

CUTICULAR LAYER ULTRA STRUCTURE
OF HAIR SHEEP'S WOOL FIBER

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Abstract. It was studied ultrastructure cuticular layer of ordinary and down wool hair of different itrabreedintrabreed types edilbay sheep breed. It is established four speciality points: configuration and size of scales and shape of scale's border. In future this points may be used for identification of itrabreedintrabreed type of edilbay sheep.

Key words: ultrastructure, cuticula, scutal layer, edilbay sheep breed, birlik's and suindik's intrabreed type.

Introduction

At the present time sheep breeding in Russia undergoes a protracted crisis period, because of low demand of wool in our country and deficiency government contractual work for wool for a long time. So to come out of a recession we should restructure the line of sheep breeding business in turn of meat production. But Russia disposes relatively poor genofond of specialty sheepbreeds, that could produce a lot of high quality meat in a short time. So it is needed to import edilbay sheep breed from Kazakhstan, which is fat-rumped, fast-gaining and has outstanding meat production. Now we are creating breeding-sheep-rearing farm of edilbay breed in Volgograd region, as a Today these sheep breed cause interest from meat producers, and for another thing it represents very important genetic resource. So it is very interesting and important to learn their biological traits, one of which is cuticle layer ultra structure of hair fibers.

The exterior of the each fiber consists of a thin layer of flattened cells which overlap to form a continuous tube around the fiber. The scales overlap like the tiles on a roof (не понятна структура предложения) with their projecting edges directed away from the skin. The milling and spinning properties of wool are largely determined by this peculiar scaly structure [2, 3], which incidentally provides a firm anchorage to the follicle in the skin of the sheep. Cuticle is very thin but has an important role, it protects hair fiber of mechanical, chemical and biological damaging factors [2, 6]. They feature two main types of scales: roof-tile-like and coroniform [2, 3]. T.I. Kuznecov points out that type and shape of cuticle scales are typical for each specie and breed of animals [3]. According to the dates from A.I. Erochin, it's possible to define type of wool fiber and breed category of animal by shape and relative positions of cuticle scales [2]. On evidence from N.P. Roldugina and

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B.I. Petritshev hair luster and silk heavily depend on exterior ultra structure of fiber. Damage effect susceptibility of fiber varies with scale adherence measure and outer edges shape of each scale. According to the dates from N.P. Roldugina, if cuticle of lambs fiber scales is closely adherent it will be damaged less during their lives [5]. We have examined under electron microscope cuticular layer ultra structure of hair and wool fibers of different intrabreed types of edilbay sheeps. We defined out number of specific characteristics.

Methods

From each sample of wool we took little fiber tuft and dissected out a short district from the middle of each fiber tuft. From received samples we picked out some hair and wool fibers by pair of forceps, and tipped them on the objective table by twin-sticky carbonic tape.

Samples under investigation was applied with thin lay of Pt (24 nanometers) in JEOL auto fine coater JFC — 1600. Prepared mounts were putted in scanning election microscope JEOL JSM — 6490LV, where they were examined and photographed in different scales.

Results

We defined out number of specific characteristics for different intrabreed types of edilbay sheeps by form, size, configuration and external surface of cuticles scales.

Hair fiber

The roughness, represent by fragments of scales and warts, was shown on external surface of cuticular layer. The amount of warts on birlik intrabreed type of edilbay sheep hair fiber is bigger, than on suinduk hair fiber. Warts are bigger and locate in groups, so we can see them on 400-fold zoom. On external surface of some fibers we can see scales aggregations, in which scales' edges stuck together. The edge contour of aggregation is melt and surface is rough. Because of such structure fibers become coarser. The roughness on external surface of suinduk sheep fibers are much smaller, generally represent by fragments of scales and a little small-scale warts. They spread evenly by the length of fiber.

Hair fiber scales of suinduk sheeps have prolate roof-tile-like form, birlik scales are wider and have form of irregular polygon (fig. I).

