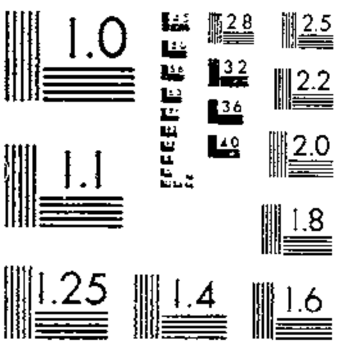
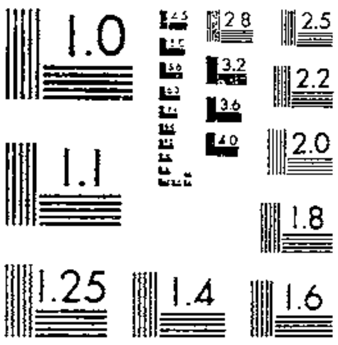
TB 35 (1927) USDA TECHNICAL BULLETINS UPDATA
STUDIES OF THE OCCURRENCE AND ELIMINATION OF KEMP FIBERS IN MOHAIR FLEECES
HARDY, J I 1 OF 1

START



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TECHNICAL BULLETIN No. 35 — OCTOBER, 1927

UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

STUDIES OF THE OCCURRENCE AND ELIMINATION OF KEMP FIBERS IN MOHAIR FLEECES

By J. I. Hardy

Animal Husbandman, Animal Husbandry Division, Bureau of Animal Industry[1]

CONTENTS

CHARACTERISTICS OF MOHAIR

Mohair is the long, lustrous coat of the Angora goat. The countries which lead in its production are Turkey, South Africa, and the United States. It is an important textile fiber on account of its luster, length, fineness, strength, and spinning qualities. Its lack of felting qualities makes it a particularly valuable fiber. The great objection manufacturers have to mohair is that it commonly contains shorter, coarse, undesirable fibers, known as kemp. Besides taking dye poorly, these fibers often cause a loss in combing of as much as about 18 per cent of the original weight of the mohair. In addition to this it is not possible to remove them completely from the good mohair.

The purpose of the investigation here reported was to study some of the characteristics and properties of kemp found in mohair produced in the United States, South Africa, and Turkey that may be applied in the production of better mohair. In the United States and South Africa flocks were begun by crossing Angoras, which grow long, fine fleeces, with the ordinary common goats, which grow a coat of coarse-hair fibers. With this as the beginning, large flocks have been established, and the mohair from these two countries to-day ranks well with that grown in Turkey. This has been accomplished

[1] The writer extends thanks to J. R. Tennyson, junior scientific aid of the Animal Husbandry Division, for assistance in the measurements of the mohair fibers.

60331°—27

through long periods of careful, selective breeding. A better understanding of this accomplishment may be obtained when the ancestors of these common goats are considered. They probably had fleeces very similar to the wild Asiatic or Rocky Mountain goats (*6, p. 162*).[2] The wool and hair covering on goats in some of the foreign countries, where they have been allowed to run in a semiwild condition, seems to be but a step toward the high development of the fleeces found on our improved Angora goats. In the year 1555 a type of goat corresponding to the Angora was reported in Asia Minor (*5, p. 412*). Just how it was developed and established is not definitely known. Wucherer (*10, p. 142*) suggests that the Angoras originated by way of mutation. The prepotency of the Angora goat is clearly shown when it is recalled how great a part the first importation (*8, p. 230*) from Turkey to South Africa played in their development in that country. In this first importation of 13 Angoras only 2 of the animals were potent. South Africa now contains more than 2,000,000 Angora goats, and produces fully 12,000,000 pounds of mohair annually. In spite of the great improvements made in the quality of mohair in the United States and other countries, there are still possibilities for further improvements.

TWO KINDS OF HAIR COVERING OF ANIMALS

Most animals which grow wool, hair, or fur have two coats, an outer or so-called protective covering, and an undercoat which provides warmth. The development of these two coats varies with the climate in which the animals live, and it has also been greatly modified under conditions of domestication where protection has been provided and special attention has been given to their breeding. In the case of the fur-bearing animals the fine undercoat is the true fur.

The wild goat has these two kinds of hair. The outer coat of coarse hairs constitutes the great bulk of covering on these animals. The hairs are very coarse and brittle and have large, medullary canals which are filled for the most part with thin-walled partitions containing air. The cuticular scales are observable with difficulty. They surround the cortex, which constitutes only a small portion of the fiber. These coarse hairs have a close resemblance to the kempy and coarse, medullated fibers of unimproved Angoras.

The fine, downlike fibers which constitute the undercoat are very fine and delicate and bear resemblance to the improved mohair of to-day. They have a well-defined cuticular scale development with a well-developed cortex, but entirely lack the medullary development found in the large fibers. These finer fibers appear like very fine mohair fibers. The two kinds of fibers are shown in Figure 4.

EXPERIMENTAL PROCEDURE

PREPARATION OF FIBERS

The samples of fibers were first cleaned by moistening in as much 95 per cent alcohol as they would absorb. This was followed by squeezing out the excess between pieces of clean blotting paper. Each sample was then similarly treated in chloroform. For a quick examination the samples were stained in alcoholic picric acid solution

[2] Reference is made by italic numbers to "Literature cited," p. 16.

and examined microscopically after having been mounted in water, glycerin, or diaphane under a 100 diameters' magnification. Fibers dyed a light shade of red were found to photograph satisfactorily.

