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Diversity and Kinship of the Swamp Buffalo (*Bubalus bubalis*) from Pampangan South Sumatra Based On Morphological Characteristics

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Abstract: Previous studies have found four variant of swamp buffalo in the region of Pampangan based on the characteristics of habitats and morphology namely black buffalo, red,belang, and Lampung. Hence done observation to know the diversity and the kinship relation based on morphological characteristics. A method of on farm was done to data characterization and morphology. Data was analyzed using NTSys ver.2.1 and presented in dendrogram. Cluster analysis done with un-weighted pair-grup method with arithmetic averaging (UPGMA) with a coefficient similarity. The results show that morphology between variant buffalo that in eye color, the color of body, body size, or shapes and sizes horns. Buffalo belang having a dark eyes, the body white ribbed and light. Buffalo black having a black eyes and black body. Buffalo red having a red eyes, the body a red light colored (blonde). Buffalo Lampung allegedly is introduce from Lampung area, adapt and married with a local buffalo. The red buffalo having red eyes, like a black buffalo but shorter size with curved horns the way down. The results of the analysis kinship based on morphological characteristics show buffalo black and buffalo Lampung allegedly came from a single characterized by value a correlation coefficient of 0,85. Inbreeding and adaptation factors believed to cause different the phenotype and morphology. Buffalo red having scarlet kinship the lowest is as much as 0,57 and predicted to have an ancestor different. Based on these results can be expressed variant swamp buffalo of regional Pampangan tending to low and the difference in the phenotype of influenced inbreeding and adaptation to the environment

Keywords: diversity, kinship, swamp buffalo (Bubalus bubalis), morphological characteristics, Pampangan South Sumatra

Abstrak (Indonesian): Berdasarkan karakteristik habitat dan pengamatan terhadap morfologi telah ditemukan empat varian kerbau rawa di wilayah Pampangan yaitu kerbau hitam, merah, belang, dan Lampung. Untuk mengetahui keanekaragaman dan hubungan kekerabatan antar varian kerbau dilakukan penelitian ini. Pengamatam lapangan ditujukan untuk memperoleh data mengenai karakterisasi dan morfologi. Data dianalisis menggunakan NTSYS Ver.2.1 dan disajikan dalam bentuk dendrogram. Analisis kluster menggunakan metode *Unweighted pair-grup method with arithmetic averaging* (UPGMA) untuk mendapatkan koefisien similaritas. Hasil menunjukkan perbedaan morfologi antar varian kerbau terlihat pada warna mata, warna tubuh, ukuran tubuh, serta bentuk dan ukuran tanduk. Kerbau rawa belang memiliki mata gelap, tubuh bergaris putih dan ukuran tubuh kecil; kerbau hitam memiliki mata hitam dan warna kulit hitam; kerbau mata merah memiliki mata berwarna tubuh lebih terang (warna bulu pirang); sedangkan kerbau Lampung diduga berasal dari daerah Lampung, yang beradaptasi dan kawin dengan kerbau lokal. Kerbau merah memiliki mata berwarna merah, memiliki tanduk yang lebih pendek dan melengkung ke bawah. Hasil analisis terhadap kekerabatan antar varian kerbau rawa diketahui bahwa kerbau hitam dan kerbau Lampung diperkirakan berasal dari satu induk dengan nilai koefisien korelasi sebesar 0,85. *Inbreeding* dan adaptasi diyakini menjadi faktor munculnya beberapa fenotip dan morfologi. Nilai kekerabatan terendah sebesar 0,57 ditemukan pada varian kerbau merah dan diperkirakan berasal dari nenek moyang berbeda. Berdasarkan hasil tersebut disimpulkan bahwa keragaman genetik dari kerbau rawa yang berasal dari daerah Pampangan relatif rendah dan perbedaan fenotip lebih dipengaruhi oleh *inbreeding* dan adaptasi lingkungan.

Kata kunci: keragaman, kekerabatan, kerbau rawa (Bubalus bubalis), karakteristik morfologi, Pampangan Sumatera Selatan

1. Introduction

Buffalo mud/swamp buffalo/buffalo river (*Bubalusbubalis*) in Indonesia is expected to come from mainland China. Buffalo locally in Asia known by several terms in accordance with the region, such Bhanis in India, Al-Jamoss in Arab countries, buffaloes in Malaysia and Indonesia [1]. Habitat buffalo tend to be specific and limited to the region tend to be inundated wetlands or the availability of food resources. One area in Indonesia that can be occupied by these cattle is South Sumatra region as the region Pampangan, District Rambutan, Ogan Ilir, South Sumatra, Indonesia. Swamp buffalo has the advantage to be bred [2]. According to [3], in addition to sustain food security is as producer of buffalo meat, including livestock that can survive with lower feed quality, tolerant of tropical parasites, and play a role in social and cultural life of farmers. The potential of livestock breeding is likely to be influenced by a low reproduction [4].

