

EXTENSION AND CURLING MODELLING AT THE MOLDAVIAN KARAKUL LAMBS

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Abstract

The purpose of the research was to highlight the peculiarities of the extension and modelling of the curling at the Moldavian Karakul lambs and to reveal the relations of these properties with other qualities and characteristics of the skin for the improvement of the lamb selection procedures of the requested type. The researches were carried out on batch of Moldavian Karakul lambs from sheep flock of the Experimental Household of the National Institute of Animal Husbandry and Veterinary Medicine, Maximovca village, Anenii Noi district. From the nonparametric properties of the curling, have been investigated the extension, modelling and types of curling modelling, as well as their relations with other properties and characters of the skin, which ultimately determines the commercial value of the skin. The researches were carried out by the methods elaborated or perfected by us, according to the Sheep Karakul evaluation Instructions with principles of improvement in the Republic of Moldova. As a result of the research it was concluded that the curling extension, the modelling and the type of curling modelling at the lambs and skins Moldavian Karakul are very important properties, which directly or indirectly determine the commercial qualities and the market value of the skin as a whole. The excellent and appropriate extension of the curling is characteristic for the lambs and skins Karakul with the jacket, Kaukasian and coastal curling type. For lambs and skins Karakul with the flat curling type is characteristic of the weak extension of the curling. The highest excellent modelling rate has lambs with curling type flat (58.5%), coastal (50.4%) and jacket (26.4%). The most suitable modelling rate is lambs with the type of curling jacket (73.4%), coastal (46.1%) and flat (35.0%). Curling modelling is in positive relationship with the length of the curls, the silk and the luster of the fibbers, and in the negative relation with the length of the fibbers. The lambs with jacket curling type, usually, have the parallel-concentric type curling modelling (48.9%) and mixed (49.9%). The lambs with the type of coastal and flat have predominantly parallel-scale modelling (81.4%) and (62.4%), respectively. The type of curling modelling is in a positive relation to the silk and luster of fibbers, and in a negative relationship with leather thickness and fiber length. Knowing the particularities of extension and modelling of the curling at the Moldavian Karakul lambs and the relations of these properties with other qualities and characters of the skin allow for the efficiency of lamb selection of the requested type.

Key words: extension, modelling, type of modelling, curling, lambs, Moldavian Karakul.

INTRODUCTION

The Karakul lamb curling consists of an integral complex of curls of different types (wave, bob, horns, peas, rings) and shapes (tubular, flattened, coastal, moire), which have a string of metric properties (characters) - the size (width), the height and length of the curls, as well as nonparametric properties - the curls extension, the modelling and the type of curling modelling. All these characters and properties of the loyalty directly or indirectly determine the commercial qualities and market value of the skin as a whole.

Extension of the curls represents the degree of their spreading on the body extremities of the lamb (head, tail, limbs, abdomen) or skins. At the Karakul lambs is characteristic existence of

the ruffled curling or of moire drawing not only on the main body parts of the lamb, but also on the extremities.

This character serves as the basis for differentiate the Karakul-pur from the Karakul-metis.

The expanded curling on the extremities may consist of curls of different types (tubular, coastal or flat, bobsleigh, or blooming, rings, semi-timbers, peas, corkscrew) or die-drawn drawing. Typically, waves, grains, or coats are spread along the tail.

On the head can be waves, bobs, horns or moon drawing. On the abdomen can be seen waves, bobs, horns, rings, peas, corkscrew, smooth. On the forelegs, to the knees, and to the hindquarters, up to the glow, there can be waves, bobs, horns, rings, peas, smooths.

Below knee, as a rule, are smooths or moarat drawing. At the some lambs, the moire drawing can also be seen on the cheeks (Figure 1).



Figure 1. Moldavian Karakul lamb with excellent extension of curling

Modelling curling is the models of curls placement to each other and their configuration on the body surface of the lamb or skin.

At different lambs, shaping occurs in varying degrees of clarity. Well-shaped modelling forms so-called "drowing" - models. The value of modelling is conditioned by the qualities of the curls, such as the type and shape of the curls, their size and length, their strength and elasticity, the width of the seam between the curls. The value of the model depends on the degree of grading and pronouncing the drawing, which is closely related to the width of the seam. The wide seam with the large space between the adjacent curls usually forms a well-defined and pronounced modelling. The narrow seem does not show clearly modelling and is not visually observed.

The type of curling modelling is the orderly placement of curls to each other, on the skin surface, which form different modelling configurations (patterns) or types of curling drawing. The aesthetic aspect of the type of loop modelling is primarily due to the parallelism of the fibres and their linear arrangement, which form the curls and the curling as a whole.

