Kinship of the swamp buffalo (bubalus bubalis) in Tanjung Senai, Ogan Ilir, South Sumatra based on morphological characteristics

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Abstract. Research conducted for observe phylogenetic relationship swamp buffalo (*Bubalus bubalis*) Ogan Ilir regency, South Sumatera based on morphological characteristic. The Sampling done by using a survey method and inventory in the field (on-farm) to obtain data of the characterization and swamp buffalo morphological. The result indicate that there are six variant, namely are BlackBuffalo, Lampung Buffalo, Red Buffalo, Dungkul Buffalo, Straight Buffalo, and Tunjang Langit Buffalo. Black Buffalo has black body colour and horns bent backwards. Lampung has black body colour and horns bent upwards. Red Buffalo has red body colour and horns bent upwards. Dungkul has black body colour and horns bent downwards. Straight has black body colour and horns bent straight to the side. Tunjang Langit Buffalo has black body colour and horns bent upwards and downwards.

1. Introdaction

Buffalo was farm animal whose distribution in almost all parts of Indonesia and ie was generally grouped into two types, namely swamp buffalo and river buffal [3]. Buffalo used as working livestock, milk producer, producer of organic fertilizer in agriculture, and meat producer which is complement or substitution of beef.

Buffalo is a ruminant animal that has its own advantages to be developed in various agro-ecosystems because it has good adaptability such as being able to survive with low quality feed, and a high level of resistance to diseases and parasites [4]. Buffalo in Indonesia, especially in South Sumatra is still maintained traditionally and is usually inherited from families that are hereditary. The cultivation of buffalo livestock still requires development. Especially in the Tanjung Senai area, which is traditionally known as a buffalo production area or center. Information regarding data on characteric appearance such as qualitative and quantitative traits, especially in the Tanjung Senai area, is expected to be useful to determine the policy of developing buffalo livestock.

Based on research conducted by [10] it was found in the Pampangan Buffalo variant in Banyuasin that the kinship relationships of the four variants of the Swamp Buffalo Buffangan were the closest to the Black Buffalo and Lampung Buffalo variants. Both variants have real similarities in hair color,

namely black, while Red Buffalo and Striped Buffalo are different. The same basic morphological characters of Black Buffalo and Lampung Buffalo are on hair color, skin color, and horn shape.

Development of buffalo cattle should be accompanied by improvements, one of which is to improve genetic quality in order to obtain superior buffaloes. Genetic quality improvement can be done by breeding, namely selection or crossing that is adapted to the current buffalo situation[6]. Then we need information about kinship relationships based on morphological characteristics and diversity of buffalo phenotypes, especially in the Tanjung Senai area. Morphology is the external appearance of living things as an expression of biological balance so that it can be used to determine the origin and kinship.

2. Materials and Methods

This research begins with a field survey beforehand to determine the location of observation, maintenance information, livestock cultivation from the research location community. This research was carried out quantitatively and qualitatively. Quantitatively it means that every member of the buffalo is measured. And qualitatively it means observing the characteristics possessed by buffalo variations that appear.

2.1. Data Retrieval Techniques

2.1.1. Preliminary Survey

The survey was conducted together with the owner of the farm, which is to find information related to maintenance, the number of livestock, methods of cultivation, gender, age, and the process of livestock marriage. The initial survey results obtained information that there are 6 variants of buffalo in the Tanjung Senai Region (Figure 1), namely Black Buffalo, Lampung Buffalo, Red Buffalo, Dungkul Buffalo, Straight Buffalo, and Buffaloes Supporting the Sky. Measurement of morphological characteristics further needs to be done to determine the classification of these variants.

