

A MONOGRAPH
ON
WOOLLEN FABRICS
IN THE
North-Western Provinces and Oudh.

BY
A. W. PIM, ESQ., M.A., I.C.S.

Published by Authority.



ALLAHABAD:
North-Western Provinces and Oudh Government Press.
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P R E F A C E.

THIS report has been prepared in accordance with G. O. No. $\frac{2793}{1-73B-8}$, dated 13th October 1897.

The district reports have been drawn up on the lines of a list of questions circulated to all districts, but are in many cases unavoidably meagre.

The best reports received are those from Garhwál (Pandit Dharmnand Joshi), Mirzapur (Babu Dip Chand Rathor), Sitapur (Mr. J. C. Smith, C. S.), Naini Tal (Mr. W. B. Cockburn), Gorakhpur (Mr. W. Raw, C. S.) and Aligarh (Pandit Shyam Bihari Misra).

The reports received from Muzaffarnagar, Bahraich, Sultánpur, Almora and Fyzabad have also been of considerable assistance, and I would express my thanks to Mr. MacRobert, of the Cawnpore Woollen Mills, for the information which he has given me.

NAINI TAL, }
17th *June* 1898. }

ALAN W. PIM, I. C. S.

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MONOGRAPH ON WOOLLEN FABRICS

IN THE

NORTH-WESTERN PROVINCES AND OUDH.

CHAPTER I.

THE RAW MATERIAL.

THE woollen industry, in the wider acceptation of the term, includes the manufacture of articles not only from true wool, but also from a large number of the animal downs, such as mohair and camels' hair.

Generally speaking, the line of demarcation between wool and hair is distinctly defined, and for the purpose of the present monograph it will be sufficient to define wool as characterised by the power of felting, a process due to the interlocking of the numerous serratures with which the surface of the wool is covered.

I—Sources of supply.—It is not easy to estimate the quantity of wool locally produced.

From the estimates given in the various district reports, it appears that the number of sheep in these provinces is approximately 1,700,000, and assuming $\frac{3}{4}$ seer of wool as the average yield of wool by each sheep, the annual outturn of wool appears to be roughly 32,000 maunds. The other sources of supply, together with the imports during the three years 1894-97, are shown in the following table, compiled from the returns of Inland and Foreign Trade :—

Place from which imported.	1894-95.	1895-96.	1896-97.
Panjáb	14,816	11,840	14,479
Rájputána and Central India... ..	1,615	2,695	4,172
Bengal	28	...	600
Miscellaneous	59	276	327
Nepal and Thibet... ..	6,417	7,146	10,175
Australia, &c.	363	820	1,527
Exports during these years	6,279	2,838	2,752
Balance remaining for consumption in the North-Western-Provinces.	17,019	21,758	28,458

These figures show a steady increase in the quantity of wool consumed in these provinces, but as the Cawnpore mills take at least $\frac{1}{2}$ of the wool imported, no conclusion can be drawn as to any increase of the local woollen manufactures.

White wool imported from the Panjáb comes mainly from Fazilke, the wool mart for Bikanir, and in fact the only important wool mart in India.

Black Panjáb wool is derived from the tract of country stretching up from Kaital and Rewari towards Rawal Pindi.

The import of wool from Thibet (which comes by way of Haldwáni or Tanakpur) shows a steady increase during these three years, but is liable to great variations.

For example, taking the years 1893-95 the figures are 5,801 maunds, 10,887 maunds and 6,417 maunds, so that the figures for 1896-97 are not so high as those for 1893-94.

Various causes have been assigned for this uncertainty in the imports from Thibet.

The vexatious restrictions imposed by the Thibetan authorities seem to be partly responsible for the irregularity; but there are other causes, as for example the closing of the passes by an early fall of snow, or an outbreak of disease among the sheep.

II—Local import and export.—Of the 32,000 maunds at which I have estimated the provincial outturn of wool, the greater proportion is used in purely local manufactures, and few districts appear to have an import or export of any importance.

The district monographs show, however, that Cawnpore, Agra, Meerut, Muzaffarnagar, Bijnor, Moradabad, Mirzapur and Garhwál import wool to a greater or less extent.

Of these districts, Meerut and Muzaffarnagar import from the Panjáb and from the neighbouring districts; Cawnpore has a very large import from all parts, owing to its woollen mills; and Agra is to a certain extent a centre of the trade in raw wool.

Mirzapur is unable to supply enough wool for the carpet industry, and draws it from Hamírpur, Fatehpur and Jalaun.

Garhwál imports some 1,200 maunds of wool from Thibet for local use; but the activity of the agents of the Cawnpore Woollen Mills, in securing Thibetan wool from the Bhutias, has made it much more difficult for the Garhwális to obtain a supply of wool.

III—Character of the raw materials.—Unlike most other textile materials, such as cotton and silk, wool is not the product of certain latitudes only, but may be said to be a product of all parts of the world. Few animals adapt themselves so readily to diversities of climate and pasturage as the sheep, and few are more susceptible to improvements induced by the care of man.

Experience has, however, shown that the better class of wools for clothing purposes are only produced in fairly temperate climates. The effect of the intense heat of the Indian plains is to produce a hard, dry and frizzly wool, almost devoid of natural grease; while the small amount of attention paid to the breeding of sheep has resulted in great unevenness of fibre and a tendency to the occurrence of dead hairs, which greatly diminish the value of the wool for manufacturing purposes.

The cold and dry climate of Thibet, on the other hand, produces a long and soft wool, deficient in the elasticity and wavy curl necessary to the manufacture of the finer classes of fabrics.

Even the best Thibetan wool is, as I am informed by the Managing Director of the Cawnpore Woollen Mills, markedly inferior to Australian wool. This inferiority is mainly caused by the presence of dead hairs, and by the irregularity in length and fineness of the fibre, defects which render the finest Thibetan wool impossible as a constituent of the better class of cloths.

By itself it would make a fair homespun or cloth of the Cheviot class;—but labours under the additional disadvantage of taking dye badly.

IV—Different breeds, and efforts made to improve them.—With the exception of the hill districts of Garhwál, Almora and Naini Tal, there appears to be only one breed of sheep commonly kept in these provinces.

