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Qualitative Morphological Characterization of Bligon Gat in Different Agroecological Zones in Bantul Regency, Yogyakarta

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ABSTRACT
Bligon goat is one of the goat breeds that is widely raised in Yogyakarta, Indonesia. This study was conducted to determine the qualitative morphology characteristics of Bligon goat in different sexes and agroecological zones. Observations were conducted on Bligon goats from the hilly areas (45 males and 60 females) and lowland (63 males and 74 females). Data were analyzed descriptively by chi-square analysis and clustered by multiple correspondence analysis (MCA). The results indicate that the qualitative morphological characteristics of Bligon goats in the hilly and lowland areas were significantly different ($p<0.05$), except for the jaw shape and ear orientation characteristics. There were differences ($p<0.05$) in the hair color characteristics of the head, body, chest, backline, rump mane, and legs in male and female Bligon goats in hilly areas. In contrast, goats in lowland areas had no differences in qualitative morphological characteristics except for the ear orientation ($p<0.05$). Based on the unique qualitative morphological traits, the population of Bligon goat in this study can be well clustered into two agroecological zones, while male and female goats have almost similar characteristics. In conclusion, populations of Bligon goats in different agroecology can be characterized based on their unique qualitative morphological characteristics, although male and female goats have almost similar characteristics.

Keywords: *Body characteristics, Exterior traits, Local goat, MCA, Phenotypic*

1. INTRODUCTION

Goat is a livestock commodity that has a strategic role in the smallholder farmers' life in the Special Region of Yogyakarta. Goats are savings and insurance for farmers as well as a provider of quality manure. The goat breed currently widely available in Yogyakarta is the Bligon goat raised in Bantul and Gunungkidul District [1,2]. Currently, nine breeds of goats in Indonesia have been designated as germplasm for local goats [3], but nationally, Bligon goats have not been designated as germplasm for local goats. The requirement for determining a livestock breed as germplasm of a local breed of livestock in Indonesia must pass the observation test, which is a test for evaluating specific qualitative, quantitative, and distribution areas characteristics [4].

Bligon goat excellence as national germplasm is still poorly known during the conservation efforts and new limited discourse. On the other hand, erosion and pollution of germplasm continue to occur, so it is feared to be extinct. Moreover, the lack of attention to this goat resulted in decreased productivity to maintain goat farmers' interest has shifted to the goat with a larger body size that resulted in the Bligon goat population not developing [5]. Characterization and inventory of genetic resources is the first step for implementing genetic improvement strategies. Phenotypic characterization is extended to include a description of the production environment that affects the natural environment and management practices and the differences in livestock used. The study of the geographical distribution of livestock is also an integral part of phenotypic characterization [6,7,8].

This study was aimed to characterize the population of Bligon goats in different agroecological zones in

Table 1. Description of body coat color traits of Bligon goat population in the Bantul Regency