When this color was desired the small locks were tied with a fine, cotton thread at both ends and in the middle. The lock was then placed in about 100 c. c. of warm water made alkaline with two drops of concentrated caustic soda and heated to 180° F. This solution was then poured off, and the lock was rinsed with warm water. The fibers were boiled in a water solution of safranin until stained to a pale reddish color. The sample was then rinsed in warm water repeatedly, and dried between pieces of blotting paper after having been moistened in alcohol solution until the excess of water was removed from the fibers. By being moistened in absolute alcohol and dried between pieces of blotting paper the samples were satisfacto-

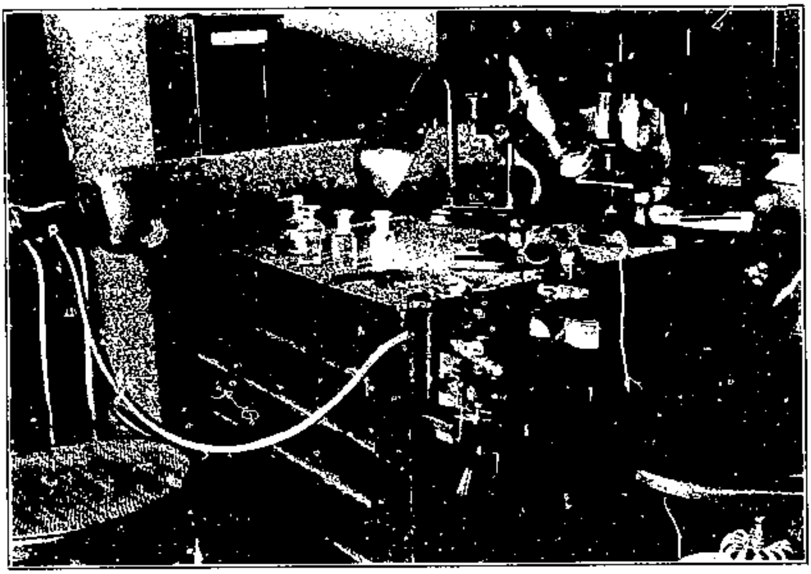


FIG. 1.—Some equipment used in studies of mohair fibers showing, in the foreground, freezing microtome clamped to desk. The horizontal tank contains carbon dioxide used for freezing the specimens to be cross sectioned

rily dried for mounting in diaphane. Equipment used in the work is shown in Figures 1, 2, and 3.

SECTIONING OF FIBERS

Cross sections and longitudinal sections of fibers were prepared from stained fibers and were obtained through the use of a freezing microtome. The fibers were thoroughly moistened with water and frozen in ice in a vertical position for cross sections, and in a horizontal position for longitudinal sections. As the sections were cut by the microtome knife they accumulated in one little droplet on the edge of the knife. This was best transferred to a slide by bringing the slide close to the edge of the knife, when the droplet was readily blown by means of a glass tube to the slide. When sections of individual fibers were made they were wiped off the knife with a piece of smooth, hard-surfaced filter paper, and removed from the paper by means of a sharp needle under the low power of the microscope.

DESCRIPTION OF SAMPLES

Locks of hair from the skins of wild goats were obtained from the National Museum. The commercial samples of mohair originated in various sections of the United States, South Africa, and Turkey and were obtained from one of the largest manufacturers of mohair plush. Samples of mohair plush were also obtained from a large domestic manufacturer. Twenty-seven samples of mohair of known breeding were obtained from J. M. Jones and J. L. Lush, of the Texas Agricultural Experiment Station, who have been making an exhaustive study of the diameter measurement of wool and mohair fibers since 1923.

FIG. 2.—Equipment for measuring mohair fibers microscopically. The upper portion of the microscope contains ground-glass focusing equipment for use in photographing the fibers. The lamp at the left provides uniform illumination of proper intensity

The commercial samples of mohair included the more common commercial grades of Texas, Oregon, Middle West, Turkish, "White Cape," and "Basuto Cape" mohair. The plush samples were all of good quality and from the same manufacturer. Twelve of the plush samples were manufactured in 1926. Twelve other samples were manufactured about 1916.

EXAMINATION OF SAMPLES

The plush samples were examined for kemp both with the naked eye and under a binocular with 7.5 diameters' magnification. The cleaned and dyed locks of mohair were also examined for the presence of kemp under the binocular with 7.5 diameters' magnification. For the examination of the cuticle, cortex, and medulla of fibers, magnification on the microscope of 100 and 250 diameters was used. For examination purposes the fibers were held in place on glass slides by means of strips of adhesive tape and then mounted in water, glycerin, or diaphane, as desired. When long fibers were examined from base to tip they were mounted on slides which were especially prepared from cleared photographic plates.

MEASUREMENT OF SAMPLES

The length of the locks of mohair and of the kemp were measured in millimeters. The length of a representative lock was measured before cleaning, and after cleaning and dyeing the average length of five kemp fibers was taken as the length of the kemp. The diameter of all the mohair and kemp fibers was measured with a ratchet-stop micrometer caliper having an enlarged barrel graduated in four-hundredths of a millimeter. All the kemp fibers were measured at the same point microscopically by means of a graduated