It is characterised, according to Hodgson, by 'medial size, colour tending to black, a very coarse but true fleece, a Romanized nose, drooping ears, and a long and thick tail frequently passing into the monstrous *dumba bussel*.' Efforts have been made to improve the breed by the importation of merino rams to Agra and Dehra Dún, but the experiments have always ended in failure: as the imported sheep cannot stand either the intense heat of May and June or the continued dampness of the rainy season.

Agra wool, though inferior to the Panjáb product, is of a slightly better quality than down-country wool; but this superiority does not seem to have anything to say to any importation of merino stock.

Private enterprise in India has never taken much interest in the breeding of sheep except for fighting purposes; and any modifications induced have, therefore, been in the direction of heavy horns and powerful hind-quarters.

The various attempts made at improving the breed of sheep have been reviewed in the Dictionary of Economic Products, and the writer finds the chief cause of failure in the omission of any attempt to improve the indigenous strain before introducing foreign blood. A secondary cause is, however, found in the fact that all such experiments must be carried on by Governmental agency, in which it is very difficult to secure the necessary continuity through a long term of years.

In the three hill districts, the breeds mainly kept are:—

- (1) the *Hunia*, kept by the Bhutias on the higher ranges, a black-faced and polycerate variety of sheep largely used as a beast of burden;
- (2) the *Jumbli* or *Gharan*, an inferior breed found on the lower slopes of the hills and yielding $\frac{1}{2}$ seer of coarse wool;
- (3) the Bhutias import a considerable quantity of what is known as 'Jara' wool the produce of some Thibetan breed, apparently the Hundera, while in Garhwál the Barwal sheep, Hodgson's 'fighting ram of the hill tribes,' appears to be bred to a small extent.

The Bhutias are beginning to learn that greater care in the preparation and packing of the fleeces would increase their profits; but, like the Gadarias of the plains, they are very reluctant to give up the extra weight added by a good supply of dirt.

The colour of the wool varies greatly: in the plains black predominates, especially in the western districts, while in the hills all shades of colour, from black to brown and grey, are met with.

V—Goats' hair, &c.—The quantity of goats' hair annually produced in these provinces may be roughly estimated at 3,000 maunds.

Its use is practically confined to the hill districts and to some few districts in the plains, such as Mirzapur.

In the hills the hair-yielding goat is known as '*lakota*,' '*arti*,' or '*kaleta*.'

VI—Camels' hair.—Camels' hair is only mentioned in the reports sent by the Aligarh, Agra and Etáwah districts. Its uses are evidently very restricted, and I am unable to form an estimate of the annual outturn.

VII—Pashm.—A certain quantity of *pashm* used to be imported from the Panjáb for the use of the Kashmiri shawl-makers settled in Lucknow and other cities, but the industry has now died out in these provinces and with it the import of *pashm*.

VIII—Shearing.—Shearing is in most districts carried out three times a year: in February, June and September; but in some cases the intermediate shearing is dispensed with, and the Bhutias of Garhwál are reported to shear rams three times a year, but ewes only twice.

The wool from the spring shearing is ordinarily the best; but in the hills sheep are used as pack animals through the winter months, and the fleece is in consequence greatly deteriorated, while they thrive during the rains on the '*bugials*' or pasture grounds close to the snow line, to which they are sent in charge of a shepherd.

Sheep are usually washed in the nearest river or tank before being shorn; but the process is very superficial and is dispensed with in the hills. Shearing is carried out with shears or with large scissors, but in some districts an ordinary sickle or '*hassiya*'

(called in Garhwál 'bhalti' or 'takar malhi') is used, by which the wool is taken off in small pieces—a process highly unpleasant for the sheep.

One man can shear from 15 to 20 sheep a day, and the owner of the sheep is expected to provide a feast known as 'murka' for the shearers if they belong to his 'baradari,' otherwise $\frac{1}{5}$ of the wool shorn is a usual wage.

The weight of the fleece varies from three *chhattaks* in the case of an ordinary plain's sheep to 12 or 14 *chhattaks* for the best hill breeds; and taking an average for the provinces the annual yield of wool cannot be more than 12 *chhattaks* per sheep, a very small yield compared to the 6 or 7 pounds of an English sheep.

In most cities the fleeces of dead sheep are plucked out (not shorn) and sold by the butchers to the makers of coarse fabrics, such as the bags used in sugar refining.

IX—Goats and Camels.—Goats are clipped once a year, and the yield is about $\frac{1}{2}$ seer of hair (called 'charu' in the hills, at each clipping.

Camels are also clipped once a year. The yield at each clipping is 1 to 2 pounds for a male and 2 to 4 for a female, the cause of the difference being that the back and shoulders of the male camel are never clipped.

X—Price.—The fleece when shorn is made up into a bundle, and is usually sold in that state. The price varies largely according to the quality of the wool and to the amount of dirt which may be expected to be mixed with it. An average of 2 $\frac{1}{2}$ seers per rupee may be assumed, the prices having risen considerably within the last few years, especially in places such as Mirzapur with considerable local consumption of wool.

Bikanir wool (white) fetches from under Rs. 20 to over Rs. 35 per maund according to its fineness and freedom from burrs, and Thibetan wool Rs. 20 to 30 per maund.

Goats' hair costs 10 to 12 seers per rupee and camels' hair 5 seers per rupee.

CHAPTER II.

PROCESSES PRIOR TO SPINNING.

I—Processes prior to spinning.—The initial processes in the preparation of wool for spinning are sorting, washing, picking, teasing out matted portions by hand, scutching and combing, but all of these are not necessarily employed. The processes in use in the hills differ to a certain extent from those customary in the plains.

II—Sorting.—Wool-sorting is in many cases not carried out at all, and is confined to the separation of black from white wool, or to the picking out of the worst pieces of wool, which are set aside for the stuffing of saddles and similar purposes.

In the hills, sorting is said to be becoming more common through the influence of the agents of the Cawnpore Mills.

III—Washing.—Washing of the wool is uncommon, except in Garhwál, and soap never seems to be employed; indeed, unless carefully carried out, the application of alkaline substances is very detrimental to wool.

