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SELECTION OF MOLDOVAN KARAKUL SHEEP BY THE BODY WEIGHT

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Abstract

The research purpose was the factors which determine the variability of Karakul sheep body weight, heritability degree identification and repeatability of this character, determining the selection efficiency of the sheep by this important character. The research has been made on the Moldovan Karakul sheep flock INZMV, village of Maximovca, Anenii Noi district. The body weight of the sheep was determined with technical weighing scales: at birth, 20-90 days, at 6-18 months, adult age, annually. The research has shown that the body weight of Karakul sheep has a decisive impact on meat production and on fur skin surface obtained from new-born lambs. Thus, from the rams of 6 months, which were intensively fatted, with body mass 35-36 kg, it were obtained carcasses of 16.6 ± 0.3 kg, of R and U categories, according to UE classification scale. The slaughter yield of these ram lambs was 47.5 %. From reformed sheep, which were intensively fatted, with body mass of 64-65 kg, were obtained massive carcasses, with weight of 32.3 ± 1.0 kg, reported to R and U categories, according to UE classification scale. The slaughter yield of these sheep was 54.8 %. It has been found that, as bigger are the lambs at birth, that bigger is the standard surface of the fur skins. With increasing of lambs body weight at birth from 3.9 up to 4.4 kg, the share fur skins with big surface (> 1400 cm^2),increase from 28.2 % up to 63.8 % or 2.3 times (P < 0.001). With further increase of lambs body weight up to 5.4 kg, increase substantially the share of fur skins with very big surface (> 1800 cm^2), from 15.3 % up to 91.4 % or with 6.0 times (P < 0.001). Phenotypic correlation coefficient (r_{xy}) between body weight of Karakul lambs and standard surface of fur skins is: $r_{xy} = 0.64 \pm 0.04$ (n_{st} = 10-15-22; P < 0.001). From corpulent parents it were obtained progeny with a big body weight. The rams with big body weight 86-100 kg have given progeny with high body weight at birth of 5.16 ± 0.03 kg, rams with average body weight of 71- 85 kg, have given progeny with average body weight of 4.78 ± 0.04 kg, and rams with low body weight of 60 – 70 kg, have given progeny with lowest body weight – 4.45 ± 0.04 kg. The progeny of corpulent rams exceeded, after the body weight at birth, the progeny of average rams with 0.38 kg or 7.9 % (P < 0.001) and of the small ones with 0.71 kg or 16.0 % (P < 0.001). This shows that between body weight of ram fathers and body weight of lambs progeny exist a positive genotypic correlation. In good years with sufficient vegetation on the pasture, the body weight of the sheep achieved a high level, and was on average at breeding batch: at adult rams – 92.6 ± 3.0 kg, at sheep jelly – 57.8 ± 0.3 kg, at rams of 18 months – 63.6 ± 5.5 kg, at sheep of 18 months - 53,1 ± 0,4 kg, being significantly higher, than in bad years, respectively, with 11.7% (P < 0.05), 14.8% (P < 0.001), 16,1% (P < 0.05) and 7.6% (P <0.001). Based on the research results, it were made following conclusions: body weight of Moldovan Karakul sheep is one of the most important morph productive selection characters, because it has a direct impact on both, the meat production and on fur skins surface obtained from lambs at age of 2-5 days after birth; the internal factors which treat the phenotypic variability of body weight, the most important is heredity (genotype), and of external factors – nutrition and feeding (forage base); sheep of Moldovan Karakul type are more precocious, comparing to sheep of Asian Karakul, which represents one of the interior biological particularities of this interracial type of sheep. This type of sheep continue to grow in body until the age of 2.5-3.5 years. Selection of Moldovan Karakul sheep after the body weight is modestly efficient, thanks to heritability and moderate repeatability of this character. The coefficient of body weight heritability is not very high (h^2 = 0.3), but quiet (t_r = 2.6; P < 0.01). The coefficient of body weight repeatability (r_w) at different age of young sheep and adult sheep varies within the precinct of 0.23 – 0.47.

