NEW RESEARCHES CONCERNING VARIABILITY OF MILK PRODUCTION AT THE MOLDAVIAN KARAKUL EWES

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Abstract

The purpose of this paper was to the revelation of phenotypic correlations of milk production with some morph-productive characters of organism ewe and lamb descendent that influence variability of this production at the Moldavian Karakul ewes. The research was conducted on lactating ewe from flock of sheep of National Institute of Animal Husbandry and Veterinary Medicine from Maximovca village, Anenii Noi district, Republic of Moldova. The ewes milk production was determined by milking control, systematically conducted at every ewe once in 15 days during the whole lactation, according to the Instructions of evaluation of Karakul sheep with improve principles, approved by the Technical and Scientific Ministry of Agriculture and Food. Were investigated correlative connections of the ewes milk production with body weight and skin own qualities (class and type of curls) of the ewe, also with and body weight at birth lamb-descendent and skin qualities (class of evaluation expressed points) in its evaluation marks. It was found, that milk production of Moldovan Karakul ewes is in linear curve relationship with their body weight. This means that with weight gain of ewes up to a certain level (in our case - 60 kg), their milk production is increasing. After reaching the optimum level of body weight, the ewes' milk production tends to decrease. The coefficient value of linear correlation is small and close to zero (r_{xy} = 0.024 - 0.043) but linear curve nature of this relationship is confirmed by the correlation attitude (η_{xy} = 0.186 - 0.285) which is significant (P < 0.05). The ewes milk production is not in physiological (genotyping) relationships antagonistic qualities of their skin, because have been not detected any significant correlations between skin own qualities (class and type of curls) evaluation marks we have at the moment after ewe birth at the age of lamb and its milk production after calving there of. Between the milk production of ewes-mother and the skin qualities of descendents lambs there is a positive correlation, direct linear and significant (r_{xy} = 0.133 ± 0.062; t_r = 2.14; P <0.05). This correlation additive influence on the selection process geared both towards improving milk production and the skin lambs qualities in the flock. Between the lamb body weight at the birth and the ewe milk production, what have been obtained in lactation that following after the birth of this lamb, there is a correlation quite close, directly linear high significance (r_{xy} = 0.460 ± 0.055; t_r = 8.36; P <0.001). The existence of positive correlation between these two important morph-productive characters favoring selection efficiency by both characters, obtaining the additive effect in its improvements. In the researched flock, the coefficient of direct linear regression of the milk production depending on lamb body weight at birth have been was $R_{x/y}$ = 12.20 ± 0.09 kg, what it means, that with increasing of body weight of lambs at birth with 1 kg, the ewes milk production will increase on average by 12.2 kg.

Key words: Karakul ewes, milk production, variability, phenotypic correlation

INTRODUCTION

The ewes' milk production, being of great interest for human consumption, was and is a permanent subject of study and knowledge in order to improve the methods and procedures of the qualitative and quantitative, improvement in the final objective of obtaining economic benefits from the exploitation of sheep for milk.

This problem has been and remains the current at all stages of development of human society in most countries of the world. Problems of improving milk production at the ewes in different races were reflected in multiple research both older [4, 7, 8, 14, 15, 18 to 20, 22, 24, 26-32, 34] and recent [1-3, 10-11, 13, 16, 17, 21, 25].

Unlike other races, the milk production of Karakul ewes has been less studied [2-8, 14, 15, 22, 24, 26, 29, 32, 34], given the fact that they are raised predominantly in arid regions with poor vegetation (desert, semi-desert),

which does not provide a solid basis feed for the development of bone of this production. The milk production per lactation at the Karakul ewes imported from Central Asia to Europe was quite low and amounted from 43.3 kg after some authors [22] up to 50 kg after other authors [7]. At the same time, research has shown that, by means of growth through crossbreeding with other races good sheep milk as well as through improved animal feed, milk production at the Karakul ewes may be raised.

In the Republic of Moldova, the problems Karakul ewes milk production have been studied by T. Nica 1938 [15], Ф. В. Ильев 1966, 1969 [28, 29], Н.И. Богданович, 1985 [26] I. Buzu, Silvia Evtodienco, 2002 [2], Chitanu Ana Silvia Evtodienco, 2006 [5], I. Buzu 2014 [3].