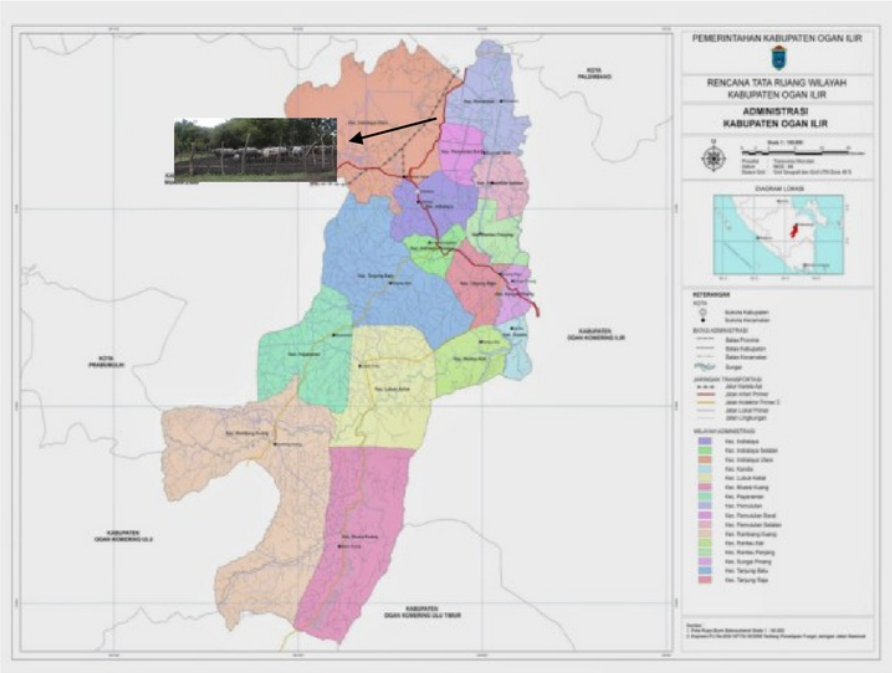

Figure 1. Map of Observation Locations of Tanjung Senai and Sejaro Sakti Hamlets, Ogan Ilir Regency, South Sumatra

2.1.2. Data collection

Data collection or sampling is done randomly. The total sample taken was 25 of the total population estimated at ± 200 buffaloes, where each buffalo variant was taken randomly to represent the population of buffalo variants in the Tanjung Senai region.

2.2. Observation Variable

2.2.1. Morphology and Characteristics of Swamp Buffalo

The buffalo body parts measured according to [6,10], namely shoulder height, hip height, body length, and chest circumference. Each variable is measured in cm. To find out the morphology of a buffalo variation can be done by measuring several variables from the buffalo body members and sketching the buffalo body for variable measurements (Figure 2). And characteristics observed such as horn shape, ear shape, nose shape, eye shape, and body shape.

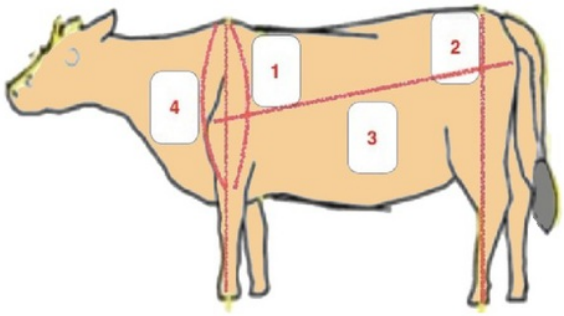

Figure 2. Morphological variables observed

2.2.2. Body parts measured include:

a. Shoulder height

Measured from the highest shoulder distance through the back of the scapula perpendicular to the ground measured using a measuring stick,

b. Hip Height

Measured from the highest distance of the hip perpendicular to the ground, measured using a measuring stick,

c. Body Length

Measured from the distance of a straight line from the edge of the bone Processus spinocus to a lump of plywood (Os ischium), measured by a measuring stick,

d. Chest size

Measured in a circle just behind the scapula using a measuring tape. Figure 2. Sketch of Swamp Buffalo Body (*Bubalus bubalis*) [10].

