obtained by crossing Romanian sheep with rams from meat breeds, which have the quality to improve this product.

MATERIAL AND METHOD

The biological material was represented by Tigaie sheep, adult and youth categories, which are in growing and livestock farms,

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located in the North-East of Romania, in Bacău, Vaslui, and Vrancea counties. In order to obtain the data necessary to determine the heritability coefficient were carried out several activities of technical control of production, for determining the intensity of growth and live weight at different ages, etc.

To establish the inter-dependence level between the values of live weight and some behaviour of carcasses, or between different couples of features were calculated the phenotypic correlation coefficients, estimating in this way the sense and the intensity of relations between specific phenotypic values of those features.

In order to determine the share participation and share of influence of factors directly involved in expressing the characteristics taken into account, as well as to determine the degree of genetic determination of respective characteristics, the heritability values were estimated using the REML (REstricted Maximum Likelihood-) which guarantees obtaining estimates in the normal space of parameters.

The effect of hybridisation was revealed with the help of the heterosis percentage, determined using the relation:

$$H = \frac{\overline{X}_{F1} - \overline{X}_P}{\overline{X}_P};$$

where:

$\overline{X}_{F1}$ = average character to the obtained products;

$\overline{X}_P$ = average character for paternal forms.

The data obtained have been centralized in tables and graphics, after they were processed statistically, using for this purpose programs and methods unanimously accepted in modern experimental technique. The calculated statistical parameters were:average ($\overline{X}$); the standard error of the average ($\pm s\bar{x}$); coefficient of variability (V%) and Tukey test.

RESULTS AND DISCUSSIONS

At the beginning of the 20^{th} century, Peterson who was quoted by C., Drăgănescu, defined the heredity as a correlation between parents and offspring. On this basis, and in accordance with the stated afterwards, you can calculate the heritability coefficient (h^2) of some quantitative characters and the result obtained is that portion of the total phenotypic variance that is transmitted to the progeny. If the value of heritability coefficient for a particular character tends toward zero it means that between the genotype and the phenotype there is an extremely weak link, and the character in question is dependent on very small extent by genotype and accordingly it will be strongly influenced by environmental factors, and any attempt to improve it does not have too many chances to succeed. If the value of the heritability coefficient tends to 1.0 this means that the phenotype reflects almost exactly the genotype and, hence, that character must be transmitted faithfully in descent, without being subject to environmental influences [8].

The particularly important role of the heritability coefficient value is represented by the fact that the additive genetic variance and non-additive can be determined using this indicator, because its value actually represents the main element through which one can estimate how much of the total variance of qualities, to a population of animals subjected to a process of improvement, is genetically determined and how much is due to environmental biases.

Heritability for body weight. Generally in sheep and in particular meat breeds, heritability weight at birth and weaning is very low. To determine the heritability coefficient for quantitative characters of which meat production depends on was based on the determination of h^2 at different age groups. Otherwise, the data included in table 1 shows that in general live weight recorded at different periods of age for the Țigaie breed presents a low heritability coefficient. The fact that birth weight is $h^2 = 0.25$ means that the selection based on this character is not indicated, it would be more appropriate taking into account the live weight determined at 150 days whereas the heritability coefficient increases to 0.36.

For weight at the same age groups, Bonett G. L. et al., (1991) cited by Pascal C. (2004), estimated a heritability coefficient for body weight at birth of $h^2 = 0.20$ and Young cited by Mochnacs et al. (1978), communicated for the same character a heritability coefficient between 0.19 and 0.35.

Table 1 Heritability coeficient estimated for live weight registered at different ages of young sheep

Character	h^2	Values determined by other authors	
		h^2	Authors and year
Corporal weight at calving	**0.25**	0.19 - 0.35	YOUNG, 1963
Corporal weight at 30 days	0.17	0.20	GJEDREN, 1967
Corporal weight at 65 days	0.15	0.20	PURSER, 1966
Corporal weight at 75 days	**0.28**	0.27	GJEDREN, 1967
Corporal weight at 135 days	0.27	0.25- 0.50	BROADBENT, 1967
Corporal weight at 150 days	**0.36**	0.22 - 0.40	WATSON, 1967

Other authors, such as Serra, F., cited by Mochnacs et al., communicates the values of the coefficient of heritability for the weaning weight of being between 0.10 and 0.35; Comerron, N. D. (1992) estimated the level of the heritability coefficient between 0.19 and 0.23 for body weight at the age of 45 days and between 0.13 and 0.27 for the determined at 80 days, and for body weight recorded at 150 days, the same author concluded, $h^2 = 0.23$. Flamant (1970) quote by Mochnacs et al. (1978) [4], makes a summary of the data regarding the heritability weight at weaning and fixes for this the weighted average of $h^2 = 0.26$.

The total of these values indicates that the genetic factors have large influence additives in expressing this character, actually less highlighted from this point of view in the analysis of body weights determined for the period of breastfeeding. This implies that for the production of meat, sheep breeding is necessary for mothers and for the quantitative milk production, by printing such descendants' upper body weight until weaning.