In Garhwál, the wool is soaked after shearing in hot water (except in the case of Thibetan wool), and then in cold, after which it is beaten gently with a stick (*tagsa*) split up half its length.

IV—Hand-picking.—Hand-picking has to be resorted to in the case of wool growing in tracts abounding in thorny undergrowth, and especially for the removal of burrs, a process very difficult to carry out in any way except by careful picking.

The workers are usually women, and wages are very low, less than one anna per day.

This involves the teasing out of matted portions of wool, which are very common in the fleeces of the low-bred and ill-kept sheep of the plains.

V—*Scutching or carding.*—The processes employed in carding wool are exactly the same as in the case of cotton, and have been fully described in the monograph on that subject.

In the manufacture of common blankets, the Gadarias scutch themselves, using an ordinary bow, the string of which is made of gut or of some strong fibre such as hemp.

The bow is held in the left hand with the string partially buried in a heap of wool, the operator being in the usual squatting position. The string is then caused to vibrate, either by being plucked with the hand or with a suitably shaped piece of wood.

If large quantities of wool are required, as in the case of the Mirzapur carpet industry, the wool is cleaned by a professional '*behna*,' usually a Muhammadan.

The instrument employed by him, known as the '*dhunki*' or '*pinja*,' has been described in the monograph on cotton, and it is sufficient to say that it consists essentially of a heavy bow suspended string downwards, with the string resting some six inches from the floor.

A pile of wool is placed under the string, which is then depressed until it is well in the wool, when it is let go. The string is made to vibrate violently either by hand or by being struck with a dumb-bell-shaped instrument called the '*muttiya*.' By its vibrations it disintegrates the wool, and frees it from all kinds of dirt which are neither viscons nor prickly.

The wages of the '*behna*' or '*dhunna*' are very low, varying from half anna to one anna per seer, and do not average more than two annas per day.

VI—*Combing.*—Wool-combing is not found in the plains, chiefly because the staple of the wool is too short to admit of its being carried out.

The only mention made of this process is in the Garhwál report, in which it is stated that the long Thibetan wool is usually treated in this way. The comb employed is of the very simplest nature, resembling a '*panja*' or claw, and the wool is rather cleaned than combed.

The combs do not appear to be heated before use.

The cleaned wool thus reduced to sliver is made into balls (called '*punis*' or '*galas*') weighing about one *chhattak* each, in preparation for the next operation of spinning.

CHAPTER III.

SPINNING AND WARPING.

I—*Spinning.*—Spinning is usually carried out by the aid of the '*charkhi*,' which has been described at length by Mr. Silberrad.

It consists essentially (*vide* Panjáb Report) of "two parallel discs the circumferences of which are connected by threads. Over the drum so formed passes a driving band also made of thread, which communicates a rapid motion to the axis of the spindle (*takua* or *takla*). The end of a '*puni*' is presented to the point of the spindle, which seizes the fibre (with the aid of some saliva) and spins a thread, the '*puni*' being drawn away as the thread forms so far as the spinner's arm will reach."

The thread so formed is then slackened and allowed to coil itself on the body of the spindle, until the latter is full, when the yarn is removed in the form of a '*kukri*' or cop (also called *challi*).

The process is exactly the same for wool as for cotton, except that in the former case the spindle is larger.

In the hills, however, and in the Bándá district, spinning is more usually carried on with the primitive instrument known as 'dherna' or 'takli.'



This is usually of the shape shown above and consists of a fairly heavy wooden base, made of either a circular piece of wood or else of two pieces crossing at right angles with a wooden axis rising perpendicularly to this base.

The wool is, after scutching, made into 'punis,' or else into coils (called 'dila') suitable for winding round the left wrist.

The end of this 'dila' is fastened to the end of the axis of the 'takli' (or *taku*) by inserting it into a small slit in the axis.

"The 'takli' is then spun round in the hand; and when it has got firm hold of the wool is allowed to hang in the air supported by the thread which it is spinning, the right hand of the operator keeping up the rotary motion, while the left regulates the draft of the wool." "When the thread gets so long as to bring the 'takli' out of reach or to let it touch the ground, the draft of wool from the 'puni' is stopped and the piece that has been spun is wound round the 'takli.'"

The Garhwál Report states that the Bhutias, when spinning yarn intended to be used in the more complicated of their two systems of weaving, twist the 'taku' in one direction when spinning the warp threads and in the other for the weft.

The thread produced from the 'charkhi' is said to be stronger and more reliable, owing to the greater regularity of the motion of the spindle. The 'taku' has, however, a great advantage in its portability, which allows the shepherd to carry on his spinning while following the flock.

In the hills the 'taku' is used by all sexes and ages for spinning, while in the plains the women do most of the spinning, usually only for home consumption. There are a certain number of persons who spin for wages, but their pay is miserably low, as not more than 4 or 5 *chhattaks* of wool can be spun in a day and the profit on spinning a seer of wool is only two to two and a-half annas.

When yarn has been unevenly spun, or if it be required for a coarse, thick fabric, the yarn has to be doubled or even trebled.

II—Twisting.—For this twisting the 'charkhi' can be used and also a form of the *taku* (called *masan*), the difference being that the upper end of the spindle is grooved for the reception of the twisted threads.

The woollen thread is then wound into 'attis' or skeins on the [—] shaped frame called 'ateran.' Two cops (*kulcris*) are usually wound on the same frame, so that the yarn is double.

Each skein (*atti*) weighs about 4 *chhattaks*.

The skein of wool is usually soaked in water and thrown over the 'paraita,' a conical frame turning on a wooden axis which is fitted into a hole in a lump of earth in such a way that the frame can revolve freely.

III—Winding.—The next process is to wind the wool on 'uras' or reels. These are much larger if intended for the warp than for the weft, because in the latter case the reels must be small enough to fit inside the shuttle.

This process is effected as follows:—

A piece of '*narkhul*' or hollow cane is fitted on to the spindle of the '*charkha*.' The end of the skein of wool on the '*paraita*' is fastened to the spindle, and the revolution of the '*charkha*' winds the wool off the '*paraita*' on to this piece of cane.