The low reproductive ability can be affected by the marriage patterns and the environment is less supportive. The study [5] provides information about the four variants of swamp buffalo found in the region Pampangan, District Rambutan, Ogan Ilir, South Sumatra, namely buffalo black, red, striped, and Lampung.

The variation found in the swamp buffalo endemic South Sumatra is thought to be influenced by mating patterns between people in the population. High rate of inbreeding decreases the reproductive ability [4]. Based on these results need to be studied more widely about how the phenotypic diversity can occur and kinship between the swamp buffalo variants based on morphological characteristics, so that it can become scientific information in conservation or cultivation.

2. Experimental Sections

1.1 Research Location

The location is in an area sampling Pampangan Rambutan district, Banyuasin, South Sumatra. The locations are shown in Figure 1. At the time of the survey conducted to determine the location of the location to determine the distance between locations. The location is determined by purposive random sampling. Each buffalo population is represented by two individuals were determined after surveys and direct observations. On-farm methods carried out for characterization data and morphology.

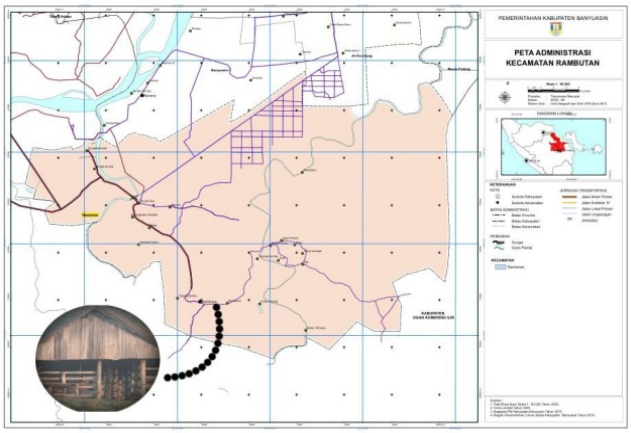

Figure 1. Map Location Observation Rambutan Village, District Rambutan, Banyuasin, South Sumatra (Source: Personal).

2.2 Data Retrieval Techniques

According to [6] and [7] to determine the morphology of each variation buffalo to judge the chest circumference, shoulder height, body length, tail length, head length from the boundary ear to mouth, wide head, hip height. The diversity of the characteristics of the fourth variation is done directly. Variables that were observed include body surface characteristics (hair color), eye color, shape and direction of growth of the horn. Data obtained from morphological characters of each buffalo analyzed using NTSYS ver. 2.1. Cluster analysis is done by using the un-weighted Pair- Group Method with Arithmetic Averaging (UPGMA) with similarity coefficient. Furthermore, morphological characters will be tabulated and descriptions [4].

2.3 Kinship between variants of the swamp buffalo Morphological characters include a specific character from head, neck, body, tail, and legs described descriptively. Table 1 lists the parameters for the observation of morphological characters swamp buffalo.

Table 1. Parameters of morphological characters swamp buffalo

Head	Characters	Information
Horn	Colour	0 = red, 1= black, 2= stiped
	Textured base	0= notched
	texture tip	0= flat
	tip shape	0= blunt, 1= pointed
	the direction of	0= up into, 1= back into, 2= down into
	Growth	0= none, 1= availbale
	Accessories	0= red, 1= black, 2= mottle
	Color base of the	0= red, 1= black, 2= mottle
	horns	0= triangle, 1= round, 2= flat

	Color horns	0= round
	Shape the base of the horn	
	Shape the horns	
Ears	shape	0= triangle
	colour	0= red, 1= black
	accessories	0= none, 1= availbale
	tip	0= pointed, 1= taper
Nose	colour	0= black, 1= mottle
	color mustache	0= merah, 1= hitam, 2= putih, 3= tidak ada
	accessories	0= none
Eyes	Sclera Colour	0= black, 1= white, 2= reddish white
	Sclera shape	0= round
	Iris Colour	0= black, 1= bluish-black
	Iris Shape	0= round, 1= oval
	Pupil colour	0= black, 1= grayish black
	Pupil shape	0= round, 1= oval
Eyelid	colour	0= merah, 1= hitam, 2= hitam keabu-abuan
	Accessories	0= tidak ada
	tip	0= tumpul
	corner of the eyelid	0= pointed
eyelashes	colour	0= red, 1= black
	shape	0= straight

3. Results and Discussion

Naming swamp buffalo variants based on the color characteristics buffalo fur or body color. The correlation coefficient is useful to determine the phylogenetic relationship between variants buffalo. Values closest kinship found in swamp buffalo black variant and Lampung. The correlation coefficient of the black variant and Lampung at 0.87 indicates a close genetic relationship between the two, while the lowest correlation coefficient of 0.57 indicates a kinship between the black and striped buffalo just as friends. Based on morphological character data obtained, both variants of the swamp buffalo have a real equation for the coat color. Black buffalo and Lampung has a body color is black and eyes are also black. This differs from the two other variants, namely red buffalo and buffalo striped who has a body color red or red and white stripes. Red buffalo has characteristics which are also red eyeballs.

