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Phenotypic Variation of Ongole Grade Cattle at Forestry Land in Tuban Regency East Java Indonesia

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***Abstract*—** *Phenotype is the physical characteristics of an animal expressed according to the genetic material it received from both its parents at the point of conception. It is an animal's ; chest girth, body length, body height, hip height, hip width, head length, width head, horn and coat color. In order to support this purpose, phenotypic characterization of 295 Ongole grade cattle (1-6 years old) in Jatirogo, Palang, villages, Tuban regency and Technical Implementation Unit of Ongole Grade was done, where they are one of area village breeding center for Ongole Grade cattle in Indonesia.*

***Keywords*—** *Phenotypic variation, Ongole cattle, village breeding center, genetic distance.*

I. INTRODUCTION

Tuban, East Java Indonesia is one of cattle genetic resources (special of Ongole grade cattle) has adapted to and distributed in different agro-ecological zones dominance by teak forestry. As the result, cattle production is the one of the main components of agricultural activities in all parts of this place. For smallholder farmers, cattle play multiple roles as source of food, income and serve as an asset and security against risks (Terefe et al., 2012) and Indonesian farmers, in common with smallholders in developing countries, keep cattle not only for meat production, but also for financial security, draught power, manure for cropping and social status (Widi, 2004). Multi-function of cattle genetic resources in the country is identified through production system and breed characterization studies in their natural production environment (FAO, 2012). Accordingly, these genetic resources must be conserved. Several regulations and measures have been put in place to prevent endangered livestock and wildlife to become extinct.

The loss of indigenous livestock breeds means a loss of well-adapted animals to local environments and production conditions at a time where the production systems are facing the challenge of climate changes and where sustainability is increasingly becoming an important characteristic of all livestock production systems. The Ongole Grade cattle are well-adapted to local environment of dry areas and they are thought to be resistant to tropical diseases (Godfrey, 2010). Until now the population size of these cattle population has been poorly documented. It is had been reported that the numbers of the indigenous cattle reared in traditional systems have increased from 15,419,720 head in the year 2015 to 16.092,560 head in 2016 (Dirjen Peternakan, 2017).

Ongole grade cattle is one of Indonesian local breeds cattle. The existence of the ongole grade cattle in Indonesia began since the Ongole cattle was imported from India in 1914 (Ministry of Agriculture of the Republic of Indonesia, 2014) and placed in Sumbawa and then to immigrated on Java island and well adapted in Indonesian climate, became local breeds Indonesia. According Breeds of Livestock: Department of Animal Science (2001) the Ongoles are large-sized animals with, large dewlaps which are fleshy and hang in folds extending to the navel flap, and slightly pendulous sheaths, the gray-white cattle, having white or gray color, stumpy horns and a long coffin-shaped skull. They have long bodies and short necks; limbs are long and muscular. The forehead is broad between the eyes and slightly prominent. Eyes are elliptical in shape with black eyelashes and a ring of black skin about 1/4 to 1/2 inch wide around the eyes. Ears are moderately long, measuring on an average for 9 to 12 inches, and slightly drooping. Horns are short and stumpy, growing outwards and backwards, thick at the base and firm without cracks. The Ongoles are very fine and majestic-looking cattle, huge in size, extremely docile and suitable for steady, heavy draught. Their performance has been admirable under varying conditions and they are one of the most unique triple-purpose cattle of the tropics, serving well as draught, milk and meat animals. By virtue of their adaptability traits and superior productive capacity under harsh tropical conditions, they have been very much sought after and beneficial in tropical cattle production (Narendra Nath, 2006).

The high intensity of local cattle are crossing with the excotics breed (e.g. Simmental, Brahman and Limousin) five years ago has affected the emergence of phenotypic character differences between cattle from crossbreed and purebred ongole grade cattle as reported by Sudrajad and Subhiharta (2014). On the other hand, Ongole grade cattle are germplasm (resources genetic) of East Java and must be conversed and preserved existence. The first step in maintaining the superiority of a cow is to identify the specific character possessed by the female cow. Characterization is important because so far Ongole grade cattle in Tuban has done a lot of crossing with exotic cows. Female cattle are also a priority in the implementation of breeding and rescue of cattle that are still productive. According to Forabosco et al. (2004) with the characterization can be known the nature of quantitative and qualitative as the character of the cow clumps of economic value-associated with productivity. Quantitative nature is characterized by various body sizes, whereas qualitative properties are a feature that can be directly known visually such as the color of body parts and shape of the horn without measurement. These properties are referred to as phenotypes,

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traits arising from genetic, environmental, and genetic interactions with those environments.