Heritability for slaughter yield and qualities of tissue of animal carcasses. In the case of determinations regarding the heritability coefficients for tissue characteristics of animal carcasses, the values estimated by various authors are generally low, ranging from 0.21 for the quantity of fat from the carcass and 0.28 for the total weight of the carcase.

In the case of the researches carried out there has not yet been determined the heritability of quantitative characters for some affecting meat production, the data obtained being shown in table 2.

For the amount of meat in the carcass the estimated heritability fall in this group of heritability environment whereas $h^2 = 0.37$. This average value reveals that this character is influenced more strongly by additive genetic variance.

Table 2 The heritability coefficient estimated for the yield at slaughter and some carcass characteristics

Character	h^2	Values determined by other authors	
		h^2	Authors and year
Slaughter yield	**0.34**	0. 35	Quaas et al. 1988
Carcass weight	**0.28**	0.31	Quaas et al. 1988
Bones from carcass	0.23	-	-
Carcass fat	0.21	0.28	Quaas et al. 1988
Meat carcass	**0.37**	0.33	Quaas et al. 1988
Ratio bones / meat in carcass	0.22	-	-

For other characters the specified values are between $h^2 = 0.21$ for the quantity of fat from the carcass and $h^2 = 0.34$ for the yield at slaughtering. For the housing weight ($h^2 = 0.28$) and bone/meat ratio of housing ($h^2 = 0.22$), the estimated value are intermediate.

Heritability of characters that depend on the physical structure of the housing. So far the estimated values for the heritability coefficients specific for the characters which determine the physical structure of animal carcasses, indicates a low enough influence of additive genetic variance (table 3).

Table 3 Heritability coefficient estimated for characters on which the physical composition of the housings depend

Character	h^2	Values determined by other authors	
		h^2	Author and year
Neck and shoulder	0.38	-	-
Meat from neck and shoulder	0.29	-	-
Neck and shoulder bones	0.25	-	-
Bones/meat ratio from neck and shoulder	0.25	-	-
Brisket and meatloaf	0.24	-	-
Meat brisket and meatloaf	0.19	-	-
Bones from brisket and meatloaf	0.22	-	-
Bones/meat ratio from brisket and meatloaf	0.23	-	-
Chop	0.21	-	-
Chop meat	0.19	-	-
Chop bones	0.17	-	-
Bones/meat ratio from chop	0.25	-	-
Jigo	0.25	0.22 - 0.54	Wasmmouth, 1972
Jigo meat	0.28	0.25	Wasmmouth, 1972
Jigo bones	0.24	0.25 - 0.33	Wasmmouth, 1972
Ratio bones/meat from jigo	0.21	-	-

Certainly in the context of a high level of heterosis effect, these relatively low values we can consider normal, because over these characters shows stronger genetic variance of the non-additive (dominance, over-dominance, epistasis). The expression of non-additive interactions, for composition of carcasses, justified in terms of those characters, making industrial crossings to increase meat production at sheep in order to obtain a high heterosis effect.

From the data presented it should be noted that at all characters examined, the heritability coefficients determine values at Ţigaie breed are generally small, ranging between 0.17 and 0.38.

Heritability for some sizes of carcasses. Carcass quality depends very much on its dimensions. In a practical way in raising sheep for meat production aims to achieve not too long but broad and globular with the perimeter of the housing and the jigo with the greatest values. All these features are at the level of an appearance of toughness, but also a special appearance and conformation.

Table 4 Heritability coefficient estimated for some housing dimensions

Character	Determined values for h^2
Large length of housing	**0.36**
Small length of housing	0.24
Large length of jigo	**0.42**
Large perimeter of jigo	**0.41**
Small perimeter of jigo	0.24
Carcass width of jigo	0.33
Width of thorax housing	0.31
Carcass chest depth	0.34
Carcass depth at basin	0.20

Particularly important is the fact that in terms of estimated values of heritability coefficients specific to each of the analyzed dimensions, it highlights a good homogeneity of h^2 values for these characters, from where it may come off the notion that their expression is manifested similar additive genetic influences.

Phenotypic correlations between different groups of specific qualities of the period of growth and body development from youth sheep of the Tigaie breed

At the level of an individual's body has been found that many of his characters are developed in conjunction with one another. When changing the value of a character shall entail the amendment of another character, the value of the same body, it is said that these two characters overwhelms (Vintilă, I., 1988). The meaning and the quantity, in which changes occur at the same time the two correlative characters, can be measured using the coefficient of correlation and regression. Correlations between different characters can be of genotypic nature (r_G) or environmental (r_E), but together they give phenotypic correlations (r).

Genetic correlations are caused by the pleiotropic action of some genes, or chaining of different genes. Related to the level and value of correlations in the year 1974 Pipernea, N**.,** highlights the role and importance of them stating the following, "*knowing what genetic correlations are established between different characters has a special importance because it allowed the anticipation of a character's evolution if the selection is made after others*".