Keywords: *body weight, sheep, Moldovan Karakul, heritability, repeatability.*

INTRODUCTION

The Karakul race sheep has a number of biological morpho-productive features, one of which is basic and refers to the unique, very beautiful fur skin of the new-born lamb, slaughtered at 1-5 days after birth. For its value, it is considered a luxury fur skin, located in the same row as the noblest natural furs (sable, mink, fox). This is explained by the superior aesthetic ornamental qualities of the loops, excellent silky aspect of follicle sheath, perfect thermal features, as well the durable resistance to exploitation of fur skin apparel. For these reasons, the lambs fur skin in first days after birth is considered, so far, primary and important main production of Karakul race sheep, reared in Central Asian countries, South-West Africa and in other geographical worlds regions.

Multiple research in this area (Adametz, 1927; Bosânciuc and Taftă, 1997; Hundt, 1954; Ильев, 1957; Васин, 1971; Pascal, 2007; Ştefănescu et al., 1973; Иванов, 1914; Ursu and Romanescu, 1997; Абдиваитов, 1978; Абуов, 2010; Алимбаев, 2011; Аралбаев, 2011) demonstrate that the sheep selection of this breed in nominated areas, is done, mainly, according to fur skin qualities, not paying attention to the other animal morph-productive characters. Subsequently, other countries in other regions of the world (Kechawartz, 1957;

Nicov, 1936; Taftă et al., 1997; Бастаев, 2010) were carried out research also for other morph-productive characters of this sheep breed, especially for the milk and meat production.

The research accomplished by some notorious scientists (Дюсегалиев, 2010; Ескара, 2011), at the beginning of the XXth century, have shown, that, at this stage of spreading Karakul race sheep in Europe and other geographic regions of the world, the relative economic value of the fur skin, occupies the first place by share (56.4 – 60.4%) in total income, obtained from a sheep per year. Of this share, results the conclusion that the fur skin production was indeed, by then, primary and very important.

Comparing the results of our current research (Иванов, 1914), to scientific research from a century ago, we ascertain that the situation has changed entirely, since the economic value of fur skin production, taken together with the lamb, as related production in the mixed version of the sheep exploitation, occupies a share of only 11,8% in the total income, obtained from a sheep per year. In this context, the fur skin production being one of the selection characters of Moldovan Karakul race, although it remains paramount and cannot be considered principal. At the same time, we observe that, in this period of time, the meat production of Karakul sheep, according to the share of economic value, in the total income obtained from a sheep per year, has been moved from the last place - with the share of 2.6%, to second place (by milk production) - with a share of 27.1%, exceeding, thereby, with 2.3 times the economic value of the fur skin character. According to the economic value, the fur skin of Karakul lamb (the price of the fur skin), currently, in the Republic of Moldova, is equivalent with just 2.33 kg of meat in the carcass. Such transformations of economic value of Karakul race selection characters had happen, over time, also in other geographic regions of the world. In order to compare, we specify that, according to research from Kazakhstan (Бастаев А.У., Онкуляев М.А., 2003; Бастаев, 2010), the price of one Karakul fur skin, in this country, is equivalent with 2.0 kg of carcass meat.

In these economic conditions, the body mass of Karakul sheep, which determines the meat production, becomes one of the main characters, which are currently selected.

At the same time, in the special literature of this field (Плохинский, 1969; Шефер, 1977; Юлдашбаев, 2009), there is not sufficient information on body weight at Karakul race sheep and selection results according to this feature of the sheep populations. Therefore, the research and study of the factors that treat the body weight variability of Karakul sheep, identification of heritability and repeatability degree of this morph-productive character, determination of the efficiency of the sheep populations selection after this important character, is a quite actual issue.

MATERIALS AND METHODS

The research has been carried out on the livestock of Moldova Karakul sheep from Experimental Section of the National Institute for Animal Science and Veterinary Medicine (INZMV), v. Maximovca, district of Anenii Noi.

The body weight of the sheep was determined permanently, in accordance with the Assessment Instructions of Karakul sheep, with amelioration principles in Republic of Moldova (1996).

Youth sheep was weighed several times per year, at different ages, with different technical scales. The lamb was weighed at birth with hand scale, according to the new system, recommended by us (Buzu, 2012). At the age of 20 days, the lambs were weighed individually, with the technical medical scale for weighing children, with capacity up to 15 kg and accuracy gradation of 0.01 kg. From the age of 3 months, the youth sheep, and adult sheep, were weighed individually at the technical scales with capacity up to 150 kg and with accuracy gradation of 0.1 kg.