Observations show of 54 morphological characters were observed, there are 45 characters in common between the two variants of black buffalo and Lampung. Differences in the two variants are only visible on body size and antler growth direction. According to [8] are generally white buffalo coat color red and black with sparse and coarse body hair. One of the causes of diversity coat color is genetic. Research [9] describes the frequency of cruciferous cause color variations on the swamp buffalo.

Stated by [10] plumage color depending on the style and amount of pigment in the cortex, and sometimes in the air cavity inside the hair. White pigment on hair that is not there, and white due to air content in the hair. Oxidation of melanin causing compounds that are colorless, so hair dark to be white because of the hydrogen peroxide.

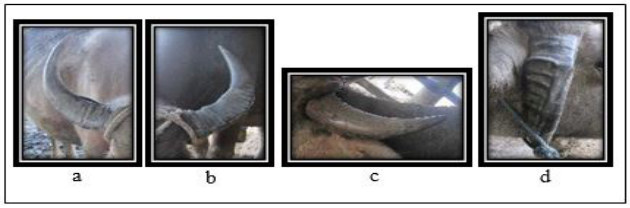

Figure 2. Horn shape variations of the swamp buffalo: (a) red, (b) black, (c) mottle, (d) Lampung (Windusari *et al*., 2016)

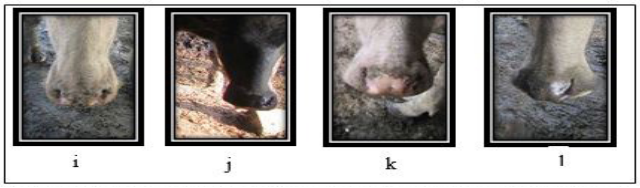

Figure 3. Nose shape variations of the swamp buffalo: (a) red, (b) black, (c) mottle, (d) Lampung (Windusari *et al*., 2016)

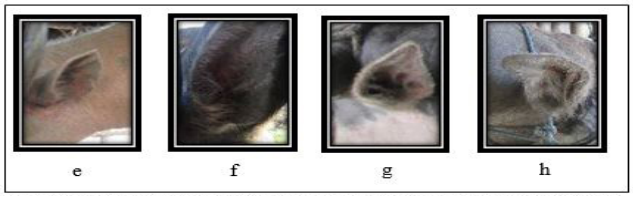

Figure 4. Ears shape variations of the swamp buffalo : (a) red, (b) black, (c) mottle, (d) Lampung (Windusari *et al*., 2016)

Figure 5. Variations of the shape and color of the eyes of the swamp buffalo : (a) red, (b) black, (c) mottle, (d) Lampung (Windusari *et al*., 2016)

Horn determined morphological differences of 31 morphological characters were observed covering the base of the horn shape, ear shape, accessories on the

nose, the shape of the sclera, the shape and color of the iris, pupil shapes, colors and accessories on the eyelid. Shape of the tip and the base of the eyelid, colors and shapes of eyelashes, the shape of the tip and base of the brow, and the form of accessories on the eyebrows, accessories on the neck, the direction of hair growth, the general form of the body, the color of the shoes, the direction of hair growth leg, accessories feet, hair color tail body, body hair growth direction of the tail, the tail accessories, color and texture of the tail whip, and the shape of the tip of the tail whip.

Kinship of the fourth variation influenced swamp buffalo internal factors such as genetics and external factors such as environment and lifestyle. Environment can affect quantitative traits. Diversity is the result of differences in the genotype environment. According to [11] expressed a kinship patterns cattle is thought to occur because the deployment and migration (gene flow). One of the reasons is also that in breeding [12]. Close and away the kinship of all four variations of the swamp buffalo can be affected by several factors including internal factors are genetic factors and external factors that include environmental and lifestyle of the fourth variation of the swamp buffalo.

The phenotypic variation is influenced by genetic factors and environment. At the genetic level, these traits not only influenced by a gene locus but by many gene loci [13].

As an overview of the morphological characteristics of the four variants of the swamp buffalo in the area Pampangan, Figure 2, 3, 4, and 5 demonstrate this. Referring to the results of the study [14] stated that based on morphological characteristics of the fourth variant of Buffalo is known that the correlation coefficient ranged from 0.57 to 0.85. Stated [15] that the value of the correlation coefficient greater than 50% is an indication of similarity and indicates the individual is derived from the same species as the comparator. Genetic diversity may occur because of the genetic variation, both inter and inter species on a population [13]

4. Conclusion

Based on the results obtained can be concluded that the variant diversity of swamp buffalo is determined by differences in morphology based on the body color, eye color, as well as the direction and growth of the horn. The closest kinship relations defined between black buffalo and variants Lampung with a correlation coefficient of 0.85 and relationships found in the farthest red buffalo with a correlation coefficient 0.57.

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