In many cases, however, these latter operations are omitted and the yarn used at once in laying out the warp.

IV—Warping.—The object of warping is to lay a sufficient number and length of parallel threads to form the warp of the fabric to be woven.

The first operation is to plant a double row of sticks (called '*sarkandas*') in the ground at intervals of about two feet. The sticks need not necessarily be in a straight line, but the total length of any curve described must be equal to the required length of fabric. The warp layer fixes two reels of thread on the ends of sticks in such a way that they can revolve freely.

One end of the thread on these two reels is then attached to the end peg, and the warp-layer, taking a stick in each hand, walks along the line dropping the threads one inside and the other outside the upright sticks, alternately, so that the two threads cross each other between each pair. Having got to the end of the row of sticks she returns in the same way; and so on until the required number of threads has been laid.

In the case of a fabric which is to have a stripe or check pattern, reels of different colours must be used, and the right proportion of threads of the different colours laid.

The whole system of sticks is called a '*panja*.' A series of light sticks are then passed between the two rows of thread at the crossings, and are loosely tied so as to keep the crossings intact, when, as is now necessary, the uprights (*sarkandas*) are removed and the series of parallel threads rolled up on the sticks at either end in preparation for sizing.

V—Sizing.—Sizing (*mari dena* or *pai karna*) is effected by immersing in starch water of some kind. The best starch (known as *mandi*) is prepared from wheaten flour, but in some cases barley, *juar* or rice flour replaces wheat. After soaking in this preparation the warp is stretched on trestles to dry, and is then brushed with a brush (*kunch*) made of *khas-khas* grass.

Sizing is in some districts carried out with a paste made of oilcake; other substitutes for wheaten flour are '*ganwara*' seed (Muzaffarnagar) *sani* (Bijnor), cooked ber fruit (Sitapur), infusion of *shisham* leaves (Bareilly), and infusion of the '*dhandayan*' plant (Moradabad and Naini Tal). In some parts sizing is dispensed with altogether; and although it is supposed to strengthen the threads, its main use appears to be in preventing the warp threads from sticking together.

In Garhwál the process employed in warping and sizing is somewhat different.

When a ball of yarn, intended for the warp (*puran*), has been spun on the '*taku*' it is taken off and steamed over a vessel of boiling water. The thread is then wound lengthways on a stick known as '*takar kattha*.' A number of pegs (*mokha*), usually 10, are then fixed in the ground and the thread laid round them in such a way as to form a series of crossings (mesh), one between every pair of pegs.

Small sticks are passed through these crossings and the warp is then ready for the loom.

CHAPTER IV.

WEAVING.

I—Weaving.—The loom for wool weaving is merely a stronger and more roughly made edition of the cotton loom, which has been fully described and illustrated in the monograph on that subject.

I shall therefore confine myself to a general description taken partly from the Panjáb report referring for details of construction to last year's monograph.

The loom does not differ in essentials from the hand looms of other countries.

The warp is stretched horizontally from the weaver, who sits with his feet in a pit about 18 inches deep, in order to allow the heddles free play. The further end of the warp is made fast by a rope, which, after going round a peg at some distance from the weaver, is tied to a post within easy reach of his hand, so that he can regulate the tightness of the warp at pleasure. As the cloth is made it is wound up on a roller at the near end, the rope controlling the further end being proportionately lengthened.

The warp is controlled by means of heddles (*bai*), of which one pair is sufficient for plain weaving.

These consist of parallel pairs of sticks of the width of the loom, one above and one below the warp. Each stick has a series of loops of thread attached to it, and the loops attached to the upper stick pass through the corresponding ones attached to the lower.

Strands 1, 3, 5, &c., of the warp are passed through the loops of the one heddle, and strands 2, 4, 6, &c., through the loops of the second one.

The heddles are suspended from the roof, and worked by treddles set in motion by the weaver's feet. The lowering of one heddle thus pulls down every alternate thread without affecting the others and leaves a space through which the shuttle containing the weft thread can be passed.

The shuttle (*bharni*, *dhirki*) is very similar to the old boat shuttle used in Europe, and the yarn for the weft is wound on hollow spools which are fitted on to an iron pin (*salai*) running along the centre of the shuttle.

The yarn passes out through a hole in the end of the shuttle in which a glass bead (*manka*) is sometimes inserted in order to diminish friction.

When weaving begins one of the heddles is depressed, the shuttle is thrown between the two sets of warp threads, and the weft thread thus laid is driven home by the heavy lay (*hatha*). The lay consist of two parallel beams suspended from the roof and connected by a series of parallel strings through which the warp threads pass.

The position of the heddles is then reversed and the shuttle is thrown back, passing this time (in plain weaving) over the threads of the warp under which it passed before.

The process is continued until the required length of fabric has been woven.

As the process of passing the threads of the warp through the heddles is a tedious one, it is usual to leave a sufficient length of warp thread unwoven to pass through the heddles and lay, so that the new warp is simply attached to the old, each thread being twisted (not knotted) on to the corresponding one.

When weft stripes are required, yarn of the desired colour is inserted in the spindle and the required number of weft threads laid. Woollen cloth is usually woven in strips not more than a foot wide; a sufficient number of these strips are subsequently sewn together to form a fabric of the required width.

In many districts the instruments employed in weaving are of a much more primitive nature. The heddle consists merely of a piece of stick to which are attached a series of loops passing round the alternate threads of the warp.

When this is raised by the hand, threads 1, 3, 5, &c., go up and the weft thread, which is merely wound round a stick, is passed through the opening made.

On the further side of the heddle from the weaver a bamboo stick, about 2 inches in diameter, is passed through the warp in such a way that the threads which

pass through the loops of the heddle pass under it, and the others above. When the heddle is released, threads 1, 3, 5, &c., sink down through the strain round this rod, which is known as the *santa* or *wansat*, and the weft thread can be passed through again in the opposite direction. Each thread of the weft will, therefore, lie between two crossings of the warp threads.