In order to carry out the sheep weighing, on the scale shelf, was installed and attached a narrow cage with two doors (incoming and outgoing). The cage dimensions were provided, to fit a tightly closed hornless ram (horned rams were weighed separately in a bigger cage). This sheep cage was entered voluntary at the door, after it was closed immediately.

In order to ensure the conditions for voluntary entry of the sheep in the cage, in front of the

scale was arranged another enclosure which fit 50 sheep with pen and hall to entry. At the cage exit was arranged another enclosure with a capacity of 50-200 sheep. At the simultaneous opening of the doors, the sheep from the entry hall, seeing through the cage the sheep from the opposite enclosure (outgoing), enters voluntary the cage, after which the doors would be closed immediately. After weighing, at the opening of the exit door, the sheep went out freely of the cage. This weighing system allowed the examination of appearance and constitution of the animal, the animals weight registration, without its injury, contributing to relief the staff work and increase its productivity.

According to the instructions in force, in addition to weighing the youth sheep, whole sheep population of all ages, was weighed in fall, at the end of October, after which, was started the season of sheep insemination, according to the elaborated mating plan. The data of sheep weighing and notes of their appearance and constitution defects identifications, were recorded in the Register body weight evidence of Karakul sheep (F-10K).

The data obtained, as a result of investigations were statistically processed, using computer software „STATISTICA – 6" and evaluated their certainty, according to variation biometric statistics, by methods of Плохинский, 1969.

RESULTS AND DISCUSSIONS

Results of the research have shown that body weight of Moldovan Karakul sheep, presents one of the most important morpho-productive character, given that it has a direct impact, both on the meat production, derived from the slaughtered animals carcasses, as well as on the fur skins surfaces obtained from the lambs slaughtered at the age of 2-5 days after birth.

Despite the fact that, according to the communications of Дъячков, 1980, the body weight of Karakul sheep of Asian type, compared to other breeds, is relatively low (live weight of the ewes constitute 40-45 kg, of the rams - 50-60 kg), the meat production cannot be neglected, because it complements significantly the food ration of human population.

In the Republic of Moldova, the meat production of Moldovan Karakul sheep comes from raw lambs carcasses slaughtered for fur skin (3.3-3.8 kg per carcass non-beheaded), from youth sheep carcasses (with unsatisfactory fur skin qualities) grown and fattened for meat, until the age of 6 or 18 months, as well from adult sheep carcasses, recast and removed, for various reasons, out of reproductive cycle of the flock (Table 1). Due to the fact that Moldovan Karakul sheep have a more massive development, compared to Asian type, from them will be obtained also a quite good meat production. The research has shown that, since the youth sheep of six months, with body weight of 28-32 kg (ewes) can be obtained carcasses with average weight of 12.7 ± 0.24 kg, of C category, according to EU classification grid (Pascal, 2007).

Table 1. Body weight and meat production potential of Moldovan Karakul sheep

Specification	Youth sheep of **6** months		Recast sheep	
	ewes	fattened ram lambs	Non fattened	Fattened
Body weight before slaughter, kg	28.6 ± 0.46	35.8 ± 0.3	50.0 ± 0.12	64.6 ±1.1
Carcass weight, kg	12.7 ± 0.24	16.6 ± 0.2	22.3 ± 0.49	32.3 ± 1.0
Inner fat with kidneys, kg	0.1 ± 0.05	0.4 ± 0.1	2.0 ± 0.11	3.1 ± 0.4
Slaughter weight, kg	12.8 ± 0.33	17.0 ± 0.2	24.3 ± 0.57	35.4 ± 1.0
Slaughter yield, %	44.8	47.5	48.6	54.8

The slaughter yield of the animals is 44.7%. From ram lambs of 6 months, intensively fattened, with body weight of 35-36 kg, can be obtained good and very good carcasses, with a weight of 16.6 ± 0.2 kg, of R and U categories, fat and medium fat, according to EU classification grid. The slaughter yield of these ram lambs is 47.5%. Youth sheep carcasses, of C, R and U categories, are among the most requested for export, including for EU. From

the adult recast non fattened ewes, with body weight before slaughter of 50 kg, it may be obtained mediocre and quite good carcasses, with the weight of 22.3 ± 0.49 kg, reported to the types P and O, according to EU classification grid. The slaughter yield of these ewes is 48.6%.