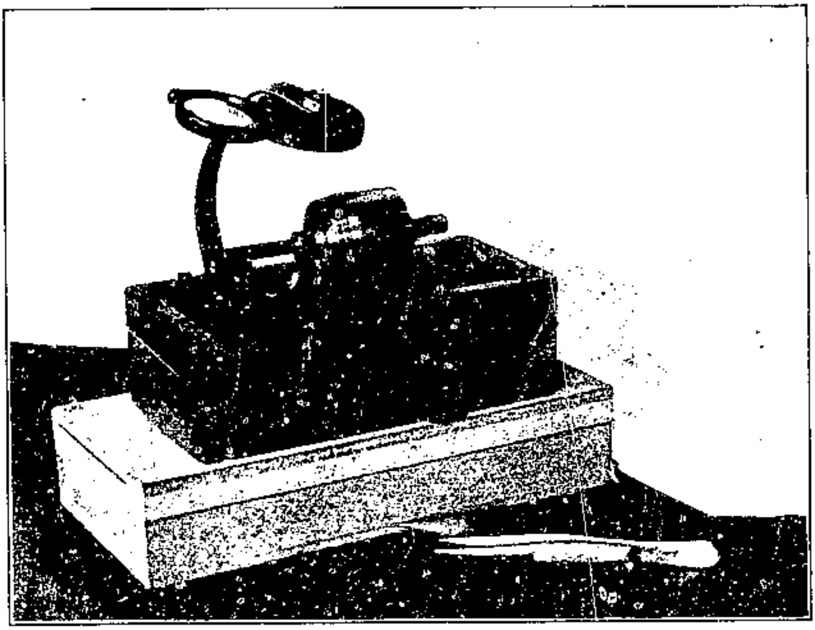


FIG. 3.—Micrometer caliper used in measuring diameter of mohair fibers. The micrometer differs from others principally in the large barrel, each division representing one four-hundredth of a millimeter. The ratchet-stop adjustment provides uniform contact for the fibers measured. The lens facilitates reading the graduations

eyepiece. The mohair fibers were measured about one-fourth of the distance from the base end to the tip end of the fibers. The kemp fibers were measured one-half centimeter from their base end. An average of 20 measurements was made for the diameter of the mohair fibers. The measurements on the fibers were made at a temperature of about 75° F. and at a relative humidity of about 30 per cent.

DISCUSSION OF RESULTS

KEMP IN MOHAIR PLUSH

The mohair fibers in 12 different samples of mohair plush were examined both with and without magnification. In these fabrics kemp or coarse, stiff, bristlelike fibers may be found readily, with the naked eye, scattered through the fabric. These fibers show up as whitish fibers, rarely if ever taking the dye to the same degree as the other mohair fibers. With a low-power binocular (about 7.5 diameters magnification) they show up very prominently.

Figure 5 shows kemp in a piece of mohair plush photographed seven times actual size. Similar fabrics were examined which were manufactured by the same concern more than 10 years ago. Some kemp was found in all samples examined, but there was more kemp in the older samples than was found in those made in 1926 or about 10 years later. This would indicate that in the last decade growers made progress in decreasing the quantity of kemp through their breeding operations.

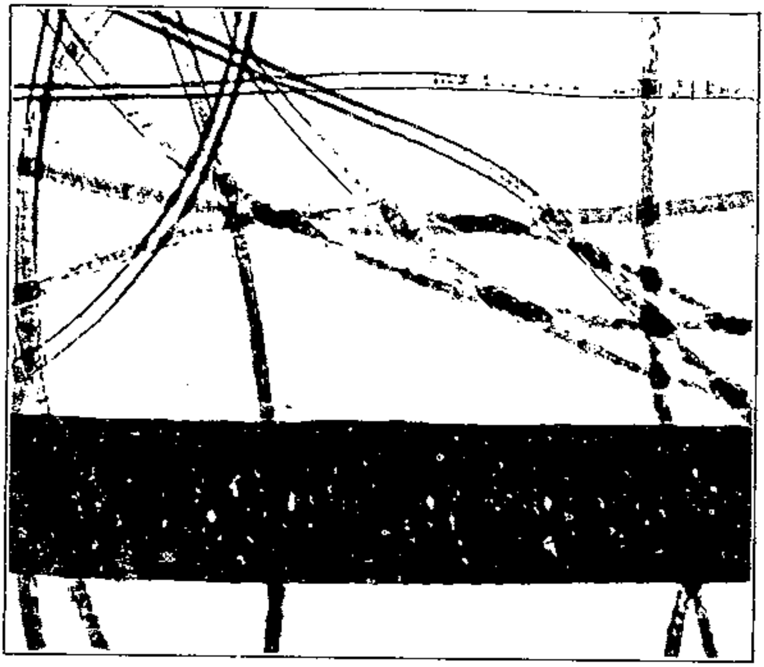


FIG. 4.—Hair fibers from Asiatic goat showing the two kinds of hair covering on wild goats. The large fibers, of which only one is shown, constitute the outer covering; the small fibers are the undercoat. Magnified 250 diameters

EXAMINATION OF COMMERCIAL MOHAIR

Forty-seven samples of mohair were selected according to grade by an expert mohair grader at the sorting room of a large plush manufacturer. Thirty-five of these samples were main sorts and 12 were off sorts. Each sample was examined for the presence or absence of kemp and medullated fibers. The samples of Texas 3's and Cape Low matchings were the only commercial samples containing only one kind of fibers which were found free from kemp. Three of the samples of beards contained coarse, mohair fibers, some of which were medullated and some were underfibers. These fine underfibers were very much like those found on the wild goat. A representative lock of each of these samples was measured for length.

Table 1 shows the results obtained from these measurements on 35 samples of the main sorts together with average lengths and diameters of kemp and mohair fibers.

The length of the locks of mohair ranged from 85 to 280 millimeters. The length of the kemp fibers ranged from 15 to 73 millimeters. The diameter of the kemp fibers ranged from 0.016 to 0.044 millimeter.