The value of correlation and regression coefficients suggests both the intensity of the relationship between two characters and correlative sense, and as one of the characters is changed when the other increases or decreases by one unit. In value, the correlation coefficients can be from 0 to 1 or from 0 to -1 indicating the degree of correlation in effect between two characters. When the value of the correlation coefficient will be very close to 1, it means that between those two characters taken into consideration, there is a very strong and positive correlation is also called functional correlation. When the correlation coefficient has values from 0 to -1, then between the two characters there is a negative correlation.

Between correlation and variance there is a close connection. By squaring the value of the correlation coefficient, we get the coefficient of determination (r^2_y), which shows how much of the variance of a character is influenced by the variance of the other character. In the following tables are presented values of phenotypic correlation coefficients of the main couples of qualities surveyed in the research which has been carried out in order to determine more specific aspects of youth sheep fattening. Knowing the value of the correlation genetic coefficients between characters of zoo-technical interest and economically, it is absolutely necessary for the work of improvement, because with their help you can raise the effect of the selection.

In a situation where two characters of great economic interest are determined in their evolution from the same group of genes, so they are in close genetic correlation, then the selection for both characters is not absolutely useful, but only for one single, because the positive change of one in the desired meaning modifies the other one. The data described below reflect the existence of positive and intense correlations between different groups of character and qualities. However, there were also situations in which between different pairs of qualities negative correlations are established.

In table 5 are presented the values of the correlation coefficients that are established between the weight at birth and the corporal one at different ages, as well as between the weight at birth and the increase of the average daily weight gain.

Table 5 Phenotypic correlation coefficients between the birth weight and the corporal weight at different ages of growth

Couples traits:	**Correlation values**	
Corporal weight at birth	r_{xy}	$\pm s_r$
Corporal weight at 30 days	0.6223	0.0849
Corporal weight at 65 days	0.5714	0.0890
Corporal weight at 75 days	0.5248	0.0923
Corporal weight at 135 days	0.5630	0.0896
Corporal weight at 150 days	0.5602	0.0898

From the data presented we may find that between the calving weight and body weights determined at different ages of youth sheep phenotypic correlations are established whose values are relatively high, but their value decreases slightly with the increase of age. Thus, between birth weight and body weight determined at 30 days, a phenotypic correlation was settled of r = 0.622; and between birth weight and the one determined before slaughter (150 days), the correlation decreases the value r = 0.560. The phenotypic correlations which are established between the body weight at birth and the daily average growth increase determined for various periods, and their amount are reproduced in table 6.

Table 6 Phenotypic correlations between the birth weight and the daily average growth increase

Couples traits :	**Corelation values**	
Corporal weight at birth	r_{xy}	$\pm s_r$
Average daily increase at 30 days	0.4713	0.0957
Average daily increase at 65 days	0.4862	0.0948
Average daily increase at 75 days	0.2760	0.1043
Average daily increase at 135 days	0.3459	0.1018
Average daily increase realized at fattening	0.3433	0.1019
Total average daily increase (150 days)	0.4542	0.0966

Between the birth weight and the average daily gain, the correlations which are established are lower in value. However, the highest value was determined between the birth weight and the average daily gain achieved in the period of breastfeeding, and the most reduced average daily increase achieved in the first 75 days of life were of 0.486 and 0.276 respectively.

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CONCLUSIONS

1. Whereas the process of production of sheep meat is seasonal, the entire production process is strongly influenced by the organizational factors specificto the traditional basins of sheep raising.

2. The phenotypic effects of the heterosis in general depend on the nature of the character, its own genetic population structure, on the line or group of animals participating in the crossings.

2.1. In the conducted researches it was established a higher value for the heritability in the case of determinations for body weight at birth (0.25), at 75 days (0.28) and at 150 days (0.26).

2.2. The most reduced values of h^2 were obtained for the body weight at 30 days (0.17) and at 65 days (0.15).

2.3. The total of these values indicate that the additive genetic factors exerts a great influence in expressing this character, a less highlighted fact from this point of view in the analysis of body weights determined for the period of breastfeeding.

2.4. For meat production it is necessary that the selection of mother sheep to be made also for the quantitative milk production, thus facilitating at weaning for their descendants to have higher body weight until weaning and a more intensive growth pace during the fattening.

2.5. For the carcase weight the determined amount for h^2 was of 0.28, while the ratio of meat/carcass bones (h^2 = 0.22) the estimated values are intermediate as determination.

2.6. The evaluation of properties on which the housing size depend on indicates a high degree of heritability the for length and the perimetre of the jigo (0.41 and respectively 0.42).

3. Between the birth weight and the body weight determined at 30 days, it was settled a phenotypic correlation of r = 0.622; and between the birth weight and the one determined before the slaughter (150 days), the correlation decreases at r = 0.560.

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