Traits	Attributes	Hilly area						Lowland					
		Male		Female		Total		Male		Female		Total	
		N	%	N	%	N	%	N	%	N	%	N	%
Head coat color	Black (1a)	8	17.8	3	5,0	11	10.5	16	25.4	29	39.2	45	32.8
	Brown (1b)	4	8.9	14	23.3	18	17.1	-	-	-	-	-	-
	White (1c)	-	-	-	-	-	-	-	-	-	-	-	-
	Striped (1d)	33	73.3	43	71.7	76	72.4	47	74.6	45	60.8	92	67.2
	X^2-w/np	7.147*						2.935^{ns}					
	X^2-b/np	36.575*											
Body coat color	Black (2a)	6	13.3	2	3.3	8	7.6	11	17.5	16	21.6	27	19.7
	Brown (2b)	6	13.3	27	45.0	33	31.4	5	7.9	10	13.5	15	10.9
	White (2c)	5	11.1	5	8.4	10	9.5	20	31.7	32	43.2	52	38.0
	Striped (2d)	28	62.2	26	43.3	54	51.4	27	42.9	16	21.6	43	31.4
	X^2-w/np	13.572*						7.340^{ns}					
	X^2-b/np	43.289*											
Crest color	Black(3a)	17	37.8	6	10.0	23	21.9	20	31.7	32	43.2	52	38.5
	Brown (3b)	4	8.9	21	35.0	25	23.8	-	-	-	-	-	-
	White (3c)	4	8.9	8	13.3	12	11.4	19	30.2	18	24.3	37	27.0
	Striped (3d)	20	44.4	25	41.7	45	42.9	24	38.1	24	32.4	48	35.0
	X^2-w/np	16.912*						1.925^{ns}					
	X^2-b/np	45.632*											
Back line color	Black (4a)	6	13.3	2	3.3	8	7.6	11	17.5	17	23.0	28	20.4
	Brown (4b)	3	6.7	15	25.0	18	17.1	1	1.6	0	0.0	1	0.7
	White (4c)	4	8.9	5	8.3	9	8.6	21	33.3	30	40.5	51	37.2
	Mixed (4d)	32	71.1	38	63.3	70	66.7	30	47.6	27	36.5	57	41.6
	X^2-w/np	8.659*						3.169^{ns}					
	X^2-b/np	53.761*											
Rump mane color	Black (5a)	4	8.9	0	0.0	4	3.8	13	20.6	21	28.4	34	24.8
	Brown (5b)	0	0.0	2	3.3	2	1.9	1	1.6	0	0.0	1	0.7
	White (5c)	1	2.2	7	11.7	8	7.6	8	12.7	15	20.3	23	16.8
	Mixed (5d)	40	88.9	51	85.0	91	86.7	41	65.1	38	51.4	79	57.7
	X^2-w/np	9.889*						4.271^{ns}					
	X^2-b/np	28.388*											
Leg color	Black (6a)	9	20.0	1	1.7	10	9.5	13	20.6	19	25.7	32	23.4
	Brown (6b)	26	57.8	26	43.3	52	49.5	10	15.6	8	10.8	18	13.1
	Plain (6c)	1	2.2	4	6.7	5	4.8	8	12.7	12	16.2	20	14.6
	White+black (6d)	0	0.0	1	1.7	1	1.0	18	28.6	19	25.7	37	27.0
	White+brown (6e)	9	20.0	28	46.7	37	35.2	14	22.2	16	21.6	30	21.9
	X^2-w/np	17.164*						1.434^{ns}					
	X^2-b/np	68.847*											

N= number of observations; %= percentage of observations; X^2-w/np= chi-square within population; X^2-b/np= chi-square between population; *= significant at ($p<0.05$); ^{ns}= non-significant.

Bantul Regency, Yogyakarta, based on qualitative morphological traits. The results of this study can be used as primary data for the germplasm of local goats in Indonesia and the primary basis and guidelines in formulating sustainable development strategies for Bligon goats.

Table 2. Description of body shape traits of Bligon goat population in the Bantul Regency

Traits	Attributes	Hilly area						Lowland					
		Male		Female		Total		Male		Female		Total	
		N	%	N	%	N	%	N	%	N	%	N	%
Facial profile	Convex (7a)	33	73.3	38	63.3	71	67.6	57	90.5	69	93.2	126	92.0
	Straight (7b)	12	26.7	22	36.7	34	32.4	6	9.5	5	6.8	11	8.0
	X^2-w/np	1.174^{ns}						0.353^{ns}					
	X^2-b/np	23.287*											
Jaw shape	Lower>upper (8a)	0	0.0	1	1.7	1	1.0	0	0.0	1	1.4	1	0.7
	Lower=upper (8b)	45	100.0	59	98.3	104	99.0	63	100.0	73	98.6	136	99.3
	Lower<upper (8c)	-	-	-	-	-	-	-	-	-	-	-	-
	X^2-w/np	0.757^{ns}						0.858^{ns}					
	X^2-b/np	1.625^{ns}											
Horn orientation	Upward (9a)	5	11.1	10	16.7	15	14.3	19	30.2	25	33.8	44	32.1
	Lateral (9b)	1	2.2	3	5.0	4	3.8	1	1.6	3	4.1	4	2.9
	Backward (9c)	39	86.7	47	78.3	86	81.9	42	66.7	46	62.2	88	64.2
	Spiral (9d)	-	-	-	-	-	-	1	1.6	0	0.0	1	0.7
	X^2-w/np	1.294^{ns}						2.131^{ns}					
	X^2-b/np	11.242*											
Ear shape	Fold (10a)	0	0.0	1	1.7	1	1.0	18	28.6	22	29.7	40	29.2
	Unfold (10b)	45	100.0	59	98.3	104	99.0	45	71.4	52	70.3	97	70.8
	X^2-w/np	0.757^{ns}						0.022^{ns}					
	X^2-b/np	33.699*											
Ear orientation	Pendulous (11a)	43	95.6	51	85.0	94	89.5	57	90.5	73	98.6	130	94.9
	Semi-pendulous (11b)	2	4.4	9	15.0	11	10.5	6	9.5	1	1.4	7	5.1
	X^2-w/np	3.055^{ns}						4.688*					
	X^2-b/np	2.487^{ns}											

N= number of observations; %= percentage of observations; X^2-w/np= chi-square within population; X^2-b/np= chi-square between population; *= significant at ($p<0.05$); ^{ns}= non-significant.