The weft is pressed home with a sword-shaped instrument (*baiun*) made of some heavy wood, and the fabric is secured of the right width by some light sticks of the required length fastened across the warp.

The Bhutias in Garhwál use a more complicated process of the same general nature.

It amounts in fact to using two pairs of heddles, and the result is that instead of every alternate thread going up or going down together, the 2nd, 3rd, 5th, 6th, threads go up, while the 1st, 4th, 7th, go down. The weft thread is double and the fabric therefore appears to be woven of double threads.

II—Felting.—The cloth after weaving is harsh and of loose texture and requires to be felted.

This process is described as follows in the Muzaffarnagar Report:—

Two *chhattaks* of oil are poured on each blanket, which is then dipped in hot water in an earthen trough. The cloth is taken out and kneaded (*gholna*) for some time with the hands or feet. The black mud of a pond in which *kuser* grass grows is boiled with some *babul* pods and the blanket soaked for several days, being taken out occasionally and exposed to the air for a short time.

This gives the blanket a good colour and the final step is to wash it with soap or soapnuts (*ritha*)."

In other places blankets are treated with a sort of starch made of flour or the kernel of the *bel* fruit, and in Garhwál they are merely steamed and then kneaded on a flat stone.

III—Carpet weaving.—The weaving of woollen pile carpets known as *kalin* or *kalicha*, though now a fairly widespread industry in India, is not native to that country, but was introduced by the Muhammadans from its original home in Kurdistan and northern Persia. The harsh wool of the Indian plains will not, however, take the finer shades of colour, and for this reason Persian carpets have always been considered superior to the products of Indian looms.

The industry is carried on in many of the jails of the North-Western Provinces, but the carpets made in Agra jail are the most generally known. In Mirzapur the manufacture is carried on as a popular industry, and there are a large number of native firms. It is also carried on, to a small extent, in Moradabad, Cawnpore, Bulandshahr and Jhánsi. Besides the jail in Agra, one European firm in that city also does a considerable trade.

In carpet weaving the warp, which usually consists of strong cotton or hempen threads, is placed vertically, both ends being fastened to heavy beams.

The lower beam rests in a trench about 18 inches deep on the edge of which the weavers sit. A few rows are first put in by the ordinary method of weaving, after which the process peculiar to carpet weaving begins.

The number of workmen varies according to the breadth of the carpet; but one man to every 18 inches or 2 feet is about the average. Each man has a number of small hanks of coloured yarn hung within easy reach.

He takes a piece of wool of the required colour and twists it dexterously round a pair of warp threads, so that both ends of the wool appear in front.

The ends are then cut off with a knife to the required length and a fresh tie is made.

When a line of ties has been completed and the wool cut to the required length, a single weft thread of wool is run across the carpet and beaten home with a blunt fork (*panja*) until the whole has been compacted.

The threads of the warp are then crossed in the usual way, and the process continues.

The warp threads are completely hidden by the woollen pile and the pattern is entirely due to tying with different coloured wools. The weaver either (if he be skilful) knows instinctively the order in which the colours should come, or else he follows the dictation of some man more skilled in the art, who dictates the order of the colours to all the workmen.

When the carpet is completed its surface is clipped over with a pair of scissors.

The number of threads to the inch varies from 5 or 6 to 20 or even more. In Mirzapur, where the quality is generally inferior, seven threads appear to be the average, and the Mirzapur carpets therefore do not show the distinctness of outline or blending of colours which can only be produced by finer work.

The price of Agra carpets varies between Rs. 6 and Rs. 40 per square yard, and depends chiefly on the quality of the materials and the number of threads to the inch.

It is difficult to form an estimate as to the extent of the industry.

Agra jail produces about 15,000 yards of carpets annually; and the firm of Messrs. Weilandt & Co. also have a fairly large outturn.

In the Mirzapur district the output is large, and has increased during the last few years; but the industry does not appear to be in a flourishing condition, nor to rest on a healthy basis.

The manufacturers are in general men of no capital, who work by means of advances given to them by local contractors, receiving Rs. 4 per square yard of carpet supplied.

These contractors retail the carpets at Rs. 7 per square yard and also make large profits by supplying wool to the manufacturers at 7 or 8 rupees per maund above the market price.

Their profits have, however, been largely diminished by the fall of prices in England—a fall to which they themselves have largely contributed by the inferior work and fleeting dyes so common in Mirzapur carpets of the present day as compared with those produced twenty or more years ago.

The patterns, which are usually stiff and conventional are divided into three classes according to the character of the border known as '*hashiya barik*,' '*bari hashiya*,' and '*hozan*.'

The best patterns are derived from Persian sources, but of late years European firms have supplied models to be copied at Mirzapur.

CHAPTER V.

FELTING OF NAMDAS.

I—Namdás.—This general name includes all articles made of unspun wool. They are used for bed and floor rugs, prayer mats, horse cloths, saddles, &c.

The manufacture is carried on to a small extent in almost every district, but the *namdas* of Baharich are well known and of better quality than the others which I have seen.

The details of manufacture differ from place to place, but the general principle is everywhere the same.

A layer of scutched wool is spread evenly over a mat which can be easily rolled up.

The thickness of the layer varies according to the kind of *namda* required, but it must be uniform. Water is then sprinkled over the wool and the mat is rolled up and carefully pressed with the hands or feet for several hours. This kneading is not usually sufficient, and a second layer of wool has to be laid over the first after the latter has been partially felted. It is usual also to turn the *namda* over and repeat the process.

Wool of fair quality is required if it is desired to complete the felting by the use of water only; and as the harsh Indian wool is markedly deficient in felting properties, it is usual to add all kinds of substances in order to facilitate the process.

Soap is very commonly used, or *ritha* (soapnuts), and these do not injure the quality of the *namda*. The same cannot be said for other additions such as 'kalki' (oilcake), flour, safflower seed, fenugreek and even cowdung, which are commonly applied in the case of black wool.

*Namd*s are made either of a single colour or (especially in Bahraich) with coloured patterns. As they are not intended to be washed, the colours used are seldom fast.

The pattern is produced by first making thin felt of the required colours. This is cut into strips, which are laid out on the ground in the form of the required pattern. The wool is then spread over this and the whole felted together. In some cases the ground work is first laid out and the pattern spread over it.