From recast and intensively fattened ewes, with the body weight, before slaughter, of 64-65 kg, it may be obtained massive, good and very good, fat and very fat carcasses, with the weight of 32.3 ± 1.0 kg, reported to the types R and U, according to EU classification grid. The slaughter yield of these sheep is 54.8%. Recast sheep carcasses of category P, O, R and U are required for export, particularly, to Arab countries.

At the same time, the body weight of Karakul sheep has particular importance to obtain fur skins of large surface, because, on third equal terms, the fur skin's surface determines its commercial value.

The research demonstrates that the lamb body weight at birth has a direct and positive correlation with fur skin surface, obtained at slaughter (Table 2).

Table 2. Relation between body weight of Moldovan Karakul lambs at birth and standard surface of fur skins obtained from them

Body weight of the lambs at birth, kg	Number of lambs	Including fur skin surface (cm^2):									
		< 999		1000 - 1399		1400 - 1799		1800 - 2199		> 2200	
		pieces	%	pieces	%	pieces	%	pieces	%	pieces	%
> 5.5	14	-	-	-	-	-	-	-	-	14	100
5.0 – 5.4	35	-	-	-	-	-	-	32	91.4	3	8.6
4.5 – 4.9	57	-	-	-	-	34	59.7	19	33.3	4	7.0
4.0 – 4.4	47	-	-	5	10.6	30	63.8	12	25.5	-	-
< 3.9	39	6	15.4	15	38.4	11	28.2	6	15.3	1	2.6
Total	**192**	**6**	**3.1**	**20**	**10.4**	**75**	**39.1**	**69**	**35.9**	**22**	**11.5**

From the presented data, it is evident, that, as more the lambs at birth are bigger, the standard surface of the fur skins is larger. It was found, that the largest surface have had the fur skins obtained from lambs, with body weight, at birth of over 5.5 kg. The lambs of this batch had the fur skins over 2200 cm^2. Also, lambs with body weight of 5.0-5.4 kg had fur skins of very large surface (> 1800 cm^2). The fur skins with the surface less than 1800 cm^2, in these batches of lambs, were not at all. The lambs, with the body weight at birth of 4.5-4.9 kg have, mostly, (59.7%) fur skins with large surface (> 1400 cm^2) and 40.3% fur skins with very large surface.

The lowest surface of the fur skins was obtained from small lambs, with body weight at birth < 3.9 kg. Among fur skins obtained from lambs of this batch, it were 38.4% with middle surface (900-1400 cm^2) and 15.4%, with small surface (700-900 cm^2).

It was found that, with increasing of lambs body weight at birth, from 3.9 to 4.4 kg, the yield of fur skins with the medium surface decreases from 38.4% to 10.6% or 3.6 times (P < 0.001), and of fur skins with large area, increase from 28.2% to 63.8% or 2.3 times (P < 0,001). With further growth of lambs body weight at birth from 3.9 to 5.4 kg, substantially increase the share of fur skins with the very large surface, from 15.3% to 91.4% or 6.0 times (P < 0.001) and entirely disappears the share of fur skins with small and medium surface.

The phenotypic correlation coefficient (r_{xy}) between Karakul lambs body weight at birth, and the standard surface of fur skins obtained from these lambs is $r_{xy} = 0.64 \pm 0.04$ (n_{st} = 10-15-22). The certainty significance of the correlation coefficient has the highest probability threshold of forecasts without error (P < 0.001).

Proceeding from these considerations, the Moldovan Karakul sheep body weight was included in the genetic amelioration process of this type of sheep populations, as one of the most important selection characters at all stages, starting from assessment (1-2 days after birth), at the age of 20 days, 3 months (weaning), 6 months, 18 months and, annually, at the adult age.

The body development of Karakul sheep, as the other races, depends on both internal factors, especially, heredity (genotype, breed, line), as

well as external ones, especially on food factors (Ursu and Romanescu, 1997; Нел, 1975; Юлдашбаев, 2009).