Measurements on samples in each grade for the lengths and diameters of kemp and mohair fibers are shown in the line of averages. These averages show that the diameter of kempy fibers shows a tendency to increase with the length of kemp and with the diameter of mohair fibers. The average diameter of all the kemp fibers at their base, as found with the micrometer caliper, is only 0.0002 millimeter greater than that of the mohair fibers. The examination of

FIG. 5.—Mohair plush showing kemp fibers not removed by combing and appearing undyed in the finished cloth. Magnified 7 diameters

a large number of fibers with the microscope showed that the kemp fibers were somewhat larger than the surrounding mohair fibers and that they increase in diameter as measured at different points from the base toward the tip of the fiber. At the tip end these fibers taper down to a sharp point. The average of five fibers, which were typical kemp fibers, measured at five different points along their length from the base end to the tip end, was recorded. At these five points beginning at the base end, the kemp fibers measured 0.033, 0.043, 0.063, 0.085, and 0.01 millimeter. The diameter of the kemp fibers from this same lock from which these kemp fibers were taken, when measured with the micrometer caliper at their base end, was found to average 0.029 millimeter. This result is 0.01 millimeter less than that obtained with the microscope. This led to a comparison in results obtained by the use of the microscope and micrometer caliper. Fifty mohair fibers and 50 kemp fibers were measured at the same point microscopically and with the micrometer caliper. The results obtained are shown in Table 2. Each observation represents the average reading for a group of five fibers.

TABLE 1.—*Comparison of lengths and diameters of mohair and kemp fibers in 35 samples of commercial mohair, arranged according to manufacturer's grades*

Designation of mohair	4's					3's				
	Length		Diameter			Length		Diameter		
				Kemp					Kemp	
	Lock	Kemp	Mohair: Micrometer	Micrometer	Microscope	Lock	Kemp	Mohair: Micrometer	Micrometer	Microscope
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Texas	105	21	0.020	0.024	0.071	85		0.028		
Oregon	160	31	.018	.010	.037	195	52	.024	0.024	0.050
Middle West	160	24	.021	.031	.050	235	33	.025	.029	.030
Turkish	150	41	.02[illegible]	.025	.045	155	34	.024	.034	.043
Cape	135	25	.021	.026	.056	150	34	.021	.020	.041
Basuto Cape	165	40	.023	.022	.017	200	40	.025	.030	.041
Average	149	30	.021	.024	.051	170	30	.025	.027	.043
	Best britch					2's				
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Texas	(1)	(1)	(1)	(1)	(1)	152	40	0.031	0.026	0.052
Oregon	235	39	0.020	0.035	0.045	155	16	.024	.016	.035
Middle West	250	15	.028	.021	.047	150	34	.033	.044	.054
Turkish	170	40	.035	.036	.062	160	24	.032	.037	.047
Cape	170	18	.025	.026	.097	175	26	.028	.021	.045
Basuto Cape	200	43	.028	.027	.015	190	49	.010	.037	.062
Average	205	31	.030	.029	.053	164	32	.032	.030	.054
	Low britch					Low matchings				
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Texas	100	33	0.032	0.025	0.045	135	47	0.034	0.038	0.073
Oregon	180	59	.030	.038	.054	265	51	.013	.038	.071
Middle West	185	18	.025	.021	.015	250	31	.037	.042	.056
Turkish	225	50	.033	.025	.015	195	27	.035	.032	.017
Cape	165	18	.031	.020	.041	160		.031		
Basuto Cape	195	48	.032	.041	.060	280	73	.036	.044	.060
Average	175	38	.031	.028	.048	211	46	.036	.039	.053

[1] No sample.

TABLE 2.—*Diameter of mohair and kemp fibers measured at the same point microscopically and micrometrically, each observation being the average of five fibers*

Observation No.	Mohair fibers			Kemp fibers		
	Microscope measurement	Micrometer measurement	Difference	Microscope measurement	Micrometer measurement	Difference
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
1	0.029	0.020	0.009	0.050	0.025	0.025
2	.031	.023	.008	.040	.024	.016
3	.035	.025	.010	.040	.025	.015
4	.031	.022	.009	.023	.022	.001
5	.028	.022	.006	.040	.028	.012
6	.027	.019	.008	.035	.021	.014
7	.030	.024	.006	.031	.021	.010
8	.032	.024	.008	.040	.022	.018
9	.027	.020	.007	.050	.027	.023
10	.031	.023	.008	.034	.020	.014
Average	.030	.022	.008	.038	.024	.015

These results show that the measurements obtained with the micrometer caliper are uniformly less than the results obtained by the use of the microscope. This is probably explained partially by a slight squeezing of the fibers in the micrometer caliper. It is also due partially to the tendency of the micrometer caliper to measure through the shortest diameter when the fibers are not exactly circular. With the microscope the increased diameter due to its being flattened out by the cover glass is very slight. With the microscope there is a tendency to measure through the longest diameter when the fibers are not circular. Table 2 also shows the diameter of kemp fibers measured at the same point on their diameter at which they were measured with the micrometer caliper. The increased diameter when measured by the microscope clearly shows that the kemp fibers are oval in cross section even at their base.

EXAMINATION OF IMPROVED MOHAIR FROM FLEECES

Twenty-seven samples from mohair fleeces were given exactly the same examination as the 47 commercial samples of mohair. These fleeces were from well-bred animals, 18 of which were registered Angoras. Six of these samples were found entirely free from kemp. The average length of the samples was 228 millimeters, and the average length of the kemp was 26 millimeters. The average diameter of the mohair fibers, as measured with the micrometer caliper, was 0.033 millimeter, while the diameter of the kemp at its base was 0.027 millimeter. As has already been pointed out, the kemp fibers are squeezed together more than the mohair fibers. This means that the kemp fibers are actually somewhat larger than the figure given above. All these kemp fibers were measured microscopically and showed an average diameter of 0.046 millimeter. This is only 0.013 millimeter more than the diameter of the mohair fiber when measured with the micrometer caliper. In the well-bred animal longer mohair and shorter kemp of a smaller diameter were found.