In the special profile literature, most scientific papers are devoted to the research of the parametric properties of the curls and the curling as a whole. Particularly these were

investigated by academician Иванов М.Ф. and his collaborators at the Moscova Institute of Oviculture (Иванов, 1964а, 1964с, 1964d, 1964е) and the Askania Nova Step-by-Step Animal Breeding Institute, Herson (Перегон, 1972), by academician Vasin - at the Moscow Fursking Institute, by professor Гигинейшвили, 1975, 1976 at the Union Institute of Animal Husbandry in Dubroviți (Moscow suburb) by the researchers of the Union Institute for Scientific Research on Karakulture in Samarkand, Uzbekistan: Дьячков and Письменная, 1951, 1952, 1980; Закиров, 1987; Кошевой, 1975; Ролдугина, 2003), as well as researchers at the Neidam Research Station in Namibia, South Africa (Маттер, 1975; Нел Дж., 1975а, 1975b; Филлингер, 1975; Шеффер, 1975). The nonparametric properties of the Karakul lambs laughter were less analysed in our research (Buzu, 2017а, 2017b, 2015, 2012, 2001, 1999b, 1998), and in the work of other researchers (Pascal, 2015; Прманшаев et al., 2016а, 2016b; Туекбасов, 2011).

In the territory of the Republic of Moldova, the most profound research of the curling of Karakul lamb was carried out by Nicov (1936), who for the first time described the parametric and non-parametric properties of the curls. Subsequently, Ильев (1957) and zootechnist engineer Богданович (1957) described the variability of the curling properties at the metises lambs (Tușca x Karakul), resulting from the crossing of the local Tușca ewes with the Karakul rams Asiatic type up to the third generation. Therefore, we can see that the level of knowledge about the properties curling of lamb loaf for the skin is a valuable database in the field and refers predominantly to the Asian Karakul race and less to the metis lambs of local races.

Appreciated positively the existing researches value in the field, we can also mention that the variability of the nonparametric properties of the curling (extension, curls modelling and the type of curling modelling) at the Karakul lamb, especially to the Moldavian types, is not sufficiently elucidated.

Correlative relationships and factors that influence the manifestation of non-parametric properties of the curling are not fully revealed. Based on these, the knowledge of the degree of

manifestation of the non-parametric properties of the curls and the relationships of these attributes with other skin features is a current problem for the efficiency of the selection process.

In this context, the purpose of this work was to highlight the peculiarities of resistance and modelling of the curling at the Moldavian Karakul lambs and to reveal the relations of these properties with other qualities and characteristics of the skin for the improvement of the lamb selection procedures of the requested type.

MATERIALS AND METHODS

The researches were carried out on batch of Moldavian Karakul lambs from sheep flock of the Experimental Household of the National Institute of Animal Husbandry and Veterinary Medicine, Maximovca village, Anenii Noi district. The nonparametric properties of the curling (extension, modelling and tipe of modelling) were investigated by the methods elaborated or perfected to us (Buzu, 2012), in accordance with the Sheep Karakul evaluation Instructions with principles of improvement in the Republic of Moldova (Buzu et al., 1996).

The extension of the curls has been visually appreciated. Depending on the degree of curls spreading on the corporal extreme of the lamb (head, tail, limbs, abdomen) or skins, the following degrees of curls extension have been differentiated: *excellent*, *appropriate*, *weak* and *insufficient*.

Excellent extension - it was considered when on the extremities of the lamb (head, forehead, cheeks, tail, tops, abdomen and limbs to hooves) there is a clear presence of valuable, less valuable types of curls or the moon drawing. This degree of curl extension was the most requested. This type of extension met with valuable lambs with the typical expression of Karakul-pure race. Lambs with excellent curls extension were required for selection and breeding. The *appropriate* extension - was found when the laces had a moderate degree of spreading on the ends of the lamb or on the extremities of the skin. The curling was present on the tail, head, abdomen and limbs, slightly below the knee and hocks. Lambs with the suitable curls extension were also required for

selection and breeding. The *weak* expansion - was considered when the extremities of lamb/skins, carling, or moire drawing, had a low spread. At the lambs with weak extension, the loops could be seen only half the tail surface. The head was usually „licked” to the ears. The abdomen had few unrolled curls. On his feet, the curling did not extend even to the hocks. On the rest of the surface extremities, there were unrolled fibbers or glow, and without moire drawing. The weak extension of the curls was not desirable to the lambs Karakul, although in some sorts of skins with coastal and flat type curling was not considered a big drawback. *Insufficient* extension - was found when there was a total lack of curls or a moire drawing on the extremities of the lamb and skins. The hair cover on the extremities was made up of straight and swollen fibres. This unwanted type of curls extension was characteristic of the metis lambs (T x K) and their skins.

Curling modelling represent the mode of curls placement to each other, their configuration on the lamb or skin surface, and the drawing clarity of the curling modelling as a whole. The value of modelling depends on the degree of grading and pronouncing the drawing. The following degrees of loyalty modelling have been differentiated: *excellent*, *appropriate*, *weak* and *insufficient*. *Excellent* modelling was considered when the model of the curls was highlighted and very clearly. The types, shapes and dimensions of the curls were well visible on the skin surface. Relief of the curls was well expressed not only on the crotch and back, but also on the sides, abdomen and extremities. This degree of curling modelling was associated with the superior qualities of the skin. The excellent modelling reflects a well-clear drawing, accompanied by an excellent luster and silk. The lambs with excellent loyalty modelling were the most demanded for selection and breeding.

The *appropriate* modelling - was found when the model of drawing curling was highlighted and clearly. On the surface of the skin were valuable and less valuable curls of different types and shapes. Relief of the curls was well expressed on the bodily regions of the lamb, such as the croup, the back and, less, the lateral sides. The right modelling was generated by

hollow, flat or flat waves, bobs, furrows. Lambs with this loyalty modelling were also requested for selection and breeding.