The *namda* makers, who are almost invariably Muhammadans, and in general *julahas*, show great accuracy of eye and hand in laying out the patterns. These are in some cases geometrical figures or rude representations of buildings, but usually consist of conventional art foliage and flowers, which are in some cases very pretty, although the curves are too abrupt to be wholly satisfying to the eye.

The average price of a plain *namda* is 12 to 14 annas per seer, and of a coloured one Re. 1-8-0 per seer. The profit on two days' work is about six annas, so that the industry is not a very profitable one.

CHAPTER VI.

OTHER VARIETIES OF FABRICS.

I—Other varieties of fabrics.—The variety of fabrics produced in these provinces is very small, the common blanket, or *kammal* being the sole product of most districts.

It is unnecessary to enter into many details with regard to the 'lois' or 'kammals' of the different districts, as in few places is any high level of excellence reached.

Muzaffarnagar produces good blankets, and also some villages in Bahraich; while there is a wide difference between these and the wretched loosely-woven products of some of the more southerly districts.

The average price of 'kammals' (size 7 feet by 4) is about one rupee; 'lois,' which only differ from *kammals* by being larger and of better quality, cost (size 9 feet by 6) Rs. 3 to Rs. 4-8-0. The weight of a 'kammal' is about 14 *chhattaks* and the profit (about 10 annas) represents the work of one man and three women for two days.

In the hill districts a greater variety of fabrics is found.

Such are 'pankhi' and 'thulma,' warm cloths similar to blankets.

In the latter the weft is loosely woven and a nap is raised by brushing the surface of the cloth. 'Pakha' or 'pakhu' is a warm striped cloth of the nature of tweed. Striped carpets of coarse wool, called 'chera,' are also produced and cost about Rs. 20 per 15 feet square.

'Chuu' and 'bala' are lighter fabrics used for women's clothing.

'*Chutka*' is a kind of carpet, and the method of manufacture is somewhat peculiar.

After two or three threads of the weft have been passed through, one very thick and loosely-spun thread is inserted. This is pulled up between the pairs of warp threads by the aid of a small stick and forms a series of loops. Through these another stick is passed and the loops are cut evenly with a knife.

The price of a carpet of this description, size 8 feet by 4 feet, is Rs. 20 to Rs. 25.

The Bhutias also manufacture a kind of coarse cloth called '*choga*,' intended for overcoats, and a fabric of mixed wool and *pashm* known as '*dhusa*.' The term '*dhusa*' is also applied to fabrics of mixed wool and cotton which appear to be a speciality of Gorakhpur.

In these the warp is of English cotton and the weft of wool. Each '*dhusa*' contains about one seer of wool and half seer cotton.

The cost of manufacture is about Re. 1-5-0 and selling price Rs. 2, leaving a profit of 11 annas on 2 to 3 days' work.

Cities which are the seat of sugar manufacture, according to native methods, such as Bareilly and Sháhjahánpur, have a considerable industry in coarse woollen bags used in compressing the raw sugar.

II—Asans and jainamaz.—These names are applied to the small mats intended either as prayer-mats or merely for sitting on.

They may be either made of felt or else similar to woollen pile carpets and are often ornamented with coloured patterns.

Muhammadan '*jainamaz*' are commonly embroidered with a picture of a mosque or with texts from the Koran woven into the texture of the mat.

Articles of this nature are also imported to a considerable extent from Rájputána especially to Muttra and neighbouring cities.

III—Pashmina.—The shawl industry which used to exist in the principal cities of the North-Western Provinces has been completely crushed by the manufactures of Kashmir, with which shawls manufactured in these Provinces cannot compete either in price or in quality.

There are still some few Kashmiris attached to old families in Lucknow and elsewhere, but they appear to confine themselves to mending the family shawls and leave the trade to travelling Kashmiri or Panjáb merchants.

IV—Fabrics made of goats' hair.—Goats' hair is used to a small extent in many districts for making ropes and sacking.

In the hill districts of Garhwál, Almora and Naini Tal, as also in some parts of Mirzapur, it is largely used, both for the abovementioned purposes and for making a coarse cloth (called '*dounkhas*' in Garhwál) suitable for overcoats. The hair is cleaned and opened out by being laid on the ground and beaten with a stick.

Spinning is usually carried out by the aid of the '*dherna*,' but the '*charkhi*' is also occasionally employed. Ropes are made by hand-twisting and are in general of three strands.

Weaving is carried on in a very primitive manner without the aid of a shuttle, which is replaced by a stick to which the weft thread is attached and worked through the threads of the warp.

V—Camels' hair.—Camels' hair (*mallas*) is used to a very small extent, chiefly in Aligarh, Etáwah and Agra. In the last named district it is sometimes employed in making carpets, but in general rope-making is the only purpose for which it is employed. The hair is twisted by hand, not spun. Neither goats' hair nor camels' hair is dyed.

VI—European woollen goods.—Neither the import of European woollens nor the products of the Cawnpore Mills appear to compete very severely with local products. The chief reason for this lies in the fact that in general only the very cheapest and commonest articles are manufactured.

The production of the better kind of blankets has been affected to a certain extent; but the ordinary *kammal* remains in favour owing to its greater cheapness and durability.

The chief fabrics imported are flannels, merino, broadcloth, &c., for the use of Europeans and of some of the wealthier natives. But the comparatively high price will prevent their ever coming into general use. Woollen garments are especially difficult to preserve during the rains from the attacks of insects, and the natives consider stuffed cotton clothes to be warmer than woollen.

In the hill districts only are woollen clothes generally worn, but they are all of local manufacture.

CHAPTER VII.

DYEING.

I—Dyeing.—As this subject has been dealt with in a previous monograph, it is unnecessary for me to treat of it at length.

Wool intended for coloured *namdās* is dyed; in all other cases the dye is applied to the yarn or the made fabric.

The main industry, in which dyeing is of much importance, is that of carpet-making, in which case the dye is applied to the yarn, after the latter has been prepared, in the following manner:—

The *lachchhas* or hanks of yarn are first cleaned by being thrown into boiling water to which *reh* (1 lb per gallon), and *cajji* (crude carbonate of soda) have been added.