MOHAIR FIBERS UNDER THE MICROSCOPE

The general appearance of mohair fibers under the microscope is very much like that of wool fibers of the same diameter if compared at the same relative position on their length. There is much variation in the pattern which the cuticular scales make on both mohair and wool fibers. Some mohair fibers have a very prominent scale formation, although there appears to be a smaller number than on wool fibers of the same diameter.

Mohair fibers have a general appearance of greater smoothness than is possessed by wool fibers even where the scale formations of both are rather prominent. A comparison is shown in Figures 6 and 7.

When mohair and wool fibers are examined throughout their entire length it is found that the scale development at the tip end of the fibers is more readily seen than at the base end. The difference in scale development at the base and tip ends of the fibers is shown in Figure 8. Here one can see the scale development at the base and tip ends of the same fibers.

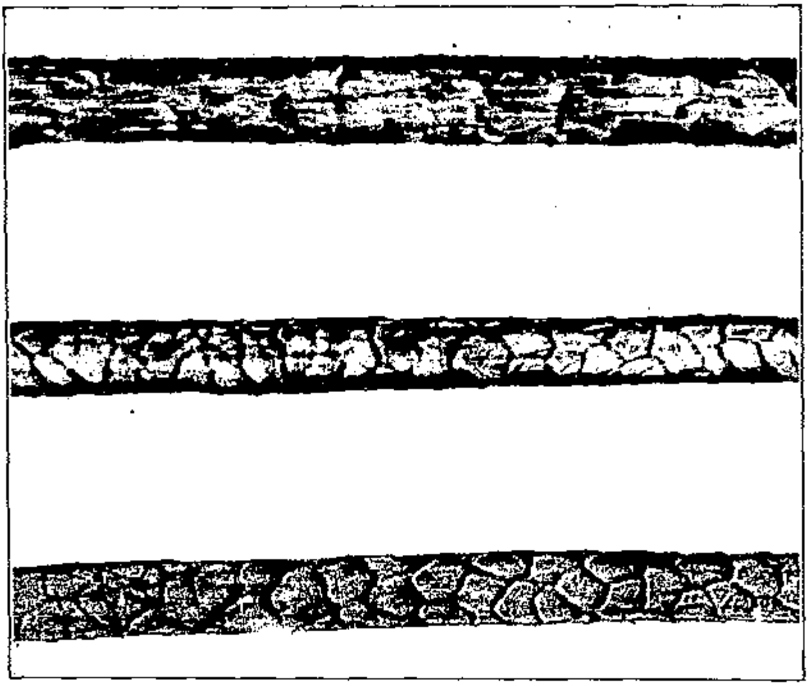


FIG. 6.—A comparison of scale formation. The fiber in the center is a wool fiber; the two on the outside are mohair fibers. Magnified 250 diameters

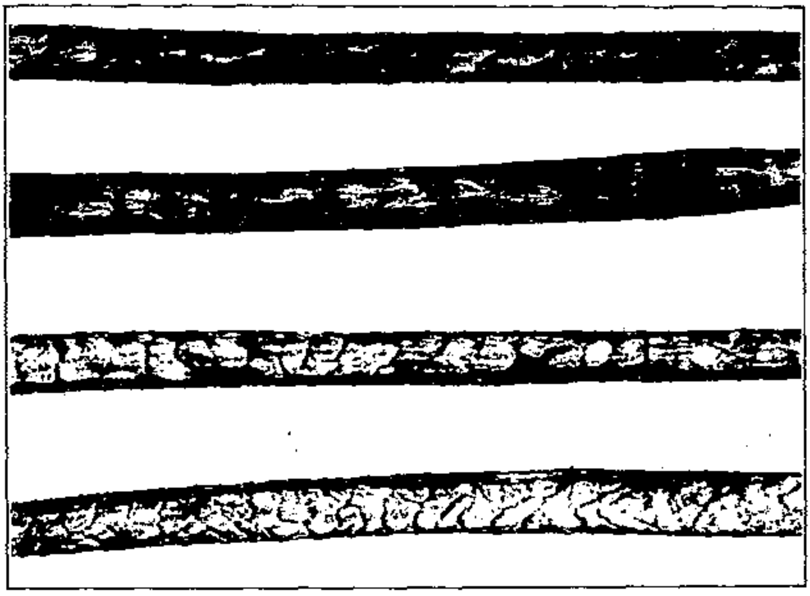


FIG. 7. The upper two fibers are mohair and the lower two are wool. Note the scale formation and the smoothness of the two kinds of fibers. Magnified 250 diameters

MEDULLAE DEVELOPMENT IN HAIR FIBERS

Hausman (*3, p. 547*) classified medullae of hair into five classes which he designates as absent, discontinuous, intermediate, continuous, and fragmental. Each of these terms is self-explanatory as they refer directly to medullae development in hair fibers. From the standpoint of the presence or absence of medullae we may divide mohair fibers roughly into three classes. In the first would come the absent, or fibers entirely free from medullae; then the fragmental, in which fragments of medulae occur along the length of some of the fibers; and finally, those with continuous medullae, in which the