Our research has shown that from corpulent parents (with a big body weight) are obtained descendants, with the body weight also big. Ewe and ram from ascendants with a big body development have heritable genetic capabilities of producing corpulent descendants. Mating the ewes with corpulent rams, contributes to obtain corpulent lambs (Table 3).

Table 3. Body weight of Moldovan Karakul lambs at birth, depending on body development of father rams, kg

Father-rams, kg			Lambs (descendants) at birth			
No. batch	n	Body weight., kg	n	M ± m	σ	C_v, %
1	7	86 - 100	581	5.16 ± 0.03	0.84	16.2
2	4	71 - 85	487	4.78 ± 0.04	0.86	17.8
3	6	60 - 70	517	4.45 ± 0.04	0.93	20.9

The research results have shown that, in one and the same flock, under equal conditions of growth and maintenance, from corpulent rams of Ist batch, with a mass of 86-100 kg, was obtained the most corpulent progeny with the body weight at birth of 5.16 ± 0.03 kg; from rams of IInd batch, with middle body weight, of 71 - 85 kg, was obtained progeny with medium body weight of 4.78 ± 0.04 kg and from rams of IIIrd batch, with body weight less than 60 - 70 kg, was obtained progeny with the lowest body development – 4.45 ± 0.04 kg.

The progeny of the corpulent rams of I_{st} batch exceeded, by body weight at birth, their fellows of IInd batch with 0.38 kg, or 7.9% ($P < 0.001$), and those of IIIrd batch with 0.71 kg, or 16.0% ($P < 0.001$). Lamb-descendants of the rams from IInd batch (with the body weight of 71 - 85 kg), exceeded, by body weight at birth, their fellows of IIIrd batch (descendants of rams with body weight of 60-70 kg) with 0.33 kg, or 7.4% ($P < 0.001$). It demonstrates that between body weight of father-rams and body weight of lambs-descendants at birth, there is a clear genotypic correlation. The heritability coefficient of body weight is not high ($h^2 = 0.3$), but quite significant ($t_r = 2.6$; $P < 0.01$).

The body weight of Moldovan Karakul lambs at birth has a quite evident repeatability at different ages and periods of development of youth sheep, and subsequently at the adult age. The repeatability coefficient value (r_w) of body weight, at different ages of the youth sheep, as well of the adult sheep, varies within the limits of 0.23-0.47 (Table 4).

Table 4. Genetic repeatability ($\mathbf{r_w}$) of body weight at Moldovan Karakul youth sheep

Age of youth sheep	Repeatability coefficient value, $\mathbf{r_w \pm m_r}$	Certainty coefficient, $\mathbf{t_{rw}}$	Certainty threshold acc. to Student
At birth – 20 days	0.47 ± 0.07	6.7	P < 0.001
At birth – 90 days	0.39 ± 0.09	4.3	P < 0.001
At birth – 6 months	0.26 ± 0.08	3.2	P < 0.01
At birth – 18 months	0.23 ± 0.09	2.6	P < 0.01
Adult age	0.25 ± 0.09	2.8	P < 0.01

This means that, as the youth sheep, is more developed at an early age, as bigger will be its body weight at the adult age. These parameters confirm that sheep selection by body weight of the youth, at different ages, as well at the adult age, is real and true. The selection effect, calculated by the classical formula **($E = h^2 \cdot d$)**, is not big, but quite significant. For example, if the average ewes body weight of the flock, would constitute 53 kg, and the average of the breeding batch would be 56 kg, then the selection differential would be 3.0 kg, and the selection effect in a generation would be:

$$\mathbf{E = 0.3 \cdot 3.0 = 0.9\ kg.}$$

Therefore, the selection of Moldovan Karakul sheep, by their body weight, is effective and

contributes to the genetic amelioration of this character in the flock and creation of sheep populations with big body development.

According to researches of Дъячков, 1980, the youth sheep of Asian type Karakul race, has a sufficient growth rhythm, reaching at the age of 4.5 – 5.0 months, the body weight of 20-25 kg. Our research has shown that, the body development of Moldovan Karakul sheep and their precocity are, under conditions of Republic of Moldova, much higher, compared to the sheep of Asian type.