2.3. Data analyses

According [8] Body characteristics are calculated to determine the average, standard deviation, and coefficient of diversity :

$$\overline{X}\ i = \frac{\sum_{i=1}^{n} Xi\ x}{n}; s = \frac{\sqrt{\sum_{i}(\mathrm{xi} - \overline{x})^2}}{n-1}\ and\ KK = \frac{\mathrm{S}}{\overline{X}}(100\%)$$

Information :

x	: Average value
S	: Baku Deviation
KK	: Diversity Coefficient
xi	: Is the 1st Size of Properties x
n	: Number of Samples Obtained from Population

2.4. Interfaith Relationship between Swamp Buffalo

Observation of morphological characters was carried out descriptively covering several parts of the body. The characteristics of the research object according to [4,7] which is presented in the table, and attached to Table 1. The morphological characters are then given a score based on the results of observations made. Data obtained from the morphological characters of each buffalo analyzed by the cluster using a statistical program SPSS version 23.0 to know each genetic distance and presented in the form of dendrogram.

Table 1. Morphological Character of Swamp Buffalo Variants for Kinship Analysis

No		Character	Information
	Head		
1.	Horn	Color	0=black
		Base Texture	0=notched
		Edge Texture	0=flat
		Edge Shape	0=flat/blunt, 1=tapering
		Direction of Growth	0=straight, 1=backward, 2=upward, 3=downward, 4= upward and downward
		Accessories	0=nothing
		Color of Pangkal Tanduk	0=black
		Horn Tip Color	0=black
		Horn Pangkal Form	0=flat
		Horn Tip Form	0=tapering
	Ear	General form	0=Leaf
		Color	0=grayish black, 1=sorrel black, 2=red
		Acessoris	0=nothing
		Edge Shape	0=taper
	Nose	Color	0=black, 1=red
		Mustache Color	0=nothing
		Accessories	0=taper
	Eyeball	Sclera color	0=Black, 1= sorrel
		Sclera form	0=black
		Iris color	0=black
		Iris form	0=circular
		Pupil Color	0=black
		Pupil form	0= circular
	Eyelid	Color	0=black, 1=red
		Accessories	0=nothing
		Edge form	0=blunt
		Base form	0=taper
	Eyelashes	Color	0=white, 1=black
		Form	0= straight
	Eyebrow	Color	0=blck, 1=red
		Edge form	0=blunt
		Base Form	0=taper
		Accessories	0=nothing
		Accessories form	0=nothing
		Accessories color	0=nothing
2.	Neck	Color	0=hitam, 1=red
		Neck Necklace	0=nothing, 1=present
		Color of Neck Necklace	0=white, 1=black, 2=red
		Accessories	0=nothing
3.	Body	Color	0=black, 1=red

		Hair Growth Direction	0=top to bottom
		Form	0=elongated
		Navel hair	0=nothing
		Navel hair color	0=nothing
4.	Feet	Hair color	0=black, 1=red
		Shoe Color	0=black
		Hair Growth Direction	0=up and down
		Accessories	0=nothing
5.	Tail		
	Tail Body	Hair color	0=black, 1=red
		Accessories Hair Growth Direction	0=top to bottom
			0=nothing
	Whip Tail	Color	0=black, 1=red
		Texture	0=bumpy
		Edge Shape	0=tapering

3. Results and Discussions

3.1. Morphology of Swamp Buffalo

Morphological data are body measurements such as shoulder height, hip height, body length, and chest circumference. The data that has been obtained analyzed to get the mean, standard deviation, and coefficient of diversity. The measurement results can be seen in Table 2.

