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Wool Characteristics of the Indigenous Sheep of Meghalaya

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ABSTRACT

The present investigation was carried out to study the wool characteristics of indigenous sheep of Meghalaya a state of North East India. Sample collected from a total of 38 sheep belonging to East Khasi Hills and West Khasi Hills districts. Data obtained were classified according to sex and location to study their effect on staple length, fibre length, fibre diameter and medullation percentage. The data were subjected to least-squares analysis of variance technique. The average staple length, fibre length, fibre diameter and medullation percentage were recorded as 6.016±0.029cm, 62.203±0.552 mm, 40.556±0.559µ and 50.974±1.042% respectively. The effect of sex was found to be non significant on staple length and fibre length and highly significant effect ($P<0.01$) on fibre diameter and medullation percentage. The effect of location was found to be significant ($P<0.05$) on staple length and fibre diameter. Highly significant ($P<0.01$) effect of location on fibre length and medullation percentage was observed. The wool samples were found to be coarse type and have an ample scope to be utilized in the carpet making industry.

1. Introduction

Meghalaya, a state of North East India, cradles in its lap a unique indigenous germplasm of sheep. It is one of the few untapped animal genetic resources. According to Twentieth livestock census (2019), the overall sheep population in Meghalaya is 15.68 thousands. Out of this, 15.58 thousands are indigenous sheep. They are considered to be well adapted to local climatic condition, resistant to parasites and diseases and are efficient producer under poor feeding and managemental practices. These sheep are important resource of poor farmers and are reared mainly for meat purpose for its considerably high body weight (Khanikar *et al.*, 2021). It is a known fact that that Indian hand knotted carpet industry is one among the world's most leading carpet industry. This industry has shown tremendous growth in recent past. Indigenous sheep of Meghalaya has potentiality for wool production but to our dismal they are not at all utilised for wool production. A study on the wool characteristics of these sheep can highlight the type of the wool which will further help in its proper utilization and popularization of the scope of wool production. Hence, rearing these sheep for wool along with meat can definitely be an avenue for addition of the income to sheep rearers. Some of the important wool characteristics are staple length, fibre length, fibre diameter and medullation percentage. Staple length is an important criterion for spinning fibre. Fibre length effects processing of fibres and yarns and fiber strength and yarn strength depend on it. Fibre diameter expresses the fineness of fibre and the value of wool depends on it. Medullation indicates thickness of wool. Keeping this into context, the present study was done to analyse the basic characteristics of wool *viz.,* staple length, fibre length, fibre diameter and medullation percentage.

2. Materials and methods

Wool samples were collected from 38 animals from East and West Khasi Hills districts of Meghalaya. Data collected were classified according to sex and location to estimate their

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effect on staple length, fibre length, fibre diameter and medullation percentage. The staple length was measured with the help of a metric ruler and to study other three parameters the samples were outsourced to Wool Research Association, Thane, Maharashtra. The data were subjected to least-squares analysis of variance technique as suggested by Harvey (1990) in order to study the non-orthogonal data associated with sex of the animal and location. The mathematical model used to study different effects on wool traits was,

$$Y_{ijk} = \mu + S_i + M_j + e_{ijk} ,$$

where, Y_{ijk} is the value of the k^{th} animal in the $(ij)^{th}$ sub-class, μ is the overall population mean, S_i is the effect of the i^{th} sex (i=1, 2), M_j is the effect of j^{th} location (j=1, 2) e_{ijk} is the random error associated with Y_{ijk} assumed to be normally and independently distributed with mean zero and variance $\sigma^2 e$.

3. Results and Discussion

The staple length, fibre length, fibre diameter and medullation percentage of Meghalaya's indigenous sheep are tabulated in Table 1. Least-squares analysis of variance showing the effects of sex of the animal and location on different wool characteristics are presented in Table 2.

3.1Staple length (SL): The overall least-squares means for staple length in the present study was recorded as 6.016±0.029 cm. The least-squares means for staple length in male and female sheep were recorded as 5.972±0.041 and 6.061±0.042cm respectively. The least-squares means for staple length with respect to two locations, East and West Khasi Hills were found to be 6.499±0.040 and 5.534±0.042cm respectively. The findings were in compliance with those reported by Lalit *et al.* (2016) in Harnali sheep; Sheikh *et al.* (2018) in Corriedale and Singh *et al.* (2018) in Magra. However, longer staple length was reported in Annual report of Central Sheep and Wool Research Institute, Avikanagar (2012) in Chokla; and Farrag *et al.* (2019) in Rahmani sheep of Egypt. On the other hand, shorter staple length in comparison to present finding was reported by Taggar *et al.* (2018) in Poonchi; Khadse *et al.* (2019) in Deccani; and Baba *et al.* (2020) in Kashmir Merino.