In the research presented above [3] it has been shown that the variability of Karakul ewes' milk production is based on the genotype of parents and, largely, environmental conditions, in particular, the basic feed and animal nutrition, calving period.

The milk production is a polygenic character with a low heritability and is in various direct or indirect links correlative with a string of other morph-productive characters. These correlative links acting additive or non-additive greatly influences the variability of milk production and efficiency selection sheep after this morph-productive very important character. At the same time, some correlative relationships of milk production with other morph-productive characters of ewe organism and lamb descendent, until now, not sufficiently studied.

Deeper knowledge of these relationships Karakul ewes has a current scientific problem, solving which would increase efficiency selection sheep by milk production.

In this context, the aim of this paper was the revelation of phenotypic correlations of milk production with some morph-productive characters of ewe organism and lamb descendent that influence variability of this production at the Moldavian Karakul ewes.

MATERIAL AND METHOD

The research was conducted on lactating ewes from flock of sheep of National Institute of Animal Husbandry and Veterinary Medicine from Maximovca village, Anenii Noi district, Republic of Moldova.

Ewes' milk production was determined, according to the Instructions of evaluation of Karakul sheep with amelioration principles, approved by the Technical and Scientific Council of the Ministry of Agriculture and Food [9], by milking control, systematically conducted at every ewe once in 15 days during the whole lactation, according to the method of T. Nica [15].

Technical principle of control of milk production, performed by this method, is that ewes shall be subject to milking control once a day, usually in the morning. To determine the quantity of milk produced by ewe all day control, the quantity of milk produced on the morning control is multiplied by the *coefficient control*. This coefficient is determined by the formula:

$$K_c = \frac{P_t}{P_d} \cdot C_r$$

were:

K_c – coefficient control;

P_t – the total amount of milking milk of lactating ewes in control day;

P_d - the total amount of milking milk of lactating ewes in morning control day;

C_r – coefficient of milk retention:

- for ewes with infants lamb C_r=1.3;

- for ewes the first two weeks after weaning lambs C_r=1.2;

- for other lactating ewes C_r=1.0.

For control the amount of milk, each individual ewe was milked in the cup, then, milk was weighed on electronic scales with capacity of 1000 g, after the milk was poured into container storage.

Data on the registration number of each milking ewes and amount of milk milking at the control have been entered in Sheet control of milk production (F-8K). Subsequently, control data sheet, the amount of milk milked in control day, were transcribed in the Register of Karakul ewes milk production (F-7K), were have been conducted individual calculation of each sheep milk production in each control period.

By summing calculated quantity of milk in all periods was deducted control of each ewes' milk production throughout lactation.

In autumn, after the cessation of milking all lactating ewes (October) were conducted totals of milk production throughout lactation of each ewes individually.

Variability of ewes milk production have been studied depending on body weight, grade and type of curls of a ewe, a lamb body weight at birth and skin qualities (class) thereof.

The value of phenotypic correlation coefficients linear (r_{xy}) and attitude correlation (η_{xy}) between ewe milk production and ewe and lamb morpho productive characters they were determined using computer software "STATISTICA - 6". The data obtained were processed statistically Research and appreciated their certainty, according to statistics biometric variation after methods Плохинский Н.А., 1969 [33].

RESULTS AND DISCUSSIONS

In our research showed interest in the first place, the results correlative links revelation of ewes' milk production with such important morph-productive characters as, body weight and skin own qualities (class and type of curls) of ewe and weight body of descending lamb at birth and its skin qualities to the evaluation marks.

A number of researchers (V. Tafta, D. Georgescu, D. Ionescu, 1962 [23] M. Mochnacs, C. Stefanescu, 1973 [12] V. Tafta I. Vintila, Stela Zamfirescu, 1997 [24]) ascertained a tendency for of positive correlation between the amount of milk and ewes body weight (r_{xy} = 0.039 to 0.12). Although this correlation is rather low, varying according to multiple internal and external factors, the authors conclude that among these productions (characters) there are in a physiological antagonism with an appropriate level of food.

Our research showed that milk production of Moldavian Karakul ewes is in linear curve relationship with their body weight (Table 1).

