Annexure
SALIENT ACHIEVEMENTS

The salient results achieved during these studies are briefed as under:

Among the five varieties of adult mohairs (ringlet type, pashmina type, flat-lock type, pure Angora heavy type and rough kempy mohair) analysed, the pashmina type mohair is found to be the finest (21.14 µm), whereas rough kempy mohair is coarsest (35.18 µm) with the grade ranging from finer than 40s to 24/22s. Although the kid mohair has a finer diameter (17.90 µm) and can be categorised in grades of finer than 40s but the uniformity in the kid mohair fibre is slightly lacking. On the other hand, Russian Angora rabbit hair (10.70 µm) is comparatively finer than German Angora rabbit hairs and hairs from crossbreed varieties. Out of the four qualities of wool (chokla, ramb. X chokla, Indian merino and merino), merino wool was observed finest. The values of diameter variation within fibre indicate that mohair fibres, in general, are more dimensionally uniform as compared to wool and rabbit hair. Non-continuous medullation was observed in case of adult mohair which ranges from 1.5 to 20.8%, whereas lattice type medullation was observed in almost 80 to 90% fibres of each variety of Angora rabbit hairs. In wool, usually, unbroken or interrupted medullation was
observed and it was lower than rabbit hair but higher than mohair. Both, mohair and rabbit hairs have observed negligible crimp frequency. Moisture regain for wool is approximately 15% and is slightly higher than mohair and rabbit hair. The total clean fibre content of mohair ranges from 64.56 - 74.79%, while it is 79.44% in rabbit hair and 55.5 to 75.0% in different wool fibres.

(2) Amino-acid analysis clearly indicated that the speciality fibres mainly consist of low sulphur and high tyrosine proteins as compared to wool which is high cystine keratin fibre.

(3) Fine mohair fibres such as pashmina type and ringlet type have coronal-reticulate pattern which changes to coronal in coarser mohair fibres. Scale margins are smooth in fine mohair fibres and changes to crenate or rippled with increase in coarseness. Scales per 100 µm are almost six in number in each variety of mohair. Based on scale length, Skinkle’s rule was obeyed by mohair fibres. Due to the distinct chevron scale design, Angora rabbit hairs have their own special appearance and its characteristic ladder shaped medulla leaves no room to be confused with other speciality fibres. It has been observed that in case of fine mohair the number of scale per 100 µm increases in kemp
fibre from their respective true fibres, whereas the trend is completely reverse in case of both wool and rabbit hairs where the number of scales per 100 µm decreases in kemp fibres as compared to their true fibres.

(4) Unilateral cortical structure consisting of predominantly orthocortex and a few mesocortex was established for both mohair and Angora rabbit hairs as against to completely bilateral cortical structure made of orthocortex and paracortex with a few peripherally or centrally situated mesocortex in each variety of wool. The melanin granules were found scattered all over the cortex particularly in adult mohair and wool, whereas kid mohair and rabbit hairs were found devoid of these granules.

(5) In stress-strain curves of mohair, a characteristic hump in the Hookean region was very much prominent. Among the different types of mohair, pure Angora heavy type mohair has shown highest elastic recovery, whereas lowest was observed in pashmina type fine mohair. Based on the values of initial modulus, best visco-elastic behaviour was shown by rabbit hairs followed by mohair and wool.

(6) In the thermograms of TGA, the IDT, FDT and residue left at 530°C (final decomposition temperature of wool)
values clearly stated the better thermal stability of speciality fibres as compared to wool.

Microfibril and matrix peaks were ascertained by isothermal treatment of these fibres on DSC in which the microfibril peak gradually disappears on thermal treatment. Here again, mohair requires longer exposure of fibre to temperature for complete removal of microfibril peak which further supports the better thermal stability of speciality hairs in comparison to wool.

In the emulsion method, 4% of non-aqueous solvent by weight of fibre at 62°C was observed to perform better scouring with minimum damage to fibre.

In alkaline bleaching the whiteness of bleached mohair increases with increase in hydrogen peroxide concentration, within 0.3-1.2% w/w, but after this limiting concentration the effect diminishes. Sodium silicate has been observed a better solution stabilizer than trisodium phosphate. pH 9 is the optimum pH for the best whiteness. At 0.9% w/w hydrogen peroxide, 30°C temp., 6 hrs is the suitable time to obtain whiter mohair. Whereas in acid bleaching 0.6% w/w hydrogen peroxide with sulphuric acid and 1.2% w/w hydrogen peroxide with formic acid have been observed effective concentrations for acceptable bleaching of mohair at pH 3. With both sulphuric acid and formic acid best
results were obtained at 45°C temperature, 0.9% w/w hydrogen peroxide and at pH 3.

Out of the different blends of mohair/wool, most easily spinnable blends with least end-breaks have been observed with the 60% composition of mohair. Whereas, among the different varieties of mohair, pashmina type mohair blended with merino gave best results in spinning with higher production of even yarn. On the other hand in Angora rabbit hair/merino blends, higher proportion of rabbit hair than 30% requires slightly higher amount of oil from 4% to 6%. Overall 30/70 blend of Angora rabbit hair/merino wool has performed best with respect to smooth spinning and even yarn.

Yarn's tensile properties are mainly effected with the fibre diameter, fibre length from which they are processed and the linear density of the yarn evaluated. Fibre diameter also plays an important role in evenness of yarn, whereas fibre length has no significant effect on yarn quality. With the increase of the twist, yarn breaking strength increases but elongation falls marginally. If the twist factor was maintained constant, yarn strength being effected by yarns linear density. Least irregularity of the yarns was observed in pashmina/merino blends with the composition of 60 or 40% mohair. Incorporation of mohair in wool always improves the ultimate yarn abrasion resistance quality
and the mohair/wool ratio has been optimized at 40:60. In case of Angora rabbit hair/wool blends, only up to 30% incorporation of rabbit hair is recommended to achieve best yarn quality.
FUTURE THRUST AREAS

The following suggestions are made for future work concerning the potential utilization of speciality hairs.

1. In view of the increasing demand of the articles made from these speciality fibres, a detailed work can be taken up on field scale to make the knitted or worsted fabric from these optimised blends of mohair and Angora rabbit hairs with local or fine imported wool.

2. Optimization of construction parameters of yarn such as linear density, twist etc. with respect to their effective use in the manufacture of knitted fabrics as pullovers, blankets and worsted suitings as shawls, ties etc.

3. As was observed in thermal degradation studies that they are having superiority over wool, a detailed research work can also be taken up to improve further their thermal retardancy characteristics by grafting these speciality fibres with acrylate monomers such as methyl methacrylate (MMA), methyl acrylate (MA), ethyl acrylate (EA) and butyl acrylate (BA) etc.