3.1.1 *Effect of sex*: Per usual of least-squares analysis of variance table, influence of sex was found to be non significant on staple length. Similar, non significant effect of sex on staple length was reported by Ahlawat *et al.* (2011) in Patanwadi sheep; Hermiz *et al.* (2018) in Arabi ewes and Mahajan *et al.* (2018) in Rambouillet sheep. Contrarily, Narula *et al.* (2010) in Marwari sheep; Taherpour *et al.* (2012) in Arabi sheep; and Rather *et al.* (2019) in Kashmir Merino found significant effect of sex on staple length.

3.1.2 *Effect of location*: The effect of location was found to be significant (P<0.05) on staple length. The staple length of wool samples from East Khasi Hills was higher than those from West Khasi Hills. Ahmad *et al.* (2010); Ahlawat *et al.* (2011); and Hassan and Talukder (2011) observed significant effects of location on staple length in Kari sheep of Pakistan; Patanwadi sheep; and native sheep of Bangladesh.

3.2 Fibre length (FL): The overall least-squares means for fibre length in the present study was recorded as 62.203±0.552 mm. The least-squares means for fibre length in male and female sheep were recorded as 61.947±1.162 and 62.434±0.121 mm respectively. The least-squares means for fibre length with respect to two locations, East Khasi Hills and West Khasi Hills were found to be 66.724±0.216 and 57.242±0.182 mm respectively. Meena *et al.* (2020) reported a similar value compared to present result in Himachal Pradesh crossbred (HPC), Jammu Kashmir merino (JKM), and Jammu Kashmir crossbred (JKC). However, Taherpour *et al.* (2012) reported lower values compared to present result in case of Arabi sheep. Higher values in comparison with the present study were reported by Farrag *et al.* (2019) in Rahmani sheep of Egypt in Poonchi; Ma *et al.* (2020) in Chinese Merino; Meena *et al.* (2020) in Australian merino (AM), AM:JKC (75:25), AM:JKC (50:50) and AM:JKC (25:75).

3.2.1 *Effect of sex:* The least-squares analysis of variance revealed that the influence of sex was non-significant on fibre length**.** Similar to the present study non significant effect of sex on fibre length was reported by Hermiz *et al.* (2018) in Arabi ewes. On the contrary, significant effect of sex on fibre length was found by Taherpour *et al.* (2012) in case of Arabi sheep.

3.2.2 *Effect of location*: The effect of location was found to be highly significant (P<0.01) on fibre length. The fibre lengths of the sheep of East Khasi Hills were found to be more in comparison to sheep of West Khasi Hills. Variability in regards to locations can be attributed to difference in climatic conditions, feeding sufficiency as well as management conditions. Ahtash (2005) observed significant effect of location in his study on fiber length of Barbary ewes of Libya.

3.3 Fibre Diameter (FD): The overall least-squares means for fibre diameter in the present study was recorded as 40.556±0.559µ. The least-squares means for fibre diameter in male and female sheep were recorded as 32.535±0.771 and 48.576±0.810µ respectively. The least-squares means for fibre diameter with respect to two locations, East and West Khasi Hills were found to be 42.486±0.771 and 38.625±0.810

μ respectively.The overall mean of fibre diameter reported by Ammayappan *et al.* (2012) in Marwari sheep; Tariq *et al.* (2013) in Mengali Sheep (Balochistan) and Singh *et al.* (2018) in Magra were in good agreement with the present result. Higher values compared to present finding was reported in Annual report of Central Sheep and Wool Research Institute, Avikanagar (2012) in Bellary, Bonpala and Garole; and Khadse *et al.* (2019) in Deccani sheep. However, lower values were reported by Lalit *et al.* (2016) in Harnali; Taggar *et al.* (2018) in Poonchi; Rather *et al.* (2019); and Baba *et al.* (2020) in Kashmir Merino.

3.3.1 ***Effect of sex:*** The least-squares analysis of variance revealed that the influence of sex was highly significant (P<0.01) on fibre diameter. The fibre diameter was observed to be more in the wool from female sheep than the male. The reason behind this difference may be due to the level of endocrine hormones like testosterone It was observed that the diameter of wool is related to testosterone concentration Nazari-Zonouz *et al.* (2018) and the testosterone present in rams, has an anabolic function which involves the promotion of protein synthesis thus producing finer wool fibre (Sanni *et al.* 2012). Similar significant effects of sex on fibre diameter were reported by Narula *et al.* (2010) in Marwari; Mahajan (2018) in Rambouillet; and Rather *et al.* (2019) in Kashmir Merino. Non significant effects were reported by Ahmad *et al.* (2010) in Kari sheep of Pakistan; Dass (2007) in Pugal; Dass *et al.*(2008) in Marwari; Ahlawat *et al.* (2011) in Patanwadi sheep; Taherpour *et al.* (2012) in case of Arabi sheep; Khan (2015) in Rambouillet and Hermiz *et al.* (2018) in Arabi ewes.