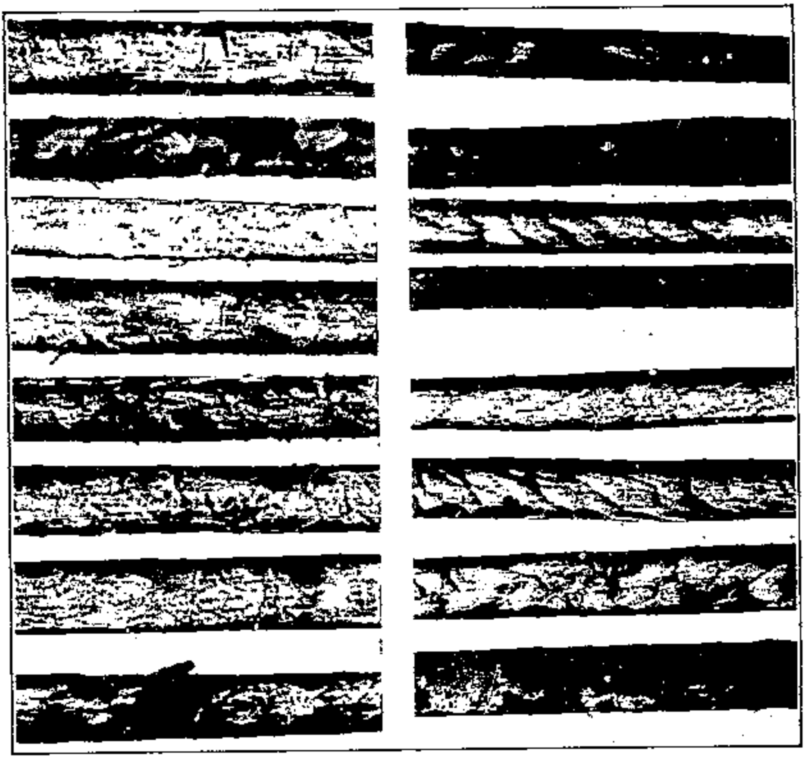


FIG. 8.—Eight mohair fibers, showing their scale development. Base portions of the fibers are shown on the left; tip portions of the same fibers are shown on the right. Magnified 250 diameters

medulla presents an unbroken appearance throughout nearly the entire length of the fibers.

COMPARISON OF MEDULLAE IN MOHAIR

A fleece of mohair may be considered ideal if it is made up entirely of a long, dense growth of bright, lustrous fibers free from any medullated fibers. Such mohair fleeces are not frequently found. In wool such fleeces are most often found in well-bred Merino sheep (*2, p. 376*). In mohair it is found that as the fibers become coarser there is a more frequent occurrence of the medullated fibers. Similarly wools have varying amounts of fibers with a discontinuous and a continuous medulla. As wool fibers become coarser the presence of medullae is more frequent. This is in agreement with the findings of Hausman (*3, p. 553*) in his examination of the medullae of the hair of 200 species of mammals. From the standpoint of the mohair growers these facts should have considerable significance. This would lead to the belief that breeding for coarser fibers in the fleeces of mohair would bring with it a tendency of these fleeces toward an increased number of medullated fibers. With the increased tendency of bucks toward medullated fibers there would be a sacrifice of the luster of the fleece. Breeding for coarser mohair, according to Rose (*8, p. 237*) lowers its desirableness and puts it in competition with crossbred wools. The maximum luster should be maintained in the mohair fleece. Luster carries with it other desirable qualities, such as uniformity of fiber and lack of medullation. Duerden and Ritchie (*2, p. 376*) state, "Where kempy fibres occur in the Merino they may be looked upon as the retention of an ancestral, hereditary character which has not yet been bred out."

It seems reasonable to believe that the elimination of kemp can be accomplished by following a careful plan of breeding. This would be a great accomplishment on the part of mohair breeders. With the elimination of kemp there would probably be a reduction of medullated fibers in the coarser fleeces and a general increase of luster in all these fleeces.

Kemp, which is the extreme type of medullated mohair fiber, is very objectionable to the mohair manufacturer. It is easily recognized by an experienced eye, being so much coarser than the surrounding fibers. In both wool and mohair these kempy fibers are as a general rule short, very coarse at the base, and come to a sharp point at the tip. In wool the kempy fibers are generally said to resist dye (*1; 4, p. 419; 7, p. 99; 9, p. 788*) or to dye less readily than the other fibers, and show up as uneven places in the finished goods, although Duerden and Ritchie (*2, p. 374*) state, "Despite all the opinions quoted, our experiments prove that kemp fibers dye just as readily as those of true wool." All the mohair plush samples examined by the writer showed that mohair kemp under practical mill conditions failed to take the dye as readily as other mohair fibers. The short tip of the kemp fiber, which is not medullated, dyes readily, whereas the heavily medullated portion is not dyed. The rate of dyeing for the finer fibers is so much greater than for the kemp that in the dyeing of light shades there is very little dye taken up by the kempy fibers in the time required for the desired shade. Even in the darker shades the difference in color of the kempy fibers may be readily seen, as shown in Figure 9. The kemp in this sample is very long; it failed to take the dye and showed up as the darker-colored fibers.

MICROPHOTOGRAPHS OF MOHAIR KEMP

A better understanding of mohair kemp is obtained from microphotographs. Some of the same fibers shown in Figure 9 were photographed under the microscope and are shown in Figure 10. These fibers show different degrees of medullation from good mohair fibers to kemp. When the medulla is filled with air it shows up in the microphotograph as black. Fiber D (fig. 10) is a kempy fiber with a portion of the medulla without air. This part of the fiber is nearly transparent. The two smallest fibers are without medullae.

Figure 11 shows cross sections and a longitudinal section of a kemp fiber. These were made from fibers similar to those used for Figures 9 and 10.

The good mohair is circular in form, while the kempy fibers vary in form from sections with flattened sides to those which are circular. The longitudinal section clearly shows the spongy, cell-like nature of the medulla of a mohair fiber. Air lodged in these spaces gives a kemp fiber its snow-white appearance.

OBSERVATIONS ON AIR IN KEMP

Kempy fibers were mounted on a slide in a thin solution of diaphane and were watched for their behavior under the microscope.