The wool is treated for about an hour and is then taken out and wrung while hot until it is dry. When cold it is washed in water and becomes clean, soft and in a fit state for taking the various dyes.

The chief colours—black, red, blue, yellow and green—are produced in the following ways amongst others:—

Black.—(a) Boil the wool in a solution of *harra* (myrobalam) and *kasis* (sulphate of iron) wash several times and dry.

(b) Boil three gallons of water add 1 lb sulphate of iron, 3 lbs. *babul* pods and 4 lbs. *jhawan* (burnt clay) all reduced to powder. Boil for an hour and then throw in the '*lachchhas*' of wool. When it has steeped for some time take out, wash and dry in the sun.

Red.—(a) Dip the yarn in a bath made of one part powdered *harra* (myrobalam) to 16 of water and then in a solution of alum. Boil with water and the powdered root of the *āl* (*morenda citrifolia*).

(b) The Bhutias produce a red dye by boiling with the roots of the '*majeti*' plant and the bark of the tree known as *utis*. Lac boiled with the leaves of a tree locally known as '*jhingan*' is also used.

(c) In Agra Jail the different shades of red are produced as follows:—

1. Red (*surkh*). Press the wool for 12 hours in *vitha* (soapnuts) made into a pulp by finely grinding it on to a stone with a little water. Add water and steep the wool, take out, wash well and dry.

Mix together in a separate vessel 4 *chhattaks* of lac finely powdered and 6 *chhattaks* muriate of tin. Put this into boiling water, stir well and then put in the wool; keep on stirring until the dye has got into the wool.

Meantime mix together $1\frac{1}{2}$ seers lac $1\frac{1}{2}$ seers muriate of tin, 12 *alhattaks* cream of tartar.

Take out the wool and put the mixture into the boiling water, care being taken that it remains at the boiling point.

Put in the wool again and stir with bamboos for some two hours; take out and wash well in clear water until no dye comes off after which fix with alum water.

The lighter shades of red, known as *gulnar* and *gulabi* are prepared by lessening the quantity of the ingredients used.

Terra cotta is produced by boiling with sulphuric acid and a little lac. If a larger quantity of lac be used, claret colour (also sometimes called *gulabi*) results.

To produce violet, treat the wool as described above. Then make a solution of 5 seers lime, drain off the lime water and steep the wool for a short time as the effect is immediate. Any shade from dark-red to violet can be obtained.

(d) Another method of producing red colour is commonly used in Cawnpore.

Soak the cloth for three hours in lime water and wash. Pound up some stick lac and place it mixed with some alkali on a cloth through which water is allowed to drain slowly into a pan underneath. Wheat flour is thrown into this infusion, which is then left to ferment.

Soak the cloth for three days until it turns a bright red. The fastness of the colour is tested by washing, and the process completed by boiling in a mixture of *tezab*, lime juice and water.

The mixed colour, commonly met with and known as *khatmali* (a mixture of black and red) is produced as follows:—

Take yarn of mixed black and white wool, grind lac and mix with water adding boiled barley flour.

A reddish tinge appears after 10 days. Soak the wool for 5 days and then boil with *lodh* (*symplocos racemosa*) and mango acid (*khatai*).

Blue.—(a) dark blue (*garyalu*) Agra Jail.

Powder two seers of indigo very finely and add it to six seers of sulphuric acid in a strong jar.

Keep for 48 hours, stirring evenly for 5 or 6 hours.

Steep the wool in a solution of lime, wash several times in clear water and dry in the sun.

To boiling water add small quantities of the abovementioned compound of sulphuric acid and indigo, until the required shade has been obtained, then steep the wool.

When the dye has been absorbed take out the wool, wash in cold water, and fix with alum solution.

The shades of blue vary according to the quantity of the materials used.

Yellow (*zard*).—(a) Yellow can be produced in many ways. One method is to mix the wool with 20 seers of *tesu* flowers (*butaa frondosa*), taking care that each layer of wool has a layer of *tesu* on each side, fill up with cold water and steep for 24 hours. Then take out the wool, rinse well into another vessel containing cold water, add one seer muriate of tin.

Stir well and put in the wool, stirring for about two hours. When the wool has taken the desired colour, steep in a saturated solution of alum (*phatkiri*) and dry.

Most of the dyes used depend for their efficacy on the *tesu* flower; but the dye obtained is only a transient one unless special means are used for fixing.

(b) Another dye used is compounded of turmeric, *akalbir* (*datisca cannabina*) and alum, while the rind of the pomegranate followed by alum solution yields a fair dye.

Green.—(a) dark green (*gari sabz*). Agra Jail.

Steep the wool in lime water, wash and dry.

Steep and press for 12 hours in turmeric (3 seers turmeric for 10 seers wool) well pounded and ground very fine.

Boil in dilute sulphindyllic acid (2 seers indigo + 6 seers sulphuric acid) and wash in a 4 *chhattak* solution of alum.

The lighter shades of green, known as *sabz* and *dhani*, are prepared in the same way, except that the quantity of sulphindyllic acid is smaller.

Another method is to first treat with indigo and then soak in an infusion of turmeric and safflower (*kusum*).

A bath of some acid, such as extract of mango peel, is used to neutralize the alkali and fix the dye.

II—Aniline dyes.—The use of aniline dyes is largely on the increase, especially in the Mirzapur carpet manufacture.

The dyes most commonly used are the cheapest products of Nuremberg and of very inferior quality. The result is that the colours are never fast, and the knowledge of how to dye fast appears to be rapidly decaying, so much so that Messrs. Tellery, who have lately set up a factory in Mirzapur, informed me that they were obliged to import dyers from the Panjab.

III—Bleaching.—Bleaching is not resorted to in the case of the great majority of fabrics.

When required, the fabric is exposed to the fumes of burning sulphur or washed in a solution of *ritha* (soapnuts).

CHAPTER VIII.

TRADITIONS AND CUSTOMS CONNECTED WITH WOOL AND WOOLLEN FABRICS.