The sheep body weight is closely related with environmental conditions, especially, with natural forage (pasture vegetation), because, in Republic of Moldova, the sheep are, from April - May, until November-December, depending, exclusively, on natural pasture vegetation and stubbles of harvest grain (Table 5).

In particular, the sheep have access, in the period of September-October, to stubble of harvested maize, of which reasons they reach, at the end of October, the biggest fattening condition, that is why, the weighting of Karakul sheep is recommended to be done at the end of October, when the animal's body development potential is fully realized.

Thus, in the favourable years with sufficient vegetation, the average body weight of adult rams is 81.9 – 92.6 kg. The highest value of the rams body weight is 107 kg. All the rams selected from breeding batches were quite corpulent, with the typical exterior and robust appearance.

The sheep body weight has reached the average on the flock of 55.0 ± 0.3 kg and 55.5 ± 0.3 kg, which exceed the standard level of Asian type Karakul breed, (43 kg) with 12.0 – 12.5 kg, or with 27.9 – 29.0 % ($P < 0.001$).

Table 5. Body weight of Moldovan Karakul sheep in different years

Total on the flock of INZMV			Selected breeding batch		
Age group	n	M ± m	n	M ± m	Max
2006 (favourable year, with sufficient vegetation)					
Rams	6	92.6 ± 3.0	6	92.6 ± 3.0	107
Ewes	366	55.0 ± 0.3	198	57.8 ± 0.3	73
Rams of 18 months	8	59.8 ± 3.3	4	63.6 ± 5.5	80
Ewes of 18 months	138	52.2 ± 0.4	102	53.1 ± 0.4	62
Ram lambs of 6 months	34	29.7 ± 0.8	10	30.7 ± 1.1	40
Ewe lambs of 6 months	139	27.2 ± 0.4	89	29.0 ± 0.4	39
Lambs of 3 months	178	22.7 ± 0.3	162	23.0 ± 0.3	28
Lambs of 20 days	190	8.5 ± 0.8	170	8.7 ± 0.8	12
2007 (drought year, with insufficient vegetation)					
Rams	8	82.9 ± 4.2	6	88.2 ± 3.0	102
Ewes	399	47.9 ± 0.4	119	49.9 ± 0.5	65
Rams of 18 months	17	51.5 ± 1.7	5	57.2 ± 3.7	70
Ewes of 18 months	113	48.5 ± 0.5	91	49.0 ± 0.5	62
Ram lambs of 6 months	68	29.3 ± 0.8	11	35.8 ± 1.5	45
Ewe lambs of 6 months	150	25.8 ± 0.4	83	28.1 ± 0.3	39
Lambs of 3 months	210	18.5 ± 0.3	150	19.5 ± 0.2	24
Lambs of 20 days	226	6.6 ± 0.1	170	7.4 ± 0.1	10
2008 (favourable year, with sufficient vegetation)					
Rams	10	81.9 ± 2.6	4	89.0 ± 2.2	95
Ewes	292	55.5 ± 0.3	163	57.2 ± 0.4	75
Rams of 18 months	8	56.0 ± 3.0	3	64.0 ± 2.0	66
Ewes of 18 months	118	50.6 ± 0.5	85	52.1 ± 0.5	62
Ram lambs of 6 months	10	33.6 ± 1.8	4	38.8 ± 2.8	46
Ewe lambs of 6 months	138	31.7 ± 0.4	66	34.4 ± 0.4	42
Lambs of 3 months	164	22.1 ± 0.5	160	22.0 ± 0.5	27
Lambs of 20 days	226	7.6 ± 0.1	210	7.7 ± 0.1	11

Some ewes from this flock have reached maximum values of body development up to 73 and 75 kg. Having such a wide variability of this character, in the flock, it were selected quite corpulent ewes from breeding batches, with the average body weight of 57.8 ± 0.3 kg and 57.2 ± 0.4kg.