Weak modelling - was considered when the curling relief and the drawing were superficial or poorly understood, barely observed. The seam between the curls was thinly contoured; the curls were of lesser quality, bob type, the ridge blossoms. Relief of the curs could be poorly observed only on the crotch and the back. Lambs with poor loyalty modelling were not required for breeding. *Insufficient* modelling was found when the curling and drawing of curls were totally absent. The seam between the curls was not observable or contoured. Lambs with insufficient loyalty modelling were not allowed to breed.

Types of modelling curling. The orderly placement of the loops on the body surface of the lamb or skin forms different modelling configurations, called loop modelling models (model, drawing). Four main types of curls modelling have been differentiated: *parallel-concentric* (of *lira*), *parallel-scale*, *mixed* (miscellaneous) and *indeterminable* (Figure 2).

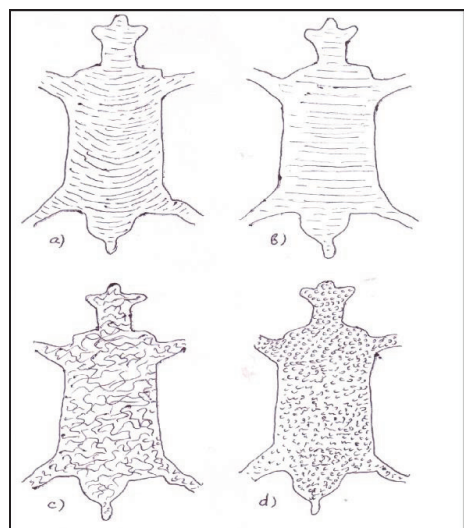


Figure 2. Types of curling modelling on skins Karakul. a) parallel-concentric; b) parallel-scale; c) mixed (miscellaneous); d) indeterminable.

The parallel-concentric modelling pattern was considered when the curls on the back of the skin, from the crotch to the thighs, the backs and the back were parallel to each other, bent in the bow shape with the convex side to the

tail, forming parallel-concentric rows. On the front of the back, on the back and the withers, the parallel-concentric model could run in parallel-scale or mixed. Lambs with parallel-concentric shaping of the curls were most required for selection and breeding.

The type of *parallel-scale* modelling was found when the curls on the main parts of the skin were placed parallel to one another in a straight, like-scale form. As a rule, these curls, called by practicing karakulists "whip" (Buzu, 1999a), were very long and expanded continuously from one side to the other side of the lambs body. Relief of the curls was clearly manifested. Lambs with such curling modelling were retained for selection and breeding.

The type of *mixed* modelling was considered when the curls on most of the skin surface were not located parallel to each other but were mixed and had a mixed sinusoidal arrangement. At the same time, curl shaping was well understood, forming an Asian ornament drawing. Lambs with this type of loyalty modelling are admitted for breeding. The type of *indeterminate* modelling was found when the curls on the entire lambs surface, including the main parts of the skin, were disordered and undefined, and the model as a whole was absent. This type of loyalty modelling was not wanted. Lambs with this type of loyalty modelling were not allowed to breed.

The data obtained as a result of the research were statistically processed using the computerized software "STATISTICA - 12" and their certainty was assessed, according to variational biometric statistics, by to Плохинский (1989).

RESULTS AND DISCUSSIONS

The extension of the curls, like other skin types, is hereditary determined and conditioned to a large extent by the genotype of the lamb's parents, their genetic compatibility.

This properties to lambs Karakul is in correlation with the type of curling, the shape of the curls, the purity of the breed (the metiers generation), the quality of the fibres (silk, luster), etc (Иванов, 1964b; Васин, 1971; Гигинейшвили, 1976; Дьячков, 1980; Вузу, 2012). It was established that the extension of the curls on the lamb's extremities is most dependent on the type of curl (Table 1).

Table 1. Extension of curls by type of curling, the silk and the luster of fibres at the Moldavian Karakul lambs

Specification	Effective of lambs, head	Extension of curls							
		Excellent		Appropriate		Weak		Insufficient	
		head	%	head	%	head	%	head	%
Depending of the type of curling									
Jacket (Tubular)	429	105	24.5	255	59.4	57	13.3	12	2.8
Coastal	231	36	15.6	121	52.4	69	29.9	5	2.1
Flat	123	6	4.9	36	29.3	63	51.2	18	14.6
Kaukasian	195	59	30.3	97	49.7	24	12.3	15	7.7
Brac	5	-	-	-	-	1	20.0	4	80.0
Depending of silk fibers									
Excellent	432	80	18.5	207	47.9	124	28.7	21	4.9
Appropriate	416	81	19.5	242	58.2	70	16.8	23	5.5
Reduced	128	44	34.4	64	50.0	13	10.1	7	5.5
Insufficient	6	2	33.3	2	33.3	1	16.7	1	16.7
Depending on luster fibers									
Intense	342	61	17.8	171	50.0	89	26.0	21	6.2
Appropriate	486	95	19.5	266	54.7	103	21.2	22	4.5
Reduced	134	47	35.1	63	47.0	14	10.4	10	7.5
Insufficient	19	3	15.8	10	52.6	5	26.3	1	5.3