3.3.2 ***Effect of location:*** However, the effect of location was found to be significant (P<0.05) on fibre diameter. The fibre diameters of wool from the sheep of East Khasi Hills were found to be more in comparison with those of sheep of West Khasi Hills. Such differences in respect to geographical location may be due to the variation in feed and fodder availability, methods of management and above all the variation in the photoperiod. Significant effects of location on fibre diameter were reported by Singh *et al.* (2005) in Corriedale; and Ahlawat *et al.* (2011) in Patanwadi sheep whereas non significant effect of location on fibre diameter was reported by Ahmad *et al.* (2010) in case of Kari sheep of Pakistan; and Hassan and Talukder (2011) in native sheep of Bangladesh.

3.4 Medullation percentage: The overall least-squares means for medullation percentage in the present study was recorded as 50.974±1.042%. The least-squares means for medullation percentage in male and female sheep were recorded as 33.377±1.437 and 68.570±1.511% respectively.

The least-squares means for medullation percentage with respect to two locations, East and West Khasi Hills were found to be 38.991±1.437 and 62.956±1.511% respectively. The mean values obtained in this study corroborated with those reported by Narula (2010) in female Marwari; Ammayappan *et al.* (2012) in Nali and Marwari; and Khadse *et al.* (2019) in Deccani. However, lower values were reported by Central Sheep and Wool Research Institute, Avikanagar (2012) in Bellary, Chokla, Gaddi, Magra; Taggar *et al.* (2018) in Poonchi; and Baba *et al.* (2020) in Kashmir Merino. Comparatively higher medullation percentage were reported by Narula *et al.* (2010) in male Marwari sheep; and Annual Report of Central Sheep and Wool Research Institute, Avikanagar (2012) in Bonpala, Garole, Malpura and Muzzafarnagri.

3.4.1 ***Effect of sex:*** The least-squares analysis of variance revealed that the influence of sex was highly significant (P<0.01) on medullation percentage. The wool fibre of female animals had more medullation percentage than the males. This can be attributed to the differences in the hormone regulation in male and females and thereby the physiological response to stress. Mehta *et al.* (2004); and Narula *et al.* (2010) found similar significant effects of sex on medullation percentage in Magra; and Marwari respectively. However, non significant effects were reported by Dixit *et al.* (2009) in Bharat Merino; Ahmad *et al.* (2010) in Kari sheep of Pakistan; and Rather *et al.* (2019) in Kashmir Merino.

3.4.2 ***Effect of location***: The effect of location on medullation percentage was found to be highly significant (P<0.01) in the present investigation. The medullation percentage of the wool fibre of the sheep of West Khasi hills were found to be more in comparision with those of sheep of East Khasi Hills. Significant effects of location was reported by Singh *et al.* (2005) in Corriedale lambs and Ahlawat *et al.* (2011) in Patanwadi sheep whereas non significant effects were reported by Ahmad *et al.* (2010) in Kari sheep of Pakistan; and Hassan and Talukdar (2011) in native sheep of Bangladesh.

4. Conclusion

The study indicated that the wool of the indigenous sheep of Meghalaya is of coarse type which can be utilised for making carpets. There is a scope for carpet industry, hence the sheep rearers should be made aware to exploit wool production from these sheep along with the meat production which can enhance income.

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Table 1. Least-Squares Means ±Standard Errors (LSM±SE) for wool characteristics according to sex and location of the animal

Sub-Class Description	STAPLE LENGTH (cm)	FIBER LENGTH (mm)	FIBRE DIAMETER (μ)	MEDULLATION PERCENTAGE (%)
	LSM±SE	LSM±SE	LSM±SE	LSM±SE
Overall mean (μ)	6.016±0.029 (38)	62.203±0.552 (38)	40.556±0.559 (38)	50.974±1.042 (38)
Sex:				
1. Male	5.972±0.041 (20)	61.947±1.162 (20)	32.536^{a} ±0.771 (20)	33.377^{a} ±1.437 (20)
2. Female	6.061±0.042 (18)	62.434±1.121 (18)	48.576^{b} ±0.810 (18)	68.570^{b} ±1.511 (18)
Location:				
1. L1	6.499^{a} ±0.041 (20)	66.724^{a}±0.216 (20)	42.486^{a}±0.771 (20)	38.991^{a} ±1.437 (20)
2. L2	5.534^{b} ±0.042 (18)	57.242^{b} ±0.182 (18)	38.625^{b}±0.810 (18)	62.956^{b} ±1.511 (18)

NB: Within parentheses are the number of observations.
Subclass means in a column with different superscripts differ significantly (P<0.05).

Table 2. Least-Squares Analysis of Variance for various factors affecting different wool characteristics

SOURCES OF VARIATION	STAPLE LENGTH		FIBER LENGTH		FIBRE DIAMETER		MEDULLATION PERCENTAGE	
	d.f.	M.S.S	d.f	M.S.S	d.f	M.S.S	d.f.	M.S.S
1.SEX	1	0.075^{NS}	1	2.235^{NS}	1	2431.197^{**}	1	11704.430^{**}
2.LOCATION	1	8.820^{*}	1	841.592^{**}	1	140.909^{*}	1	5427.538^{**}
3.ERROR	35	0.032	35	0.687	35	11.826	35	41.1054

** P < 0.01, *P<0.05, NS = Non significant

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