Table 1 The milk production of Moldavian Karakul ewes depending on their body weight

Body weight of ewes, kg	N	The milk production on lactation, kg			
		M ± m	σ	C_v, %	Max
Year 2002					
> 60	16	72.23 ± 4.21	16.65	23.1	101.9
55 – 59.9	35	74.16 ± 3.50	20.51	27.7	144.7
50 – 54.9	36	70.64 ± 3.65	16.58	23.5	116.9
< 50	21	69.20 ± 2.69	15.89	23.0	106.2
Average = 54.8	108	71.85 ± 1.62	16.89	23.5	144.7
Year 2004					
> 60	17	77.86 ± 4.95	20.41	26.2	118.5
55 – 59.9	51	82.26 ± 2.81	20.15	24.4	139.0
50 – 54.9	26	79.48 ± 4.19	21.43	26.9	133.9
< 50	16	72.35 ± 3.20	21.47	29.6	99.5
Average= 55.7	135	79.30 ± 1.68	19.49	24.6	139.0

This means that with the increase of the body weight of the ewes up to a certain level, their milk production is increasing. After reaching the optimum level of body weight, ewes' milk production tends to decrease.

Found that with increasing body weight ewes from 45 to 60 kg, their milk production increased slightly: in 2002 this increase was insignificant - from 69.20 ± 2.69 kg to 74.16 ± 3.50 kg, or 7.2% (P> 0.1), and in 2004 the increase was significant -from 72.35 ± 3.20 kg to 82.26 ± 2.81 kg, or 13.7 % (P < 0.05).

With further increase in body mass of 60 kg ewes up their milk production has a slight downward trend. This phenomenon is confirmed by the fact that both in 2002 and in 2004, record production of ewes' milk was recorded in average body mass, but not in those with major body mass.

Therefore, the relationship between body weight of ewes and their milk production has a linear curve character, which is observed more evident in the graph in Figure 1.
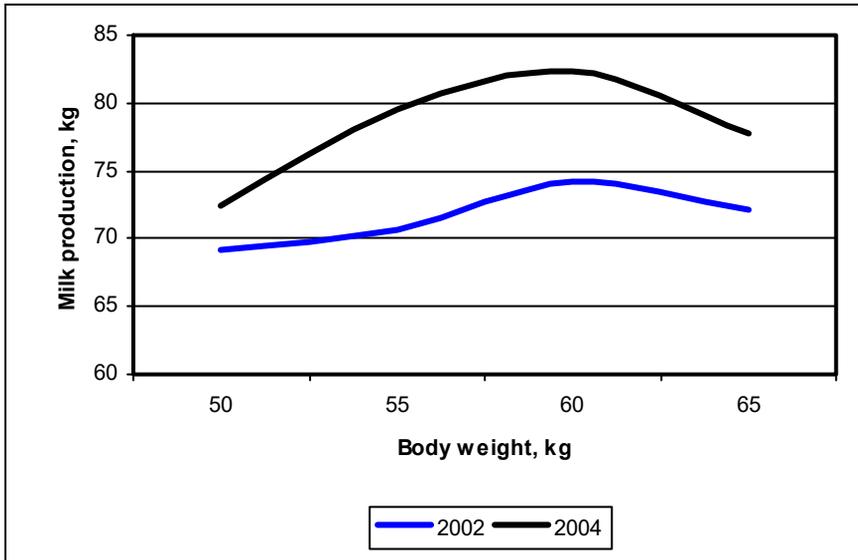
Fig. 1 The attitude of correlation of Moldavian Karakul ewes' milk production
depending on their body weight

Since the value of linear correlation coefficient (r_{xy}) approaches zero and does not reflect the reality of this relationship correlative we calculated the correlation attitude (η_{xy}), which indicates existent or inexistent linear curve correlation between body mass of ewes and their milk production (Table 2).

Table 2 Coefficient of linear correlation (r_{xy}) and the attitude of correlation (η_{xy}) between body weight of Moldavian Karakul ewes and their milk production

Year	N	Linear correlation $r_{xy} \pm m_r$	t_r	The attitude of correlation $\eta_{xy} \pm m_\eta$	F_{st}
2002	108	0.024 ± 0.096	0.25	0.186 ± 0.034	1.40
2004	135	0.043 ± 0.086	0.50	0.285 ± 0.081	2.20

As demonstrated in the histogram curve, attitude correlation between ewes body mass and their milk production is basically positive, but also warns us that, with increasing body weight over 60 kg ewes in this population (flock) of sheep may be a decrease of milk production value.