The excellent extension of the curls is more characteristic for lambs with jacket and Kaukasian type of curling, which have tubular curls, and is rarely found at the lambs with the coastal, flat or Karakulcea curling type. We found that at the lambs with jacket curling type the majority of individuals had the right extension (59.4%) and excellent (24.5%) of the curls on the extremities of the body. Share of lambs with weak extension and insufficient curls in this batch is unimportant and represents 13.3% and 2.8%, respectively. Characteristic for lambs with jacket curling is the extension of tubular curls (short wave, bean, peas) and small blossom ridge on the extremities. In the batch of lambs with the Kaukasian type of curl, the individuals with the right extension (49.7%) and excellent (30.3%) of the curls also predominate. Lambs with weak and insufficient curls in this batch are in the minority. Characteristic of the lambs in this batch is the extension of the small curls on the extremities, worthless and defective, such as rings, peas, corkscrew.

In lambs with the type of coastal curling, the appropriate extension (52.4%) of the loops also prevails, but an essential share of individuals with the weak extension (29.9%) of the loops is also found. The slight extension of the loops to the lambs with the coastal type curling is characterized by the appearance on the extremities of some of the linings made of undrained fibres and placed on the skin,

especially on the head, legs (above the knees and hocks), partly on abdomen and tail.

The worst extension of the curls was found in lambs with flat type curling. In this group predominates the individuals with weak extension (51.2%) and insufficient (14.6%) of the loops. Lambs with the appropriate loops extension in this group occupy a minority share (29.3%) and are the smallest compared to the other batch. The weak extension of lambs with a flat type curling is characterized by the presence on the skin of the edges of the mirror-linen, consisting of short, un-ruled short fibres leather, with intense luster and silk. For lambs of these types, weak extension is not considered a major drawback and therefore does not diminish their class.

For brac lambs, 80% of cases are characterized by the insufficient extension of the curls to the body extremities and are characterized by the presence of un-ruled fibers (straight) on the abdomen, legs (above knees and hocks), tail. Un-ruled fibres at these lambs are not skinned, they are long and high, like moustaches. Such fibres are characteristic of the lambs of Metis origin and the skins of the specification "Karakul-metis" and "Smuşka".

At the type Karakulcea lambs, it is more often the proper extension of the curls with the moire drawing. In some geographic regions and countries of the world (South Africa), the Karakulists have created new type sheep of Karakul with a hair cover, so-called "smooth",

with the moire drawing and weak extension of the (Филлингер, 1975; Шеффер, 1975). This kind of skins has an increased demand on the world markets. From their extremities (especially from the legs) with a smooth and glossy glow are made quite elegant and original coats, with the type "fir" arrangement in combination with "muton".

Research has shown that the extension of the curls is in negative correlation with the silk and luster of the fibres of the hair cover. It has been found that the higher the silk and the luster of the fibres, the more extension the curls on the extremities of lambs Karakul is weaker. Thus, lambs with better fibre silk possess a lesser extension of the curls. The largest share of individuals with excellent curl extension was found in the batch of lambs with low silk (34.4%) and insufficient (33.3%) of fibres, and the lowest share - lambs with excellent fibre silk (18.5%). Lambs with excellent fibre silk yield, with the percentage of individuals with excellent curling extension, with low silk, with 15.9% ($P < 0.001$). The largest proportion of individuals with the weak extension (28.7%) of the curls was registered at the lamb batch with excellent fibre silk, and the smallest share (10.1%) - in the lamb batch with low silk. The first batch of lambs, exceeded after this index the second by 18.6% ($P < 0.001$).

Extension of the curls on the extremities is also indirectly related to the fibre luster. Research has shown that the lambs with the intense and proper luster of the fibres have an extension of the curling on the weaker ends compared to congeners with reduced fibre luster. Thus, in the lamb batch with excellent fibre luster, the share of individuals with excellent curling extension was 17.3% lower compared to the lamb batch with reduced fibre gloss ($P < 0.001$). At the same time, the weight of the individuals with the reduced extension of the curling in the lamb group with the intense luster of the fibres was 15.6% higher compared to the reduced luster fibre lamb batch ($P < 0.001$). In the batch of lambs with intense luster of fibres there was the lowest registered (17.8%) of individuals with excellent extension and the highest percentage (26.0%) of individuals with the weak extension of the curls on the extremities. Inversely, in the group of lambs with reduced luster fibbers was recorded the highest share

(35.1%) of individuals with excellent extension and the lowest percentage (10.4%) of individuals with low extension curls extremities.

In practice, when lamb Karakul evaluation, curls extension is appreciated as an important feature in high quality skins and, as an ancillary character, in lower quality skins. Knowing the reciprocal correlation of this character with other skin properties allows the selector to direct the selection process in the desired direction.

The modelling curling, as well as other skin characters, is hereditary and is correlated with many other features, such as the type of curling, type and shape of curl, size and length, fibre length, luster and silk, body regions lambs or leather quality areas, the width of the stitch, the linear arrangement of the fibbers, etc.

An evident link of curling modelling is observed with the type of curling (Table 2).