2. MATERIAL AND METHODS

This study observed the qualitative morphological characteristics of 243 Bligon goats from hilly areas (45 males and 60 females) and lowland (63 males and 74 females) determined by purposive sampling. Bligon goats were observed for qualitative morphological characteristics, including head hair color, body hair color, crest color, backline color, rump mane color, leg color, face profile, jaw shape, horn orientation, ear shape, and ear orientation. Data were analyzed using descriptive analysis (number and percentage) and chi-square analysis to compare sexes and agroecological zones. Multiple correspondence analysis (MCA) was carried out to determine the relationship between variables on each factor [9], [10].

3. RESULT AND DISCUSSION

3.1. Morphological traits of Bligon goat

The number and percentage of each level of 11 qualitative morphology traits in male and female Bligon goats in each agroecology were presented in Table 1 and Table 2.

The results showed that male and female Bligon goats in hilly areas have significantly different ($p<0.05$) qualitative morphological characteristics. The differences include head hair color, body hair color, crest color, backline color, rump mane color, and leg color. At the same time, the jaw shape, horn orientation, ear shape, and ear orientation were not significantly different. The

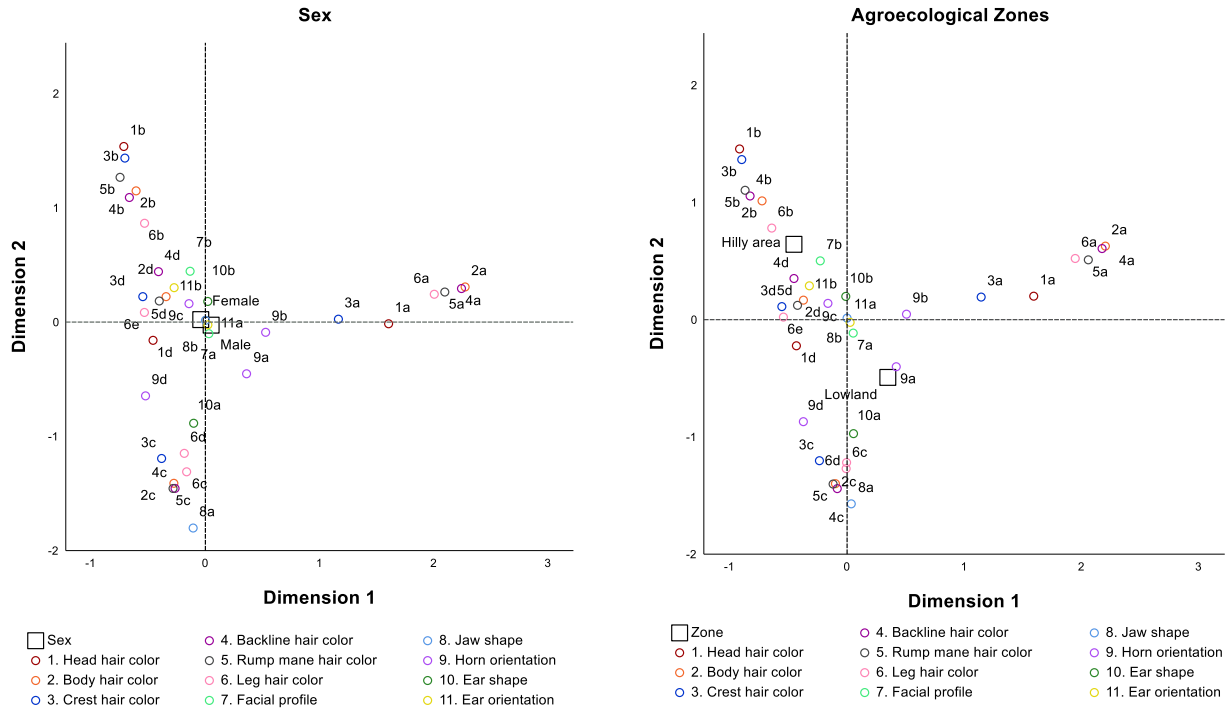

Figure 1. The scatter plot graph of the multiple correspondence analysis (MCA)

lowland male and female Bligon goats had the same qualitative morphological characteristics, except for the ear orientation traits ($p<0.05$). When compared between hilly and lowland areas, the qualitative morphological traits of Bligon goats were significantly different ($p<0.05$) in both zones, except for jaw shape and ear orientation.