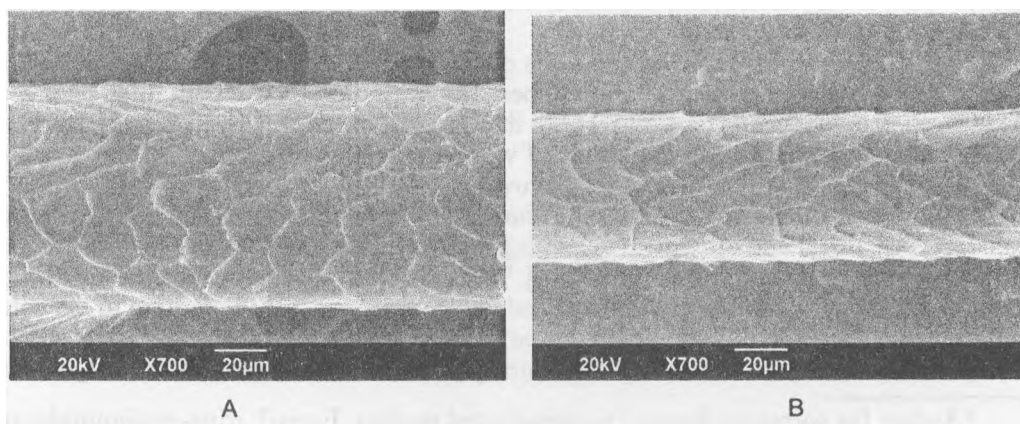


Fig. 1. The exterior surface of cuticulare layer hair fiber (700x): A — fiber of birlik intrabreed type edilbay sheep; B — fiber of suindik intrabreed type edilbay sheep

In 1 mm of birlik intrabreed type sheep fiber length was counted 46,79 scales, whereas in the same length of suindik intrabreed type sheep fiber was counted a little less number of scales — 46,59. The table 1 lists absolute sizes of hair fiber scales of sheep studied intrabreed types.

Table 1

Hair and wool cuticular layer specific characteristics of birlik and suindik intrabreed type edilbay sheep fiber

Type of fiber	Characteristic and measure	Intrabreed type	
		birlik	suindik
Hair	<i>Qualitative characteristics</i>		
	Configure of scale	Wide, irregular polygon	Prolate, roof-tile-like
	Outer edge shape of scale	Outer edge — plane, bright; side edges — wavy	Plane, bright
	Rugosity	Yes	Yes, very weak
	The number and localization of roughnesses on the fiber's surface	A lot of, localized in groups	A little, evenly spread
	The number of scale on 1 mm of fiber length	46,79	46,59
	The number of scale on average diameter of fiber	5,23	4,77
	<i>Quantitative characteristics</i>		
	Size of scale, μm		
	Length	25,68 \pm 1,09	25,56 \pm 0,89
	Width	22,66 \pm 0,85	13,44 \pm 0,57
	Height	1,64	1,63
Wool	<i>Qualitative characteristics</i>		
	Configure of scale	Tight ring	Wide ring
	Outer edge shape of scale	Bright, light wavy	Misty, dentate
	Rugosity	No	No
	The number and localization of Roughness on the fiber surface	Little to no	A lot of, evenly spread
	The number of scale on 1 mm of fiber Length	62,19	69,96
	The number of scale on average diameter of fiber	1	1
	<i>Quantitative characteristics</i>		
	Size of scale, μm		
	Length	17,64 \pm 0,92	14,90 \pm 0,95
	Width	16,69 \pm 1,25	15,34 \pm 0,57
	Height	1,14	1,20

Birlik intrabreed type sheep hair fiber scales adherence form. The upper edge of scale practically doesn't overhang over a fiber, whereas upper edge of suinduk sheep scale overhangs over fiber a little.

Longitudinal rugosity, which proposes glassy glace of wool, was shown on the scale surface of both intrabreed types of sheeps. Rugosity is more clearly visible on birlik sheep scales, in part it depends on damage of edges of suinduk sheep scale (fig. 2).