We have found that the best modelling of the curling possesses the lambs with type flat, coastal and jacket. Lambs with the Caucasian curling type possess the worst model of curling. The largest and predominant proportion of individuals with the excellent modelling of curling (58.5%) was recorded in the lame batch with the flat type curling.

At the lambs with the coastal type curling, also, predominate the individuals with excellent modelling (50.4%) and less than half of this group (46.1%) constituted lambs with the appropriate modelling curling. Lambs with jacket type curling have, for their part, the appropriate modelling (73.4%) and excellent (26.4%) of the curling. After to the weight of the individuals with excellent modelling, the lambs with flat type curling overcome the conjuganers with the jacket type curling by 32.1% ($P < 0.001$) and the ones with the and those with coastal type of curling - by 8.1% ($P < 0.1$).

The excellent curling modelling is present only at the lambs, with the type jacket, coastal and flat curling.

The lambs with Caucasian type of curling, for the most part, the curling modelling is weak (66.0%) and insufficient (13.7%).

The modelling of the curling depends largely on the length of the curls.

Table 2. Curling modelling according to the type of curling, qualities of curls and hair fibre at the Moldavian Karakul lamb

Specification	Effective of lambs, head	Modelling of curling							
		Excellent		Appropriate		Weak		Insufficient	
		head	%	head	%	head	%	head	%
Depending of curling type									
Jacket	429	113	26.4	315	73.4	1	0.2	-	-
Coastal	232	117	50.4	107	46.1	8	3.5	-	-
Flat	123	72	58.5	43	35.0	8	6.5	-	-
Kaukazian	197	-	-	40	20.3	130	66.0	27	13.7
Depending on length curls									
Very long	35	31	88.6	4	11.4	-	-	-	-
Long	251	204	81.3	47	18.7	-	-	-	-
Medium	495	70	14.2	411	83.0	13	2.6	1	0.2
Shot	190	-	-	38	20.0	138	72.6	14	7.4
Very short	10	-	-	-	-	2	20.0	8	80.0
Depending on length fibbers									
16-17 mm	19	-	-	7	36.9	10	52.6	2	10.5
14-15 mm	60	9	15.0	38	63.3	10	16.7	3	5.0
12-13 mm	153	40	26.1	94	61.4	18	11.8	1	0.7
10-11 mm	195	62	31.8	108	55.4	25	12.8	-	-
8-9 mm	144	60	41.7	69	47.9	14	9.7	1	0.7
6-7 mm	59	21	35.6	31	52.5	5	8.5	2	3.4
4-5 mm	3	3	100	-	-	-	-	-	-
Depending on silky fibbers									
Excellent	427	221	51.8	186	43.6	19	4.4	1	0.2
Appropriate	424	77	18.2	276	65.1	61	14.4	10	2.3
Reduced	120	3	2.5	38	31.6	68	56.7	11	9.2
Insufficient	6	-	-	-	-	3	50.0	3	50.0
Depending on luster fibbers									
Intense	337	189	56.1	138	40.9	10	3.0	-	-
Appropriate	489	108	22.1	310	63.4	59	12.1	12	2.4
Reduced	145	6	4.1	52	35.9	76	52.4	11	7.6
Insufficient	7	-	-	1	14.2	3	42.9	3	42.9

The highest proportion of individuals with excellent curling modelling was recorded at the lamb batch with very long curls.

The highest proportion of individuals with weak and insufficient curling modelling was recorded at lambs with short and very short curls. It was found that in the batch of lambs with very long curls, the overwhelming majority of individuals have an excellent modelling (88.6%) and only 11.4% of the lambs have an appropriate modelling of the curling. Lambs with long curls are predominantly an excellent modelling (81.3%) and in the minority (18.7%) - a proper modelling of the curling. In the batch of lambs with medium long curls, the share of lambs with excellent curls modelling decreases to 14.2%, and the overwhelming majority (83.0%) possesses appropriate modelling of the curling, and some individuals with a weak modelling. In the batch of lambs with short

curls, there are no individuals with excellent curling modelling, and the proportion of individuals with the proper loyalty modelling decrease to 20.0%. The majority of the individuals in this batch have poor modelling weak (72.6%) and insufficient (7.4%) modelling. Among lambs with very short curls predominate individuals with insufficient (80.0%) and poor (20.0%) modelling of curling. Therefore, the longer the curls are, the better the modelling. The long and very long curls form, as a rule, excellent curling modelling. Medium and long curls form the appropriate modelling, and short and very short curls form the weak and insufficient curling modelling. The curling modelling also depends on the length of the fibres.

Research has shown that the best modelling of the curling is formed at lambs with a moderately short length of fibre - 8-9 mm (not considering the batch of lambs with very short

fibre lengths of 4-5mm, because they were very small number - 3 heads).