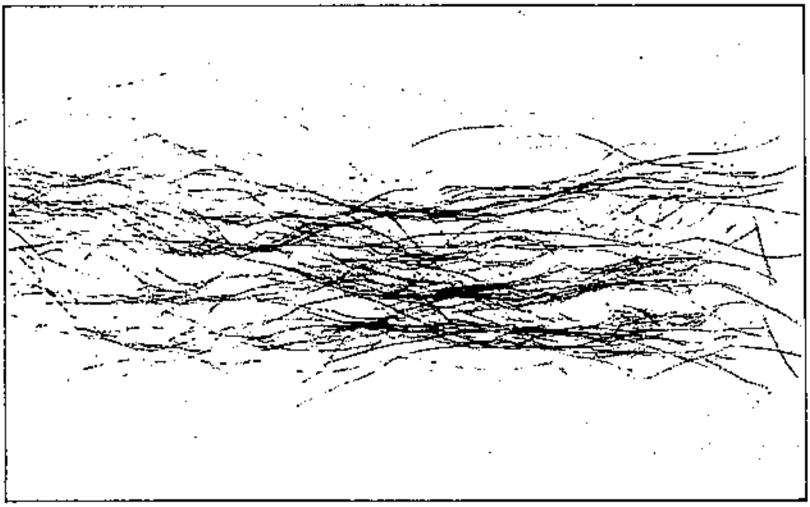


FIG. 9.—Showing about one-half of a small lock of mohair with kemp. The coarse, shorter fibers are kemp. Actual size

Wherever there happened to be a slight break in the fiber the diaphane worked slowly into the medulla of the fiber. The air was seen bubbling out at the breaks in the fiber as the diaphane worked its way in. The interchange of diaphane for air under these conditions was a very slow process. The cover glass was slightly depressed while the fibers were under observation, and the air could be seen as it worked its way more rapidly out of the fibers in the form of small bubbles. This air held in the medulla probably increases the difficulty of the dye penetrating the fibers and partially accounts for their decreased rate of dyeing. The effect of this air on the passage of light is readily seen in the same manner. When kempy fibers have had their air removed in this manner they become transparent.

Figure 12 shows four microphotographs of mohair kemp which were taken while they were being cleared with warm sulphuric acid. The fibers were mounted on a slide in water and covered with a cover glass. The acid was dropped on the slide and worked under the cover glass.

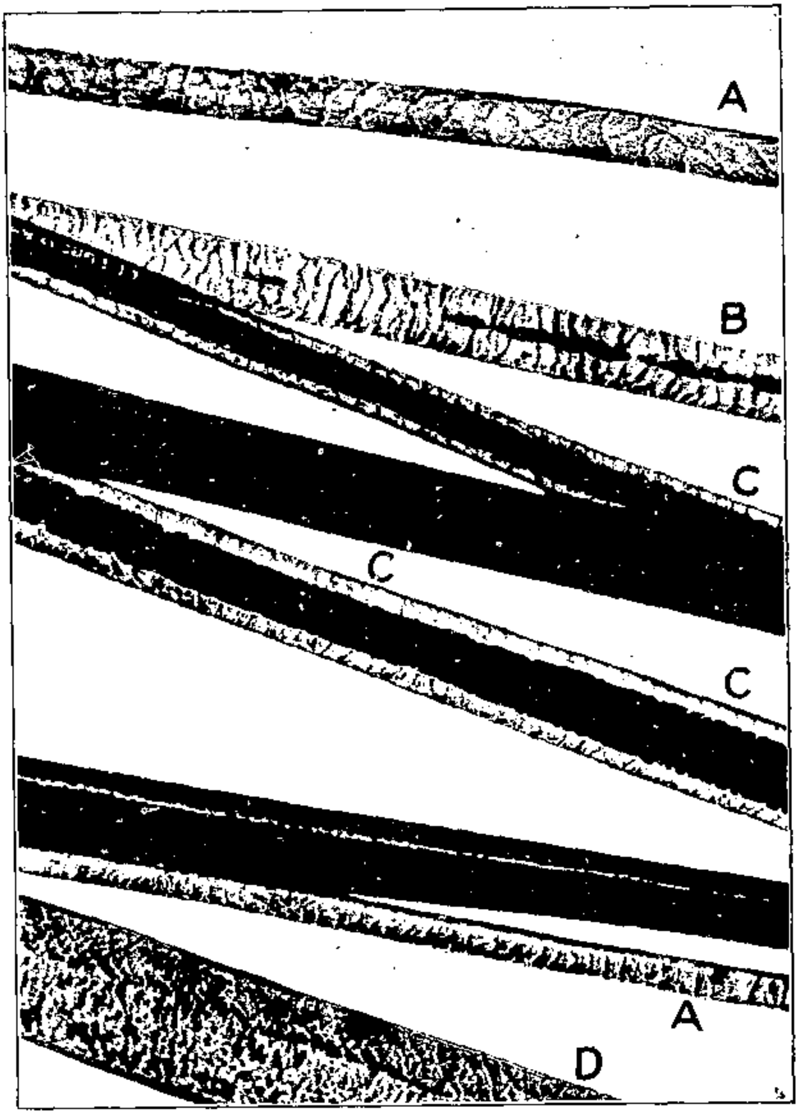


FIG. 10.—Good mohair without medulla, and different degrees of medullation. A, good mohair; B, partially medullated mohair; C, mohair with continuous medullations; D, coarse, kempy mohair. Magnified 250 diameters

SUMMARY

Of 47 commercial mohair samples examined, of which 35 represented main sorts, three showed entire freedom from kemp. Two of these samples contained fine underfibers, which were objectionable from the standpoint of uniformity.

Of 27 samples from improved Angora goats 6 were free from kemp. Two of these samples had many medullated fibers, also objectionable because of their close resemblance to kemp.