From these findings, we can deduce the conclusion that the selection of Moldavian Karakul ewes towards increasing body weight up to a certain optimum, specific for each flock in part (in our case - to 60 kg), contribute to increased ewes milk production ewes. Knowledge of this correlative relationship has great importance for selector which makes sheep selection towards improving milk production and body weight.

For karakulisters has a particular interest the compatibility of own qualities of ewes skin with their milk production.

Because the ewes skin qualities are appreciated, generalized and reflected in their class evaluation marks at their age lamb, examination of milk production according to it is only possible at least at the age of 23 months, after the first calving. We must mention that the appreciation of Karakul ewes milk production according to own quality skin is quite important because in practice, meet people skeptics who suppose the existence of incompatibilities between these two morph-productive characters. Assessment results in milk production ewe class are shown in Table 3.

Table 3 Milk production of Moldavian Karakul ewes depending on their class

Class ewes	N	Their milk production, kg			
		M ± m	σ	C_v, %	Max
Elite	50	74.99 ± 5.11	36.10	48.1	148
Class I	135	71.25 ± 2.59	30.09	42.2	167
Class II	58	72.16 ± 4.62	35.13	48.6	151
Average flocks	243	72.36 ± 2.17	33.75	46.6	167

Data analysis research showed that significant differences between ewes milk production of different classes of evaluation have not been registered, because certainty coefficient of these differences is below the zero threshold of probability theory without error after Student forecasts (P > 0.1). It was noticed only a slight higher productivity elite class ewes, compared with their congener classes I and II, but this difference is not significant.

The lack of certain regularities ewes' milk production according to their qualities of skin (class for evaluation marks) is confirmed by the fact that milk production record was not obtained in class elite group of sheep, but in lot of class I sheep, which on average have had the highest milk production. In parallel with research of milk production depending on the ranking, we examined the relationship of this productive character with type of curls of a ewe (Table 4).

Table 4 Milk production of Moldavian Karakul ewes depending on their type of curls

Type of ewes curls	N	Their milk production, kg			
		M ± m	σ	C_v, %	Max
Jachet	87	73.12 ± 3.65	34.07	46.6	155
Costal	80	71.00 ± 3.61	32.23	45.4	167
Plat	23	72.66 ± 6.29	30.15	41.5	148
Kaukazian	53	72.68 ± 4.80	34.96	48.1	151
Average flock	243	72.36 ± 2.17	33.75	46.6	167

Research results have shown that slight tendency to higher milk productivity ewes with type of curls jacket is not significant because the level of certainty of difference, after the development of this character between this lot of ewes and other congener lots with curls types costal, flat and kaukazian, does not reach the threshold zero of probability theory forecasts without error after Student (P> 0.1). Therefore, ewes' milk production does not have any relationship to the type of their curls.

Based on these researches we can conclude that sheep milk production does not depend on their own qualities of skin they have at the time of evaluation marks after birth at the age of lamb. In the same sense we can say that milk production of Moldavian Karakul ewes is not in physiological (genotyping) antagonistic relations with qualities of their own skin, what is important for selection without impediment of sheep population towards improving the level of productivity of both characters (productions) selection.

The milk production, is maternal morph-productive character, is closely linked to physiological processes triggered mammary gland as a result of fetal development during pregnancy.

The development of the mammary alveoli (mamo-genesis) occurs when the contents of hormones of placental origin (estrogens) and placental hormone (lactogen) increases, as a result of fetal development. Lacto-genesis itself is defined as a period of differentiation of mother epithelial cell, during which enhances synthesis of specific components of milk (V. Taftă, 1997 [24]).

Given that the Karakul race specific qualities of lamb skin forms in the last third of gestation of his mother, presents particular interest physiological processes of interrelation with the fetal development of the mammary gland regeneration and restoring its lactogen capacity, which determines the milk production.

In this context, we investigated the relationship between the amount of ewes milk and skin qualities of descendants - lambs (Table 5).