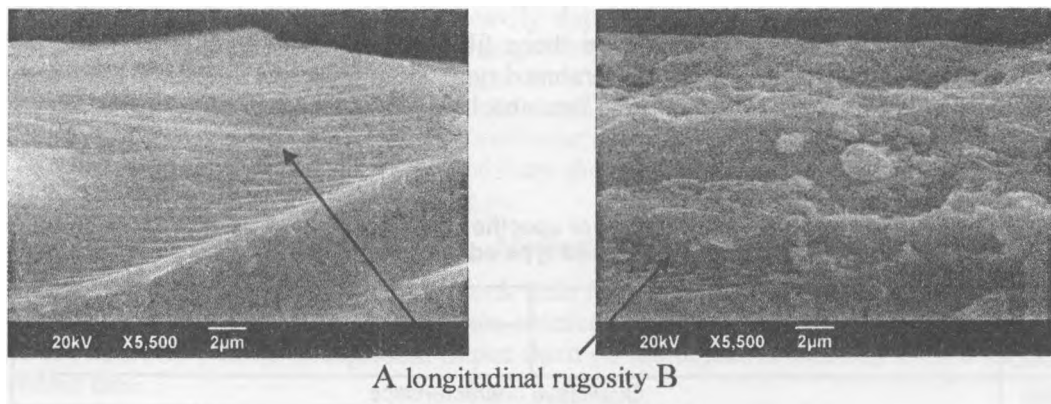


Fig. 2. The scale surface of hair fiber (5500x):
 A — surface of birlik sheep scale; B — surface of suinduk sheep scale.

Wool fiber

As the case with wool fiber on hair fiber there are warts and scales' fragments. But on wool fiber of birlik sheep there are imperceptible amount of warts and scale fragments, whereas on suinduk sheep fiber a lot of warts spread evenly by the length of fiber. A great deal scale edges of suinduk sheep fiber are damaged (fig. 3).

Cuticular layer scales of both intrabreed types of sheep ordered annularly, each of scale encircle the fiber. Scales are coroniform with sharp and bright edge shapes. The upper edge of birlik fiber scales rather high overhang of follow scale, in average on 1,2 nanometers (fig. 3).

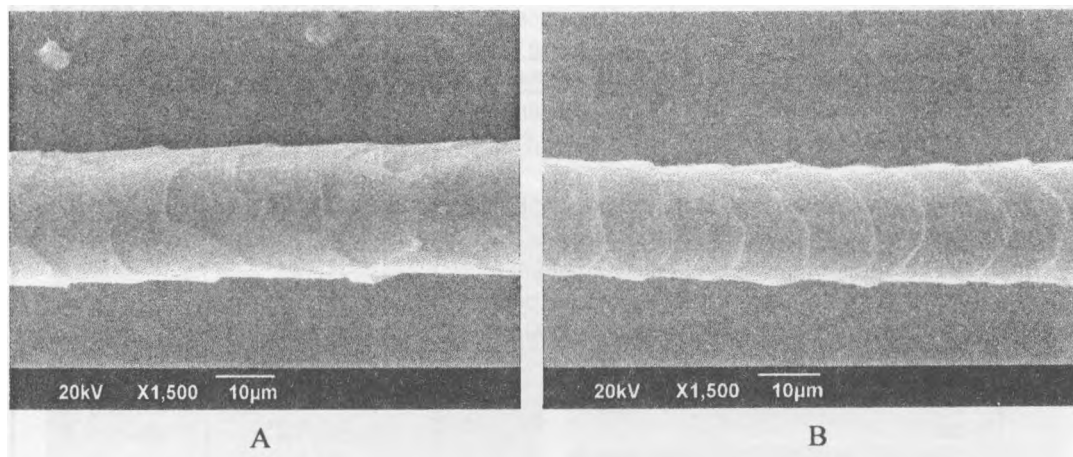


Fig. 3. The scale surface of wool fiber (1500x):
 A — surface of birlik sheep scale; B — surface of suinduk sheep scale

Scales of suinduk sheep fiber have dentate configuration, shape of edges are melting, upper edges are damaged a little, scales adherence form.

We measured average length of wool fiber scales. We meant length by the most distant point of scale edge. The length of birlik sheep scale is $17,64 \pm 0,92$ micrometers, and

length of suinduk sheep scale is $14,90 \pm 0,95$ micrometers. At that in the most immediate points of scale length of each scale amount to 50-70% of designated length.

In 1 mm birlik intrabreed type sheep fiber length contains a lot of scales videlicet in average 62,19 scale, by the side of suindik intrabreed type sheep fiber length contains 69,96 scales. There is no longitudinal rugosity on the the scale exterior of sheep both studied intrabreed types.

Conclusion

It is established four speciality points: configuration and size of scales and shape of scale's border. In future these specific characteristics may be used to identify intrabreed type of edilbay sheep breed.

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Аннотация. Изучена ультраструктура кутикулярного слоя остевых и пуховых волокон животных различных внутрипородных типов эдильбаевской породы овец. Выявлены четыре отличительных особенности, характерных для животных бирликского и суюндукского внутрипородных типов: форма и размеры чешуек кутикулярного слоя и форма края чешуек. В дальнейшем эти показатели могут быть использованы для определения внутрипородного типа овец эдильбаевской породы.