Table 2. Average value, standard deviation, and diversity coefficient of the six swamp buffalo variants in Tanjung Senai

No	Observation Variable	Swamp Buffalo Variations					
		Black n=16	Lampung n=4	[illegible] n=1	Dungkul n=2	Straight n=1	Tunjang Langit n=1
1.	Shoulder height	124,4±5,6 4,5%	117,7±5 4,3%	131	125±4,2 3,4%	120	125
2.	Hip Height	123,6±6,9 5,6%	117,7±2,5 2,1%	132	125,5±5 3,9%	121	123
3.	Body Length	112±19,3 17,3%	120±19 15,8%	100	124±1,4 1,1%	121	126
4.	Chest size	196,1±11,9 6%	196,5±12,7 6,5%	163,7	194,2±0,3 0,1%	190,7	199

3.2. Black Buffalo

Observed blackbuffalo obtained shoulder height 124.4 cm, hip height 117.7 cm, body length 112 cm, and chest circumference 196.1 cm, lower than the study [10] namely hip height 126.5 cm, body length 124.4 cm, but larger on the chest circumference that is 181 cm. In accordance with [7] the quantitative requirements for female buffalo seeds aged ≥ 36 months have a minimum shoulder height of 115 cm, a body length of 120 cm, and a chest circumference of 170 cm. Shoulder height, and black buffalo chest circumference has met the Indonesian National Standard [5] said that a population is still considered uniform if it has a coefficient of variation below 15% and is not effective if it is selected. Shoulder height, hip height, and chest circumference of black buffalo can be said to be uniform and not effective for selection.

3.3. Lampung Buffalo

Lampung buffalo observation results obtained shoulder height 117.7 cm, hip height 117.7 cm, body length 120 cm, and chest width 196.5 cm. In accordance with the [7] Quantitative requirements for female buffaloes aged ≥ 36 months have a minimum shoulder height of 115 cm, a body length of 120 cm, and a chest circumference of 170 cm. Shoulder height, body length and buffalo chest circumference have met the Indonesian National Standard. [5] said that a population is still considered uniform if it has a coefficient of variation below 15% and is not effective if it is selected. Shoulder height, hip height and buffalo chest circumference can be said to be uniform and ineffective for selection.

3.3.1. Red Buffalo

Red buffalo observation results obtained shoulder height 131 cm, hip height 132 cm, body length 100 cm, and chest circumference 163.7 cm, higher than the study [10] namely hip height 125 cm, but lower in body length 117.5 cm, and chest circumference is 183 cm. In accordance with the [7] Quantitative requirements for female buffaloes aged ≥ 36 months have a minimum shoulder height of 115 cm, a body length of 120 cm, and a chest circumference of 170 cm. The height of the red buffalo shoulder has met the Indonesian National Standard.

3.3.2. Dungkul Buffalo

Dungkul buffalo observation results obtained 125 cm shoulder height, 125.5 cm hip height, 124 cm body length, and chest circumference 194.2 cm, higher than the study [10] namely hip height 125 cm, body length 118 cm, but smaller on the chest circumference that is 176 cm. In accordance with the [7] Quantitative requirements for female buffaloes aged ≥ 36 months have a minimum shoulder height of 115 cm, a body length of 120 cm, and a chest circumference of 170 cm. Shoulder height, body length, and buffalo chest circumference dungkul meet Indonesian National Standards. [5] said that a population is still considered uniform if it has a coefficient of variation below 15% and is not effective if it is selected. Shoulder height, hip height, body length, and buffalo chest circumference can be said to be uniform and ineffective for selection.

3.3.3. Straight Buffalo

Blackbuffalo observation results obtained shoulder height 120 cm, hip height 121 cm, body length 121 cm, and chest circumference 190.7 cm. In accordance with the [5] Quantitative requirements for female buffaloes aged ≥ 36 months have a minimum shoulder height of 115 cm, a body length of 120 cm, and a chest circumference of 170 cm. Shoulder height, body length, and buffalo straight chest circumference have met the Indonesian National Standard.