The success of the breeding program can be affected by several factors, including determining the number of the initial (base) population in order to produce offspring consistent with the objectives of the breeding program. Recently, local farmers and the local Government of East Java have been facing difficulties in determining the initial (base) population for the breeding program of the Ongole grade cattle. This problem can be caused by several factors including insufficiency of genetic information about the present status of the Ongole grade cattle, the lack of studies about genetic diversity in Ongole grade cattle, and also the distribution of this cattle in east java.

This research is very important to know ongole grade because Tuban is one of the centers of ongole grade cattle breeding resources in Indonesia but the purity of the cattle still needs to be studied. Smallholder farmers in Tuban mostly rearing of their cattle in teak forests where there are various types of cattle that can cause inbreeding, and this crossed can cause phenotypic variations and differences in offspring. Therefore, the phenotypic differences of ongole grade cattle population in Tuban area can be used as the first benchmark to determine ongole grade cattle germplasm. The objective of this study was to assess and to document the current situation, phenotypic diversity of ongole grade cattle in Tuban regency and how is the genetic distance from some region.

II. Materials and Methods

A. Study Area

The study was conducted in Tuban east Java Indonesia. Location of astronomy of Tuban Regency at coordinate 111^o 30 '- 112^o 35' E longitude and 6^o 40' - 7^o 18 'S longitude. Long coastal area 65 km. The height of land in Tuban Regency ranges from 0 - 500 mdpl. Most areas of Tuban regency are dry climates with conditions ranging from slightly dry to very dry. The study areas differ in topography are forestry land (Jatirogo and Palang village) and and Technical Implementation Unit of Ongole Grade Cattle. Figure 1 is map of Tuban regency.

Figure 1. Geographical distribution of the Ongole grade in Tuban Regency

B. Sampling and Data Collection

A stratified random sampling survey was used to search for the presence of Ongole grade cattle population phenotypically distinct and/or representing different ecotypes. The survey was conducted in the three villages in Tuban (Figure 1).

Two hundred twenty animals (28 males and 173 females) were selected. The phenotype characteristics such as shoulder width, chest girth, chest depth, body length, body height, hip height, hip width, head length, horn and coat color, etc. The linear body measurements were taken for mature cows and bulls when the standing naturally with head raised and weight on all four feet. Body length was measured from the point of the shoulder to the pin bone, height at withers from the ground level to the highest point of withers, head length from poll to nose, head width for distance between the temples, hump height from the base of the hump to its highest point and tail length from the base of the tail to its tip. Colour of coat was recorded visually (Figure 2.)

C. Data Analysis

Genetic Distance. The phenotype characteristics data can be used to estimate genetic distance using analysis discriminant through the Mahalanobis distance approach as described in Nei (1987). For the purposes of determining the genetic distance, correction of age category (24-48 months) and sex (male). Statistical analysis to estimate the distance Mahalanobis done with SAS program ver. 9.1.3 (PROC CANDISC and PROC DISCRIM). The Mahalanobis distance data matrix obtained is then used to create phenogram with the help of the MEGA ver program. 5.2.

III. Result

Efforts to characterize Ongole Grade cattle between sub populations then discriminant analysis of body size data, then canonical correlation analysis is performed to determine body measurements that cause differences in sub population The results of discriminant analysis using the mahalonobis distance method are presented in the table I and table II.

TABLE I. The canonic score of PO cattle in Tuban Regency

Variable	Score1	Score 2
Chest depth	0.0309	-0.1156
Head index	-47.636	11.564
head width	-0.3556	14.923
heart girth	0.0606	-0.0068
shoulder point width	-0.0236	0.0712
hip width	0.0039	0.0005
Length head	0.0635	-0.5447
Length tail	-0.0745	-0.0207
Permanent incisor	-0.0436	0.1458
Withers height	0.0957	-0.0693
Hip height	-0.0691	0.0213

TABLE II. The Mahalanobis distance matrix of Ongole Grade cattle

Location	Jatirogo	Palang	UPTD Tuban
Jatirogo	0.000	2.381	5.948
Palang	2.381	0.000	2.219
UPTD Tuban	5.948	2.219	0.000

The result showed that the highest score to lowest score in the first canonic were withers height (0.0957), length head (0.0635), heart girth (0.0606), chest depth (0.0309) and hip width (0.0039) respectively. In the second canonic, the highest score to lowest score were head width (14,923), head index

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(11.564), permanent incisor (0.1458), shoulder point width (0.0712), hip height (0.0213) and hip width (0.0005) respectively. The mahalanobis distance of the Jatirogo-Palang and Jatirogo- Technical Implementation Unit of Ongole Grade Cattle Tuban were 2,381 and 5.948, respectively. According to the Matrix genetic distance using UPGMA parameter, Ongole Grade cattle in Palang had closely relationship with Ongole Grade cattle in Technical Implementation Unit of Ongole Grade Cattle Tuban than Jatirogo.