Table 5 Milk production of Moldavian Karakul ewes depending on the quality of the skin descendant lambs

Class lamb (points)	N	The milk production of mother - ewes, kg			
		M ± m	σ	C$_v$, %	Max
Elite (9, 10)	27	84.30 ± 6.29	32.75	38.8	158
Elite (8)	52	78.89 ± 4.95	35.68	45.2	166
Class I (5, 6, 7)	120	72.38 ± 3.23	35.41	48.9	149
Class II (3, 4)	44	73.93 ± 6.35	42.13	57.0	154
Brac (1, 2)	2	65.00 ± 37.5	53.03	81.5	118

Research results demonstrate that the sheep that gave birth to lambs with superior qualities of skin, usually, have a higher milk production.

Thus, the ewes that have born lambs elite class have a higher milk production compared with lambs born congener that class I, II and brac (P <0.1). With the increase of score skin qualities lambs from 1-2 points to 10.9 points, milk production increased from 65.0 to 84.3 kg.

The correlation coefficient of ewes milk production with score qualities of skin lambs -descendants is $r_{xy} = 0.133 ± 0.062$. Although the correlation between these two characters is poor, however, the correlation coefficient is significant (t r = 2.14) and corresponds to one threshold of probability theory without error after Student forecasts (P <0.05).

The correlation between milk production of ewes' mothers and qualities of skin of lambs -descendants is weak positive and direct linear. Because, in both cases, we have made calculation of correlation coefficient of milk production on the qualities of skin lamb -descendants and, vice versa - the qualities of skin lamb descendants depending on milk production ewes-mothers, the same result was obtained. This correlation additive influence on the selection process geared both towards improving milk production and the qualities of the skin of lambs in the flock.

Based on the same principle, that mammary gland development and training of its lactogen capacity is closely connected placental with fetal development, we investigated the relationship of ewes' milk production based on the body mass of descending-lambs at birth (Table 6).

We found that between lamb body weight at birth and ewes' milk production, obtained in lactation following after the birth of this lamb, there is a relatively strong relationship.

Table 6 Milk production of Moldavian Karakul ewes depending on the body weight of lamb - descendants at birth

The lambs' weight at birth, kg	N	The milk production of mother - ewes, kg		
		M ± m	σ	C$_v$, %
> 6.5	10	95.67 ± 3.11	7.61	8.0
5.5 – 6.4	51	83.10 ± 3.94	18.05	21.7
4.5 – 5.4	89	75.00 ± 2.70	24.07	32.1
3.5 – 4.4	50	62.13 ± 2.35	21.06	33.9
< 3.5	17	52.06 ± 4.08	16.83	32.3

Thus, at the batch of ewes that gave birth to lambs with body weight less than 3.5 kg was obtained the lowest milk production - 52.06±4.08 kg. From ewes that gave birth to lambs with body weight over 6.5kg was obtained highest production of milk-95.67±3.11 kg. With the weight gain of lambs from 3.5 kg to 4.5 kg, the production of ewes - mothers milk, increased from 52.06 to 62.13 ± 4.08 kg ± 2.35 kg, or 19.3% (P<0.05).

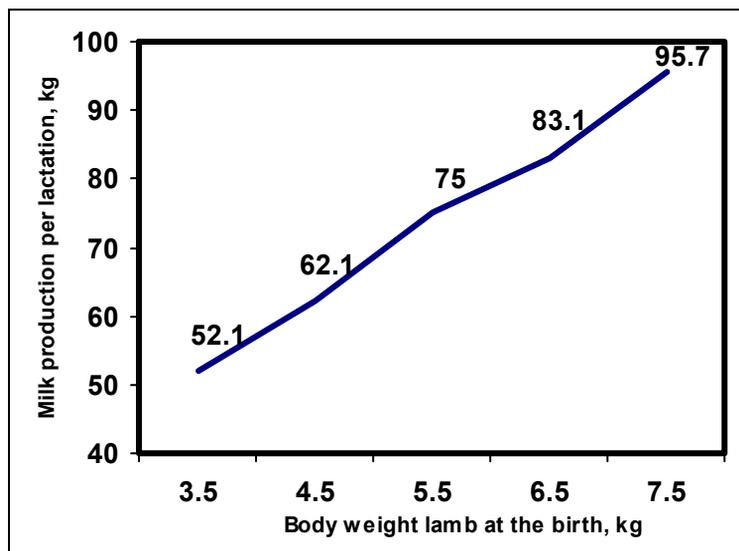This correlation can be viewed obvious from the chart diagram (Figure 2).