3.3.4. Tunjang Langit buffalo

Black buffalo observation results obtained shoulder height 125 cm, hip height 123 cm, body length 126 cm, and chest circumference 199 cm. In accordance with the [7] Quantitative requirements for female buffaloes aged ≥ 36 months have a minimum shoulder height of 115 cm, a body length of 120 cm, and a chest circumference of 170 cm. Shoulder height, body length, and buffalo chest circumference supporting the sky have met the Indonesian National Standard.

From the data above it can be seen that each variant has a different body size. [9] states that the characteristics of body measurements can describe the characteristics of a nation. In addition to genetic and environmental differences in the form of climate differences, other things that can affect the characteristics of body measurements are the management of feeding and maintenance that differ between locations. Climate factors do not significantly affect this performance because it is still in one area. Differences in growth in body measurements are likely caused by differences.

The proportion of bones, muscles and fat in the body of the animal. [2] states that during growth and development, parts and components of the body undergo changes. Body tissues experience different growths and achieve maximum growth at different speeds.

3.3.5. Kinship Relations of Swamp Buffalo Variants

The genetic distance matrix results from cluster analysis using SPSS statistical program version 23.0 between each variant of swamp buffalo presented in Table 3. are used to make phenogram construction.

Table 3. Genetic Distance Matrix Between Swamp Buffalo

Swamp Buffalo Variant	Black	Lampung	Red	Dungkul	Straight	Tunjang Langit
Hitam	0.000					
Lampung	2,000	0,000				
Red	4,123	3,873	0,000			
Dungkul	2,499	1,414	3,606	0,000		
Straight	2,000	2,499	4,123	3,162	0,000	
Tunjang Langit	3,317	2,236	4,000	1,000	4,123	0,000

Determination of genetic distance based on the characteristics of the qualitative phenotype showed that the smallest distance was found between the variants of the Tunjang Langit Buffalo and Dungkul buffalo which were 1,000, followed by the Dungkul Buffalo and Lampung variants of 1,414. The farthest genetic distance was found between the Red and Black Buffalo variants at 4,123, 4,123 Straight and Red Buffalo variants, and 4,123 variants of the Tunjang Langit and Straight Buffaloes.

The results of the dendogram below can be seen from the characteristics of the qualitative phenotype indicating that the Dungkul buffalo variant has a closer relationship with the buffalo supporting the sky. Then the Dungkul Buffalo variant is closer to the Lampung Buffalo derivative. The kinship relationship is the furthest between the Red Buffalo variant and the Black Buffalo variant, then the Straight Buffalo variant with the Red Buffalo variant, and the Buffalo Supporting the Sky variant with the Straight Buffalo variant.

From the dendrogram above it can be seen that there are 3 clusters, where the Dungkul, Tunjang Langit, and Lampung variants are included in the same cluster. Then the Black and Straight Buffalo variants are the same cluster, and the next cluster is only the Red Buffalo variant.

For the first cluster has the same character in the shape of the horn tip, nose color, eye color, eyelash color, eyebrow color, neck necklace color, bada color, and tail hair color. Then for the second part of the cluster has the same character on the color of the ear, nose color, eye color, eyelash color, body color, and tail hair color. For example, the shape of horns on Dungkul Buffalo, Buffalo Supporting Sky, and Lampung despite the different direction of horn growth, but morphologically it looks more similar to each other.

If productivity improvements (out breeding) will be carried out, it is advisable to marry buffaloes with different clusters and have a considerable genetic distance. [6] The goal is to marry cattle that have far genetic kinship, it is estimated that heterosis effects will be greater than that between cattle with close kinship or in the same cluster.

4. Conclusion

Based on the research that has been done, the following conclusions are obtained: (1). It is known that there are 6 variants of swamp buffalo in the Tanjung Senai region, namely Black, Lampung, Red, Dungkul, Straight, dan Tunjang Langit buffaloes. (2). Among the swamp buffalo variants Dungkul buffalo and Tunjang Langit buffalo have the closest kinship because og its small genetic distance.

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