IV. DISCUSSION

The Ongole grade cattle in Palang has a closely relationship with Ongole grade cattle in Technical Implementation Unit of Ongole Grade Cattle Cattle breeds have developed in different ways depending on regional climates, nutritional conditions and selection for different purposes. The mean phenotypic characteristic to be larger than the standard Ongole Grade cattles in National Standard Performance of Indonesia 7651.5: 2015. The phenotype characteristics such as body height chest girth, body length, shoulder width chest depth, hip height, hip width presented in Table III.

TABLE III. Phenotypic characteristic of Ongole grade cows in Tuban

Parameter	Age	Palang				UPTD Tuban				Jatirogo			
		Male		Female		Male		Female		Male		Female	
		Average±sd	N	Average±sd	N	Average±sd	n	Average±sd	n	Average±sd	n	Average±sd	N
Body Height (cm)	PIO	-		117.83±14.75		-		117.83±14.75	3			112.87±10.80	5
	PI2	127.57±9.79	7	122.87±8.87	5	111.10±8.24	5	122.87±8.87	8	120.91±5.21	12	117.95±5.47	13
	PI4	136.50±2.10	2	127.34±6.11	16	-		127.12±3.75	4	130.00±0	3	124.00±6.37	18
	PI6	137.00±6.55	3	129.50±7,36	26	137.00±6.55	3	129.50±7.36	3	134.00±13	3	124.09±6.28	23
	PI8	-	-	130.00±7.01	36	-	-	-	-	154.5±4.94	2	122.45±6.66	41
Chest Grith (cm)	PIO	-	-	139.00±16.82		-	-	139.00±16.82	3	-	-	130.00±13.83	5
	PI2	146.57±1.95	7	152.12±12.57		129.80±7.25	5	152.12±12.57	8	141.91±7.22	12	136.05±8.93	13
	PI4	164.50±0.70	2	180.61±8.02	16	-	-	154.75±4.99	4	146.66±5.50	3	146.38±11.45	18
	PI6	197.33±8.62	3	169.00±4.58	26	197.33±8.62	3	169.00±4.58	3	173.33±21.38	3	150.77±9.33	23
	PI8	-	-	159.72±7.42	36	-	-	-	-	208.00±4.24	2	152.32±12.46	41
Body Length (cm)	PIO	-	-	117.00 ±19.05	-	-	-	117.00±19.05	3	-	-	110.25±19.88	5
	PI2	133.00±13.31	7	123.31±10.60		106.80±10.08	5	123.31±10.60	8	122.58±7.32	12	120.70±10.81	13
	PI4	145.75± 9.54	2	137.28±14.05	16		-	125.87±6.38	4	132.00± 5.19	3	130.69±12.36	18
	PI6	156.50±12.61	3	134.16±7.28	26	156.50±12.61	3	134.16±7.28	3	150.00±13.00	3	128.36±8.82	23
	PI8	-	-	141.25±8.82	36	-	-	-	-	167.00±4.24	2	128.89±6.37	41
Shoulder width (cm)	PIO	-		31.33±4.93		-	-	31.33±4.93	3	-	-	40.50±19.33	5
	PI2	35.85±1.57	7	33.31±3.39		28.80±1.48	5	33.31±3.39	8	31.33±2.50	12	31.79±2.24	13
	PI4	35.50±0.70	2	35.25±3.80	16	-	-	35.75±1.25	4	32.00±1.00	3	34.05±4.54	18
	PI6	48.00±4.58	3	41.83±2.75	26	48.00±4.58	3	41.83±2.75	3	42.00±4.35	3	34.56±6.72	23
	PI8	-	-	36.40±3.13	36	-	-	-	-	52.50±0.70	2	33.85±4.76	41
Chest Depth (cm)	PIO	-	-	58.00±9.16	-	-	-	58.00±9.16	3	-	-	50.87±7.07	5
	PI2	63.71±3.14	7	61.37±6.02	-	51.20±0.83	5	61.37±6.02	8	60.91±4.10	12	61.03±5.34	13
	PI4	67.04±2.82	2	61.00±2.82	16	-		61.00±2.82	4	62.00±6.08	3	60.72±3.86	18
	PI6	73.66±3.51	3	68.83±2.46	26	73.66±3.51	3	68.83±2.46	3	55.66±11.67	3	59.80±5.74	23
	PI8	-		66.85±5.47	36	-		-	-	68.00±4.24	2	61.08±5.27	41
Hip Heigth (cm)	PIO			120,33±14,36				120,33±14,36	3			121,5±13	5
	PI2	130±12,11	7	127,87±9,64		113,6±8,29	5	127,8±9,64	8	125,58±6,73	12	126,03±5,68	13
	PI4	139,5±0,70	2	131,5±6,93	16			130,5±3,87	4	134,33±2,51	3	129,3±6,97	18
	PI6	138,83±8,40	3	133,3±1,52	26	138,83±8,40	3	133,33±1,52	3	143±17,08	3	129,21±6,33	23
	PI8			133,22±6,00	36					161±0,70	2	127,65±6,34	41
Hip Width (cm)	PIO			35,33±4,16				35,33±4,16	3			34,25±5,18	5
	PI2	41,57±3,50	7	37,31±3,43	20	33,4±2,96	5	37,31±3,43	8	35,25±2,41	12	36,23±3,05	13
	PI4	39,5±4,94	2	41±3,42	16			43,37±1,70	4	38±3,60	3	40,22±4,31	18
	PI6	51,66±1,52	3	44,66±0,7	26	51,66±1,52	3	44,66±0,57	3	52±5,29	3	41,71±4,76	23
	PI8			42,72±3,17	36					54,5±0,70	2	42,62±3,52	41