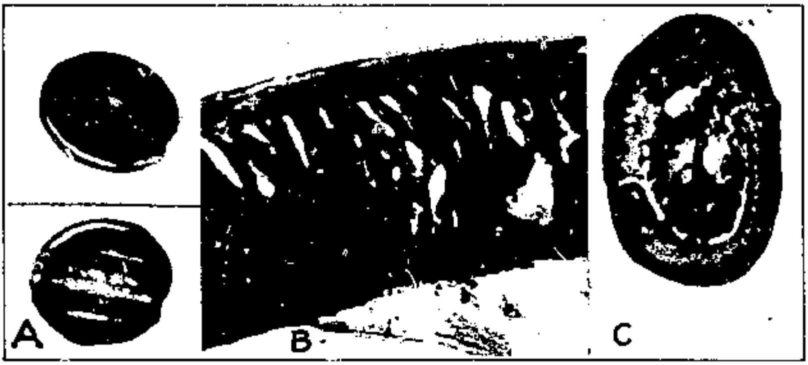


FIG. 11.—Sections of mohair fibers. A, cross section of good mohair; B, longitudinal section of mohair kemp; C, cross section of mohair kemp. Magnified 500 diameters

The average length of the commercial mohair samples examined was 180 millimeters and that of the improved mohair 228 millimeters. The average length of kemp from these two groups of samples was 36 and 26 millimeters, respectively. The improved Angoras, therefore, had the shorter kemp and the longer mohair.

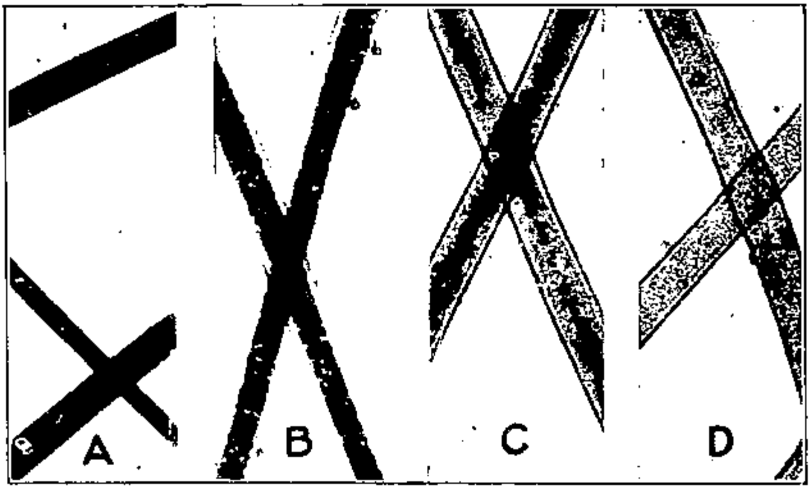


FIG. 12.—Mohair kemp before and after removal of air. A, fibers before removal of air; B and C, the air is partly removed; air bubbles may be seen in B; D, transparent fibers after air is removed. Magnified 80 diameters

With the micrometer caliper the diameter of the commercial mohair was 0.029 millimeter, and that of the improved mohair was 0.033 millimeter, while the diameter of kemp for the same groups of fibers was 0.030 and 0.027 millimeter, respectively.

The average diameter of the kemp measured microscopically was 0.052, whereas that of the improved mohair was only 0.046 millimeter.

The difficulty encountered in finding kemp in each of the samples of improved mohair indicated that there was less of it than in the commercial mohair.

The samples of mohair which were very lustrous were free from medullated fibers. As the fibers became coarser there was a greater tendency toward medullated fibers.

Judging from the quality of the mohair samples from the improved Angoras, it should be possible through systematic breeding for animals free from kemp to establish flocks of Angoras entirely free from kemp, and in this manner greatly to improve the quality of mohair grown in the United States.

LITERATURE CITED

(1) Bowman, F. H.
1908. THE STRUCTURE OF THE WOOL FIBRE AND ITS RELATION TO THE USE OF WOOL FOR TECHNICAL PURPOSES. 475 p., illus. London.

(2) Duerden, J. E., and Ritchie, M.
1923. KEMP FIBRES IN THE MERINO SHEEP. So. African Jour. Sci. 20: 366–379, illus.

(3) Hausman, L. A.
1924. FURTHER STUDIES OF THE RELATIONSHIPS OF THE STRUCTURAL CHARACTERS OF MAMMALIAN HAIR. Amer. Nat. 58: 544–557, illus.

(4) Hawkesworth, A.
1920. AUSTRALASIAN SHEEP & WOOL. Ed. 5, rev. and enl., 594 p., illus. Sydney.

(5) Hayes, J. L.
1868. THE ANGORA GOAT; ITS ORIGIN, CULTURE AND PRODUCTS. Boston Soc. Nat. Hist. Proc. 11: 405–432.

(6) Lydekker, R.
1910. GOAT. *In* Encyclopedia Britannica, ed. 11, v. 12, p. 161–163, illus. Cambridge.

(7) Matthews, J. M.
1924. THE TEXTILE FIBERS. THEIR PHYSICAL, MICROSCOPICAL AND CHEMICAL PROPERTIES. Ed. 4, rewritten and enl., 1053 p., illus. New York and London.

(8) Rose, P. D.
1924. THE ANGORA GOAT INDUSTRY IN SOUTH AFRICA. Union So. Africa Dept. Agr. Jour. 8: 230–237, illus.

(9) Thorpe T. E.
1913. A DICTIONARY OF APPLIED CHEMISTRY. Rev. and enl. ed., v. 5, illus. London, New York [etc.].

(10) Wucherer, E.
1925. UEBER DEN CHARAKTER DES ANGORAHAARES. Ztschr. Tierzücht. u. Züchtungsbiol. 4: 119–143, illus.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
U. S. GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY
▽

END