In this batch was recorded of individuals with the excellent curling modelling (41.7%) and the lowest share of individuals with a weak and insufficient curling modelling (10.4%) were registered. The Lambs with short lengths of fibres, of 6-7mm, also possess a particularly good modelling of the curling. Among these are 35.6% of the lambs with excellent modelling and 52.5%, with the appropriate curling modelling. The lambs with medium length (10-11 and 12-13mm) also have a good curling modelling. The majority lambs of these batch have an appropriate and excellent curling modelling. In the batch of lambs with the length fibres of 10-11 mm predominates individuals with the appropriate (55.4%) and excellent (31.8%) modelling curling. Among the lambs with the length of the fibres of 12-13mm, the share of the lambs with the appropriate shape of the appropriate curling constituted 61.4% and the one with the excellent modelling - 26.1%. The share of individuals with the weak curling modelling among the lambs of these lots is unimportant. With the increase in fibre length in lambs from 6-7mm to 14-15mm, the share of individuals with excellent modelling decreases from 35.6% to 15.0%, and at the same time increases the share of individuals with weak modelling to 8.5% to 16.7%. At the lambs with the length of the fibres 16-17mm, the excellent curling modelling is no longer found, and the weight of the individuals with the appropriate modelling decreases to 36.9% and at the same time considerably increases the weight of the individuals with the weak and insufficient curling modelling until 52.6% and 10.5%, respectively.

The modelling of the curling is also indirectly related to the qualities of the hair cover, in particular the silk of the fibres.

It was found that the best curling modelling was recorded at lambs with excellent fibre silk. Thus, in this batch of lambs predominates individuals with excellent (51.8%) and then appropriate (43.6%) of the curling modelling. Individuals with weak and insufficient curling modelling in this batch of lambs rarely meet. In the batch of lambs with the appropriate silk fibres, their overwhelming majority have an

appropriate (65.1%) and excellent (18.2%) modelling, and a minority share of individuals with weak (14.4%) and insufficient (2.3%) of the curling.

The lambs with low silk fibre have, for the most part, a weak modelling (56.7%) and less, appropriate (31.6%). With increasing the degree of fibre silk, from reduced to appropriate and excellent, the share of individuals with excellent curling modelling increases from 2.5% to 18.2% and 51.8%, respectively ($P < 0.001$), and vice versa, with the decrease of the degree of silk fibre from excellent to the appropriate and reduced, respectively the share of individuals with a low and appropriate low curling modelling increases from 4.6% to 16.7 and 65.9%. Hence the conclusion that the higher the fibre silk, the better is the curling modelling.

Such correlation of the curling modelling at the lambs Karakul also occurs according to the luster of the fibres. We have found that lambs with intense luster of fibres have predominantly excellent (56.1%) and appropriate (40.9%) modelling of the curling. Individuals with a weak curling modelling in this batch of lambs occupy an insignificant weight (3.0%). In the batch of lambs with the best appropriate of fibres predominates, in their overwhelming majority, individuals with an appropriate (63.4%) and excellent (22.1%) modelling of the curling. In this batch, in minority, individuals with a weak (12.1%) and insufficient (2.4%) modelling already appear in the minority. The lambs with reduced fibre lambs have, in most cases, a weak modelling (52.4%), appropriate (35.9%) and insufficient (7.6%) of the curling, and those with insufficient luster fibres, and a weak (42.9%) and insufficient (42.9%) modelling of the curling. With the increase of the degree of fibbers luster from insufficient to excellent, the lambs summary weight with excellent and appropriate curling modelling increases from 14.2% to 97%, or 82.8% ($P < 0.001$) and, vice versa, with the decrease of the degree of fibbers luster from intense to insufficient, increases the share of lambs with weak and insufficient modelling curling from 3.0% to 85.8%, or by 82.8% ($P < 0.001$). Therefore, the harder the fibber luster to lambs is better, the more qualitative is the modelling of the curling.

Superior modelling (excellent) is always determined by curls valuable (waves), long and very long, medium and high size, with excellent resistance and elasticity, short and medium, silky and luster fibres, broad curls seam. Good modelling is associated with jacket, coastal and flat curling types. The most expressive modelling is usually seen on the crotch, tailgate, back, then on the sides, descending to the extremities. The higher is the quality of modelling, the higher is the lamb's ranking and the range of skins. So, the more

valuable the lamb's skin qualities, the better the modelling degree. And vice versa, the better the skin qualities, the lower the degree of curling modelling. Therefore, the selection in the direction of improving the modelling outlook has an additive effect on all the other skin qualities, thereby, increasing the efficiency of the selection.

The type of modelling, as well as other attributes of the loop, is determined hereditary and is in several correlative relationships with other kelly characters (Table 3).

Table 3. Type of curling modelling at the Moldavian Karakul lambs depending on the thickness of the skin and the qualities of the hair