The youth sheep, having a high precocity of growth at all ages, has a quite good body development. The rams able to remount, at the age of 18 months, have had an average body weight of 59.8 ± 3.3 kg and 56.0 ± 3.0 kg with maximum values, at some individuals, of 80 and 66 kg. In breeding batches, it were selected rams able to remount, with average body weight, at same age of 63.6 ± 5.5 kg and 64.0 ± 2.0 kg. Due to the high precocity, ewes of 18 months have, also, a good development. Their body weight was, in favourable years, in average on the flock 52.2 ± 0.4 kg and 50.6 ± 0.5 kg, which exceeds the standard level of Asian type Karakul race (36 kg) with 16.2-14.6 kg or with 45.0-40.5% ($P < 0.001$). Some ewes, from this flock, have reached maximum values of body development up to 62 kg. In breeding batches, were selected ewes, with an average body weight of 53.1 ± 0.4 kg and 52.1 ± 0.5 kg.
The youth sheep of 6 months, in favourable years with satisfactory vegetation, reaches, also, a good body development. Due to a quite fast growth speed, ram lambs have had an average body weight of 29.7 ± 0.8 kg and 33.6 ± 1.8 kg, with maximal values up to 40 – 46 kg. In favourable years, with good forage base, in breeding batches, were selected ram lambs, with average body weight of 35.8 – 38.8 kg. The ewe lambs of 6 months have had, during these years, an average body weight on the flock equal with 27.2 ± 0.4 kg and 31.7 ± 0.4 kg. In the breeding batches, were selected ewe lambs, with the average body weight of 29.0 – 34.4 kg. Some ewe lambs reached, at this age, maximal values of 39 and 42 kg. These indices show a very high potential of this kind of sheep, regarding their precocity and body development of youth sheep at this age.
The quite early precocity of Moldovan Karakul youth sheep manifests immediately after birth. Thus, at the age of 20 days, lambs (mainly ewe lambs) have, during favourable years, the body weight equal to 8.5 ± 0.8 kg and 7.6 ± 0.1 kg, with maximum values at some individuals of 12 - 11 kg. At the age of 3 months (weaning), they reach, in average, the body weight of 22.7 ± 0.3 kg and 22.1 ± 0.5 kg, which is equivalent to the body weight of the Asian type youth sheep, at the age of 4.5 – 5.0 months (Дъячков, 1980).
Therefore, the precocity and a good body development of the youth sheep, at all ages, as well the big body weight of adult sheep, is one of the most important biological features which distinguish the type of Moldovan Karakul sheep versus other interracial regional geographical types of Karakul race, known in the world.
According to the authors communications (Васин, 1971), the classic Karakul race sheep (asian) are latish animals, because their body development, continues until a quite advanced age of 6 years.
Our research has shown, that the body development of Moldovan Karakul sheep, continues up to the age of 2.5 – 3.5 years (Table 6).

Table 6. Body weight of Moldovan Karakul ewes, depending on their age, kg (n = 55)

Ewes age, years	M ± m	σ	C_v, %
1.5	50.62 ± 0.53	5.43	10.7
2.5	55.74 ± 0.61	5.69	10.2
3.5	55.96 ± 0.55	5.61	10.0
4.5	56.77 ± 0.60	5.76	10.1
5.5	55.15 ± 0.69	5.85	10.6

Thus, within the age range from 1.5 up to 2.5 years, body weight of the sheep, increased significantly with 5.12 kg, or 10.1% ($P < 0.001$). From the age of 2.5 years up to 4.5 years, the body weight of the sheep increased insignificantly (just with 1.03 kg, or with 1.8%, $P > 0.5$). This allows us to affirm that the body weight of Moldovan Karakul sheep, beginning with the age of 3.5 years and up to 4.5 years, basically, remains at a constant level, after that, starts a slight decrease tendency. From these results, we can see the fact, that the type of Moldovan Karakul sheep is slightly more precocious, compared to the type of Asian Karakul sheep, which is one of the biological interior characteristics of this interracial type of sheep.
On the basis of scientific research of correlative connections, of body weight heritability and repeatability, as well as the analysis of the results obtained during several years of sheep population selection, we developed the minimal

requirements of the standard breed, as well as the parameters of the standard-purpose, concerning this character's development of Moldovan Karakul sheep at different ages. The developed parameters are used at animals assessment, their selection in breeding batches and their admission to reproduce (Table 7).