The characteristics of the body coat color of male and female Bligon goats in different agroecological zones are presented in Table 1. Body coat color between male and female goats in hilly areas has different characteristics ($p<0.05$), while lowland was not different. In hilly areas and lowland, mixed coat colors of black, brown, and whir dominate the body hair coat color of male Bligon goats, except for the legs color. In female goats, the percentage of white on the body hair coat in the lowland was higher than in the hilly area. The body color pattern was similar to that of the Lakor goat [11] but differed from the Etawah Crossbreed (Peranakan Etawah/PE) goat, which mostly has black or brown color from head to nick and white color on the back of the body [12], [13]. The presence of black or mixed colors in Bligon goats was almost evenly distributed in all body parts. The brown and black colors throughout the body of the Bligon goat were probably the color inherited from the Kacang goats [14] because the Bligon goat is the result of a cross between the Kacang goat and the PE goat [2], [15].

Body shape characteristics of male and female Bligon goats in different agroecological zones were presented in Table 2. Besides the body coat color traits, male and female Bligon goats in both zones were dominated by a convex facial profile, a proportional lower and upper jaw shape, backward horns, unfold ears shape, and pendulous ears orientation. Bligon goat's body shape was more likely to be similar to the Kacang goat's facial profile, ear, back, and jaw shape [16]. The ear shape characteristics of Bligon goats in this study were almost similar to some of the PE goats in Polman Regency, West Sulawesi, namely short and wide [14]. The facial profile was similar to PE goat [17] but different to Tunisian native goat and Northern Morocco goat [7], which have a straight facial profile.

3.2. Multiple correspondences

The Cronbach's alpha values in this study were more than 0.70, which means that the reliability level of the data in this study was reliable [18]. The inertia values in the sex category for dimensions 1 and 2 were 0.411 and 0.292, which means that dimensions 1 and 2 can explain the diversity of data by 41.1% and 29.2%, respectively. While the agroecological zone category was 0.420 and 0.316, which means dimensions 1 and 2 can explain the diversity of data by 42.0% and 31.6%, respectively. Figure 1 showed a dimensional graph representing the relationship between categories in the analysis of qualitative morphological traits. Based on sex category, 70.3% of the total qualitative morphological variation in Bligon goats was explained by two dimensions, namely

41.091% of the first dimension and 29.196% of the second dimension. Based on the agroecological zones category, 73.6% of the total qualitative morphological variation in Bligon goats was explained by two dimensions, namely 42.010% in the first dimension and 31.585% in the second dimension.

In this study, the male and female Bligon goats have closer characteristics to the centroid point between the two sexes, which means the qualitative morphological characteristics of male and female Bligon goats are similar. Bligon goats' population in this study was clustered into two groups based on their unique qualitative morphological characteristics in the agroecological zone. The qualitative characteristics that were close to the Bligon goat group in the hilly area include the striped crest color (3d), mixed dorsal color (4d), mixed rump mane color (5d), white-black leg color (6b), and straight facial profile (7b). At the same time, in the lowland, it is plain white leg color (6c), convex facial profile (7a), upward direction of the horns (9a), and folded ears (10a). The differences in morphological variables by location due to environmental adaptation or differences in origin and the effect of introgression or crossbreeding [7].

4. CONCLUSIONS

The qualitative characteristics of the morphology of Bligon goats in hilly and lowland areas were different, except for the shape of the jaw and the ears' orientation. There are differences in the hair color characteristics of the head, body, chest, backline, rump mane, and legs in male and female Bligon goats in hilly areas. In contrast, goats in lowland areas have no differences in body qualitative morphological characteristics except ears' orientation. The population of Bligon goats in this study can be well clustered into two agroecological zones based on their unique qualitative morphology. In contrast, male and female goats have almost similar qualitative morphological characteristics.

AUTHORS' CONTRIBUTIONS

IGSB conceived and planned the study. NN and P supervised the study, RDR and BAA carried out the study. IGSB, BAA and AI took the lead in writing the manuscript. All authors contributed and provided critical feedback to the study, analysis, and manuscript.

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