Specification	Effective of lambs, head	The type of curling modelling							
		Parallel-concentric		Parallel-scale		Mixed (sinusoid)		Indeterminable	
		head	%	head	%	head	%	head	%
Depending on the curling type									
Jacket	425	208	48.9	5	1.2	212	49.9	-	-
Coastal	226	33	14.6	184	81.4	7	3.1	2	0.9
Flat	117	29	24.8	73	62.4	14	12.0	1	0.8
Kaukazian	192	-	-	-	-	59	30.7	133	69.3
Depending on thickness skin									
Subtle	301	102	33.9	76	25.2	111	36.9	12	4.0
Medium	419	110	26.3	123	29.3	127	30.3	59	14.1
Thickened	245	56	22.9	66	26.9	64	26.1	59	24.1
Thick	12	-	-	1	8.3	3	25.0	8	66.7
Depending on length fibbers									
16-17 mm	20	2	10.0	1	5.0	6	30.0	11	55.0
14-15 mm	57	12	21.0	9	15.8	25	43.9	11	19.3
12-13 mm	152	41	27.0	30	19.7	69	45.4	12	7.9
10-11 mm	193	59	30.6	50	25.9	59	30.6	25	12.9
8-9 mm	145	50	34.5	60	41.4	25	17.2	10	6.9
6-7 mm	60	12	20.0	29	48.4	14	23.3	5	8.3
4-5 mm	3	1	33.3	2	66.7	-	-	-	-
Depending on silky fibbers									
Excellent	415	148	35.7	149	35.9	104	25.1	14	3.3
Appropriate	415	113	27.2	93	22.4	156	37.6	53	12.8
Reduced	121	2	1.7	19	15.7	34	28.1	66	54.5
Insufficient	6	-	-	-	-	1	16.7	5	83.3
Depending on luster fibber									
Intense	347	134	38.6	131	37.8	76	21.9	6	1.7
Appropriate	504	141	28.0	112	22.2	193	38.3	58	11.5
Reduced	135	4	3.0	23	17.0	34	25.2	74	54.8
Insufficient	14	-	-	4	28.6	4	28.6	6	42.8

The closest connection of the modelling type is with the type of curling of the skin. Typically, parallel-mixed and mixed modelling patterns are characteristic for lambs with jacket curling. The type of parallel-scale modelling, usually, encountered at the lambs with coastal, flat or Karakulcea type curling. The type of indeterminate modelling is typical for lambs with the Kaukasian type of curling.

Research has shown that almost half of the lambs with the jacket curling type have a parallel-concentric type modelling (48.9%) and the other half - a mixed type modelling (49.9%). In this batch of lambs, practically rare individuals are encountered with parallel-scale modelling (1.2%) and do not encounter individuals with indeterminate type modelling. In the batch of lambs with the coastal type

curling, overwhelming majority, predominates individuals with parallel-scale type modelling (81.4%), followed by individuals with parallel-concentric curling modelling (14.6%). Mixed and indeterminate type modelling lambs are found in this batch in rare (3.1%) and very rare (1.9%) cases. At the lambs with flat type curls, there was, also, the predominance of individuals with parallel-scale type curling modelling (62.4%), followed by individuals with parallel-concentric type curling modelling (24.8%). A mixed-type modelling of the curling is found, in this batch, at the some individuals with a minority share (12.0%), and the indeterminate one is found in very rare cases (0.8%).

Lambs with Kaukasian curling have a curling modelling of only two types. In the vast majority (69.3%), their curling modelling is indeterminate and in the minority (30.7%) the modelling is of mixed type. Therefore, the lambs with the valuable types of curling (jacket, coastal, flat), usually, have the curling modelling of valuable types (parallel-concentric, parallel-scale and mixed).

Since the type of curling is determined by the type and shape of the curls, it results that the tubular curls (tubular wave, bob) usually form parallel-concentric and sinusoidal (mixed) type modelling. The waves by coastal and flat forms, furrows generate parallel-scale and boulder shaping. Lower quality curls (rings, peas, corkscrew) usually form a non-durable modelling of indeterminate type.

The type of curling modelling also depends on the quality of the derm, especially its thickness. It was found that lambs with the thin derm have the largest share of individuals with valuable types of curling modelling and make up 96.0%, including parallel-concentric modelling - 33.9% with parallel-scale modelling - 25.2% and with mixed type modelling - 36.9%. Lambs with medium thickness derma have a high summary weight of individuals with valuable types of curling modelling and make up 85.9%, including the parallel-concentric curling modelling - 26.3%, with parallel-scale modelling - 29.3% and with mixed type modelling - 30.3%. Lambs skin has thickened a summary weight of individuals with valuable lower curling modelling models compared to the first two batches and make up 75.9%,

which is 20.1% less compared to the thin lamb batch ($P<0.001$) and 10% less than the medium thickness lamb batch ($P<0.001$). The lambs with thick leather have, predominantly, a model of non-value, indeterminate (66.7%) and less valuable of mixed type (25.0%). Therefore, thin and dense leather generates a loop with the value modelling model (parallel-concentric, parallel-scale, mixed), and the thick and loose leads to the formation of a non-value (indeterminate) type of curling modelling.

The type of curling modelling also depends on the quality of the fibres, especially their length. It was found that the highest proportion of individuals with a parallel-concentric curling modelling was recorded in the group of lambs with a moderately short length of fibre - 8-9mm (34.5%), of the individuals with curling modelling parallel-scale type was recorded at the lamb batch with the short fibre length, 6-7mm (48.4%) (not considering the batch of lambs with a very short length of 4-5mm fibres, because they were very small - 3 heads), of the individuals with curling modelling of the mixed type was recorded in the batch of lambs with the average length fibres of 12-13mm (45.4%) and individuals with indeterminate curling modelling were recorded at the lamb batch with the overlapping length of the fibres, 16-17mm (55.0%).