I—Traditions and customs connected with wool and woollen fabrics.—With regard to the origin of the woollen industry, so much only can be said with certainty that the remains of the sheep have been constantly found with the remains of prehistoric man.

The first stage was no doubt the use of the skins as coverings, but even the more advanced stage of civilisation, during which the arts of spinning and weaving had their origin, is lost in the mists of antiquity.

These arts were attributed by Pliny to the Egyptians, who represented the goddess Isis as holding a distaff in her hand, but in the opinion of Sir George Birdwood, India is more probably the scene of their origin.

In more modern times the Hindus have attributed a semi-sacred character to wool.

The Parayana Sara Sangraha, a book accepted as authoritative by the Vaishnava sect, says, "with woollen clothing on a man should perform *sradh*, as oblations offered to ancestors with such clothing on are said to be like a *sradh* performed in Gaya."

The 'Harita Smriti' again, one of the Dharam Shastras, says "fire, woollen cloth, a Brahman and *kusa* grass, these four were created pure by the All Good Brahma."

Similar mentions occur in others of the sacred books, and the influence of these ideas on practice is shown in the fact that woollen clothes are considered ceremonially pure for eating on, so that a man is not obliged to take off everything except his *dhoti* before eating.

Prayer-mats are very commonly made of wool, and some *fakirs* dress in woollen clothes and carry strings of woollen beads.

Meantime mix together 1½ seers lac 1½ seers muriate of tin, 12 *chhattaks* cream of tartar.

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There are a number of other religious practices in connection with which wool is used ; such are—

- I.—It is an ingredient in the 'pindas' which are offered during the *Srad-dhas*.
- II.—If the body of a deceased person cannot be found, another body is made of certain specified substances of which wool is one and burnt. This ceremony is known as '*purushal*.'
- III.—The special form of *mantras* known as '*malas*' intended for the realisation of some object, are recited while telling woollen beads.
- IV.—A Vaishya Brahmachari is directed by the *Shastras* to only wear woollen clothes and even his '*janeo*' or sacred thread is made of wool.
- V.—A special distribution of alms known as '*danbdhi*,' which is made when in any special difficulty, includes a woollen blanket as one of the essential gifts.

Muhammadans have not assigned such virtues to fabrics made of wool, but frequent mention is made of them in the Arabic and Persian literatures, showing that wool is considered the proper clothing of the devotee.

Muhammad himself is spoken of as '*muzammal*,' or wrapped in a blanket ; and the designation of '*al-i-aba*,' applied to Ali, Fatima, Hasan and Husain, means simply children of the blanket. The word '*sufi*' is commonly supposed to be related to '*suf*,' meaning wool, but is more probably connected with the Greek '*sophos*.'

I have not received much information from the district reports with regard to local customs or superstitions.

The general respect shown by Hindus for the instruments of their trades is illustrated by the custom reported to exist in Sultánpur, that wool is called *Lachmi* among the *Gadarias*, and if one of them find a piece of wool lying on the ground, he picks it up, touches it to his forehead and brings it to his house.

The same idea probably lies at the root of the custom reported from Bareilly, that a mixture of wool and cotton is considered so immoral as to cause the maker of it to be expelled from the '*baradari*.'

The efficacy of wool in charms, a belief which constantly crops up in European folklore, is also illustrated in India. The Aligarh district report says that it is customary when persons have burnt themselves to tie a woollen thread round the hand or foot, in the belief that the cure is thereby hastened.

When a door is fixed in a building, a woollen thread is attached as a charm to keep off evil spirits, and a thread is often fastened to the leg or neck of horses, in order to ward off the evil eye.

The same idea probably accounts for the woollen ornaments commonly worn by Banjara women. A popular remedy in cases of dog-bite is to eat pieces of red broad-cloth with plantains and to look into 7 wells, or in some districts the custom is to drink the water of 7 wells.

The carpet weavers of Mirzapur consider it a good omen if they find that an odd number of threads have been laid in the warp and a bad omen if the number is even.

They account for the origin of this idea by the legend that the first person who ever laid a warp for carpet-weaving was the devil, but as he happened to lay an even number of threads the carpet would not work out right, and he threw the whole thing into the sea in a passion.

The philosopher Lukman made the next attempt, and as he laid an odd number of threads in the warp, his success was greater than that of his predecessor, and he was therefore the founder of the carpet industry.

II—Present condition and prospects of the woollen industry.—It is difficult to form an estimate of the number of persons employed in handicrafts connected with wool. The last census returns show 79,115 as so engaged, and that estimate is probably as accurate as any which I could frame. Comparatively few, however, devote themselves exclusively to their handicraft; the great majority combining it with agriculture or the breeding of sheep.

The smallness of this number as compared with the 1,524,729 shown as engaged in the cotton industry, gives a not unfair idea of the relative importance of the respective industries in the North-Western Provinces.

Cotton clothes are a necessity to every man: comparatively few make any use of woollen. There seems little hope of the extension of the woollen industry; one branch of it, that of sheep-breeding, is steadily decreasing in most parts with the spread of cultivation and consequent diminution of grazing land, which has caused an exodus of shepherds towards the Nepal frontier.

As this process continues, these Provinces will become more and more dependent on imports for their supply of wool, and the increase of price will probably affect the local industries injuriously, more especially that of carpet manufacture, the profits of which are not large enough to afford a large increase in the price of the raw materials.

The manufacture of coarse blankets does not seem to have been injuriously affected by the competition of the mills, and will probably maintain its ground, but the finer woollen industries have suffered, and will probably suffer more in the future.

In the hill districts the competition of the mills has reduced the supply of wool available for local manufactures, and the Garhwál District Report anticipates a considerable diminution in the local woollen industry. The *namda* industry has greatly decayed since leather saddlery came into general use, but at the present time the trade appears to be a fairly steady, though not a remunerative, one.

It is not likely to revive to any large extent, but, on the other hand, shows no signs of becoming extinct.

The carpet industry of Mirzapur appears to be in a rather unsafe position, and is suffering from a glut in production, and from the inferior quality of the workmanship which has of late years been considered good enough for the English market.