Table 7. Parameters of standard body mass Karakul sheep of different age groups

Age group	Known standards		Developed standards	
	Karakul, Romania, Elite class requirements (Pascal, 2007)	Asian Karakul, assessment instructions, Ist class requirements	Moldovan Karakul, Ist class requirements	Moldovan Karakul, standard-purpose
Rams	55	55	75	85 – 100
Ewes	40	43	48	50 – 55
Rams 18 months	41	42	55	65 – 70
Ewes 18 months	35	36	43	44 – 49
Ram lambs 6 months	-	27	32	35 - 40
Ewe lambs 6 months	-	25	29	30 - 35
Ram lambs 3 months	-	16	19	20 – 22
Ewe lambs 3 months	-	15	17	18 - 20
Ram lambs 20 days	-	7.4	8.0	8.5 – 9.0
Ewe lambs 20 days	-	7.0	7.5	8.0 – 8.5

The principle of these parameters development is based on general rules, known in animal livestock, where any animal breed standard is established and recognized at the level of the minimal requirements to enclose them into the Ist class category.

Compared to the breed standard, the standard-purpose represents a model of animals, which enclose within the parameters searched by selectors, starting from the initiation stage of the creation process of a breed, type, lines, up to the final stage of creation and assimilation of the realized selection.

It should be noted, that the body weight parameters, developed for Moldovan Karakul sheep, are much higher, compared to the breed standard for other types of Karakul sheep. Thus, the minimal requirements of body weight of Moldovan Karakul lambs, at the age of 20 days, to be assigned to the race standard, are higher, compared to Asian type Karakul sheep, at ram lambs - with 0.6 kg and ewe lambs - with 0.5 kg, or with 8.1 and, respectively, 7.1%.

At the age of 3 months, the standard parameters of the Moldovan Karakul youth sheep body weight are higher, compared to Asian type Karakul sheep, at ram lambs - with 3.0 kg and at ewe lambs - with 2.0 kg, or with 18.7 and, respectively, with 13.3%.

A bigger difference of the standard body weight of Moldovan Karakul youth sheep, compared to Asian type Karakul, remains also at the age of 6 months. Thus, the standard body weight parameters at ram lambs is bigger with 5.0 kg and at ewe lambs - with 4.0 kg, or with 18.5 and, respectively, 16.0%.

With age advancing, the difference between the standard body weight parameters of Moldovan Karakul sheep and Asian Karakul sheep will emphasize. Thus, at the age of 18 months, the standard body weight parameters at ram lambs is bigger with 13.0 kg and at ewe lambs - with 7.0 kg, or with 31.0 and, respectively, 19.4%.

At the adult age, the minimal body weight standard parameters of Moldovan Karakul rams, exceed the standard of Asian Karakul breed with 20.0 kg and, the ewes - with 5.0 kg, or 36.4 and, respectively, with 11.6%.

Finally, generalizing the standard-purpose parameters of Moldovan Karakul sheep body weight, we ascertain, that they are, at all gender and age groups, detached larger, compared to the parameters of Asian Karakul race. The above mentioned results, obtained during the process of body weight amelioration at the sheep population of INZMV, demonstrates that the progressive directed selection according to this character had secured, practically, the reaching of planned parameters and the achievement of intended purpose to create the new type of Moldovan Karakul sheep.

CONCLUSIONS

1. The body weight of Moldovan Karakul sheep is one of the most important morpho-productive selected character, since it has a direct impact, on both, the meat production, derived from the slaughtered animals carcasses, as well as on the surface of fur skins, obtained from lambs at the age of 2-5 days after birth.
2. The phenotypic variability of body weight is influenced by a number of internal and external factors. Main internal factors is heredity (genotype), and of the external factors - nutrition and feeding (forage base).
3. The Moldovan type Karakul sheep are more precocious compared to Asian type Karakul sheep, which is one of the internal biological particularity of this interracial sheep type. This kind of sheep continues to develop in body growth (body weight) up to the age of 2.5-3.5 years.
4. The selection of Moldovan Karakul sheep, by body weight is modestly effective, thanks to a moderate heritability and repeatability of this character. The body weight heritability coefficient is not high ($h^2 = 0.3$), but quite significant ($t_r = 2.6$; $P < 0.01$). The body weight repeatability coefficient (r_w) of the youth sheep at different ages, as well as of the adult sheep, varies within the limits of 0.23-0.47.

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