It has been observed, that with the reduction of the length of the fibres from 16 - 17 mm to 8-9 mm, the share of lambs with parallel-concentric modelling increases from 10.0% to 34.5%, or 3.4 times ($P<0.001$). With decreasing fibre lengths up to 6-7mm, lambs with parallel-scale modelling increase from 5.0% to 48.4%, or 9.7 times ($P<0.001$). The weight of the lambs with the modelling of the mixed type curls is optimal if the fibre length is medium (12-13 mm) and decreases, both if the length of the fibres increases from this optimum, and if the length of the fibres decreases. With the increase in fibre length at the lambs from 6-7 mm to 16-17 mm, the proportion of individuals with indeterminate curling-type modelling increases from 8.3% to 55.0%, or 6.6 times ($P<0.001$). Therefore, the shorter is the hair fibres at the Karakul lambs, at birth, is shorter, the proportion of the individuals with the shaping of the valuable types (parallel-concentric, parallel-scale,

mixed) of the curling, and vice versa, as the fibres the lambs pilots are longer, the lower the weight of individuals with the shaping of valuable types of curling modelling, and the proportion of individuals with the indeterminate (invalid) modelling increases. So, short fibres form a better quality of curling and modelling than long and over-drawn fibres. The curling with the valuable modelling pattern is usually formed from the hair cover with good fibre silk qualities. We have found that lambs with excellent fibre silks have the largest proportion of individuals with the most valuable parallel-concentric and parallel-scale curling modelling, representing 35.7% and 35.9%, respectively. In the lamb batch with the appropriate silk fibre, the highest proportion of individuals with the mixed type modelling was registered - 37.6%.

Among the lambs with reduced and insufficient silk of the curling there was the largest proportion of individuals with the model of the non-value curling modelling type, indeterminate, representing 54.5% and 83.3%, respectively. It has been noticed that with the increase of the silk of the hair fibres at the lambs from the low degree to the excellent grade, the proportion of the individuals with the parallel-concentric type curling modelling increases, from 1.7% to 35.7%, or 21 times ($P < 0.001$) and those with parallel-scale curling modelling, from 15.7% to 35.9%, or 2.3 times ($P < 0.001$). At the same time, with the diminishing of the silveryness of the hair fibres at the lambs from the excellent degree to the insufficient degree, the share of the individuals with the non-worthless modelling of the indeterminate type curling considerably increases from 3.3% to 83.3%, or 25.2 times ($P < 0.001$).

The type of curling modelling is closely related to the luster of the hairpiece. I have found that lambs with intense luster of fibres possess the most valuable types of curling modelling. The total share of individuals with the modelling of the curling of valuable types is 98.3%, including the most valuable type of parallel-concentric curling modelling is 38.6%, with the parallel-scale modelling type - 37.8% and the type mixed curling modelling - 21.9%. The lambs with invalid modelling, indeterminate, in this batch are very rare (1.7%).

In the batch of lambs with the appropriate luster predominates the individuals with modelling of mixed type curling (38.3%), parallel-concentric (28.0%) and parallel-scale (22.2%). Individuals with indeterminate curling modelling, in this batch are in the minority - 11.5%.

The lower is the lambs fibre luster, the lower is the proportion of individuals with the modelling of valuable types, and the proportion of individuals with the non-indeterminable type curling modelling increases. Thus, in the batch of low luster fibres lambs, the share of individuals with parallel-concentric modelling decreased to 3.0% and in the batch of lambs with insufficient luster, they practically no longer meet. At the same time, the share of individuals with invalid, undeterminable modelling increased in these batch until 54.8% and 42.8%, respectively. Therefore, the most valuable types of curling modelling are formed at the lambs with the type curling jacket, coastal and flat, with thick, thin and medium gross leather, with short and medium long hair fibres, with excellent hair or appropriate silky, with intense or appropriate luster.

Knowing the particularities of extension and curling modelling of at the Moldavian Karakul lambs and the relations of these properties with other qualities and characters of the skin allow for the efficiency of lamb selection of the requested type.

CONCLUSIONS

The extension of the curls, the modelling and the model of curling modelling at the lambs and skins Moldavian Karakul are very important characters (attribute) that directly or indirectly determine the commercial qualities and the market value of the skin as a whole.

The excellent and appropriate extension of the curling is characteristic for the lambs and skins Karakul with the type curling jacket, Caucasian and coastal curling type. For lambs and skins Karakul with the flat curling type is characteristic of the weak extension of the curling.

The highest excellent modelling rate has lambs with flat curling type (58.5%), coastal (50.4%) and jacket (26.4%). The most appropriate modelling rate is lambs with the type of curling

jachet (73.4%), costal (46.1%) and flat (35.0%).

Curling modelling is in positive relationship with the length of the curls, the silk and the luster of the fibres, and in the negative relation (but beneficial for selection) with the length of the fibres.

The lambs with jachet curling type, usually, have the parallel-concentric type curling modelling (48.9%) and mixed (49.9%). The lambs with the type curling of coastal and flat have predominantly parallel-scale type modelling (81.4%) and (62.4%), respectively.

The type of curling modelling is in a positive relation to the silk and luster of fibbers, and in a negative (but beneficial to selection) relationship with leather thickness and fibber length.

Knowing the particularities of extension and modelling of the curling at the Moldavian Karakul lambs and the relations of these properties with other qualities and characters of the skin allow for the efficiency of lamb selection of the requested type.

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