Fig. 2 Correlation of milk production of ewes-mothers with body weight of lamb at the birth

The diagram shows that, with advancing body mass of lambs at birth from 4.5 kg to 5.5 kg, the milk production ewes-mothers also increased from 62.13 ± 2.35 up to 75.00 kg ± 2.70 kg, or 20.7% (P <0.001). The following, with the development lambs from 5.5 kg to 6.5 kg, the milk production of ewes-mothers increased from 75.00 ± 2.70 kg ± 3.94 kg to 83.10, or 10.8% (P <0.1). And further, with increasing body mass of lambs at birth from 6.5 kg above the average milk yield of ewes increased from 83.10 ± 3.94 kg up to 95.67 ± 3.11 kg, or 15.1% (td = 2.5, P <0.05).

The correlation coefficient milk production of sheep with a lamb body weight at birth has a middle value ($r_{xy} = 0.460 \pm 0.055$) and quite significant ($t_r = 8.36$; P <0.001), corresponding to the highest threshold of certainty according to probability theory without error after Student forecasts.

Therefore, the correlation milk production of ewes with lambs at birth body weight has a positive and direct linear character, because the calculation of correlation coefficient of milk production based on the body weight of lambs at birth and vice versa - body weight of lambs at birth based on ewes milk production in lactation after calving below lambs-descendants, achieve the same result.

The existence of these positive correlations between two major morph-productive characters favor selection process and its effectiveness, because, making selection after a character, obtain additive effect in relieving another character. More than that, the selector, calculating linear regression coefficient, can determine the effect of selection and planning (forecast) results. In the flock researched by us, direct linear regression coefficient of milk production based on body weight of lamb at birth $Rx/y = 12.20 \pm 0.09$kg. This means that, with increasing body weight of lambs at birth with 1 kg, the ewes milk production will increase on average by 12.2 kg.

Knowledge of biological particularities of ewes lactation Moldavian Karakul studding genotypic and phenotypic correlation of this character from respective flock, with morph-productive characters examined above, will allow zoo technical specialist to guide the process of population genetic improvement in the optimal direction, additive to selected morph-productive characters.

CONCLUSIONS

1. The milk production of Moldavian Karakul ewes is in linear curve relationship with their body weight. This means that with weight gain of ewes up to a certain level (in the sheep population studied, this level is 60 kg), their milk production is increasing. After reaching the optimum level of body weight,

the ewes' milk production tends to decrease. Linear correlation coefficient value is close to zero (r_{xy} = 0.024 - 0.043) and does not reflect the reality of this correlative links. Linear curve nature of this relationship is confirms by the attitude of correlation (η_{xy} = 0.186 to 0.285) which is significant (P <0.05).

2. The milk production of Moldavian Karakul ewes are not in antagonistic physiological relation with qualities of their skin, because they were not detected any significant correlations between skin's own qualities (class and type of curls) that have the evaluation marks time after birth at the age lamb of ewe and milk production after calving thereof.

3. Between milk production and qualities of ewes - mother and qualities of skin of descendents lambs are weak positive correlation, linear direct and significant (r_{xy} =0.133 ± 0.062; t_r = 2.14; P <0.05). This correlation additive influence on the selection process oriented both towards improving milk production and the qualities of the lambs skin in the flock.

4. Between the lamb body weight at birth and sheep milk production, lactation obtained following after the birth of this lamb, there is a correlation quite close, direct linear high significance (r_{xy} = 0.460 ± 0.055; t_r = 8.36; P<0.001). The existence of these positive correlations between two major productive morphological characters favor the selection process and its effectiveness, because, by carrying out after a character, get the additive effect and improving other character. In the studied flock, the coefficient of direct linear regression of milk production directly depending on body weight at lamb birth is $R_{x/y}$ = 12.20 ± 0.09kg, what it means, that with increasing of lambs body weight at birth with 1kg, the milk production of ewes will increase on average by 12.2 kg.

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