Coat color patterns are very important to identify because coat color is also used in differentiating cattle. The diversity of cow coat color patterns can be seen in figure 2.

According to the nation, the dominant coat color in Ongole grade Tuban cattle is white to gray. The white color in female cows is more dominant, while the grayish color more often appears around the head, neck, shoulder, dewlap, knee, and tail on the Ongole grade cattle Tuban. According to Madhusudhana, (2013) white colors affect the cow's resistance to heat and solar radiation. That's because white color absorbs only a small amount of heat and more reflects it to the environment.

According to the table in the first canonic with the high score to low score are withers height (0.0957), length head (0.0635), heart girth (0.0606), chest depth (0.0309) and hip width (0.0039). at the second canonic high score to low score are head index (11.0564), head width (1,4923) permanent incisor (0.1458), shoulder point width (0.0712), hip height (0.0213) and hip width (0.0005). The head index result highest than the other variable and suggest that this variables to be a strong characteristic to distinguish the ongole grade cattle. The

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canonical correlation value in one variable identifies the strength of the role of the variable as a differentiator between sub-populations, low of variable value suggest that this variable have a low corelation with to distinguish this cattle.

Figure 2. Phenotypic characteristic of Ongole grade in Tuban; A. black muzzle; B. medium crest; C. long horn & coat color white to gray; D. red & black vulva

The mahalanobis distance of ongle grade cattle in Tuban regency showed that the Jatirogo with palang (2,381), Jatirogo with Technical Implementation Unit of Ongole Grade Cattle Tuban (5.948).

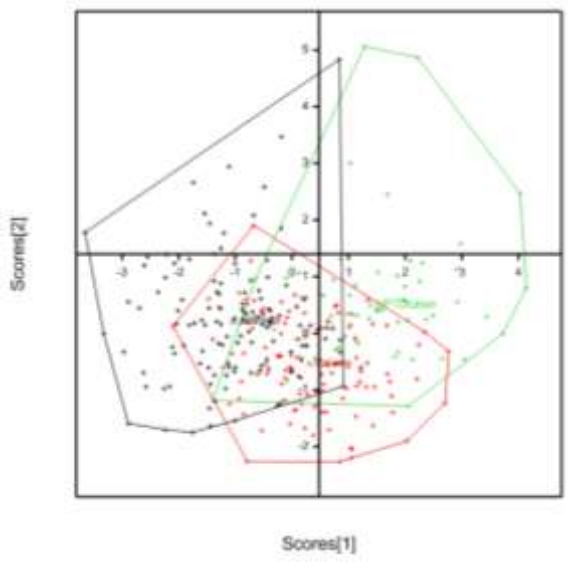

Figure 3. Matrix of mahalanobis distance of PO cattle in Tuban Regency

According to the mahalanobis distance showed that Matrix genetic distance using UPGMA parameter Ongole Grade cattle in Palang closely relationship with Ongole Grade cattle in Technical Implementation Unit of Ongole Grade Cattle Tuban than Jatirogo. The trees are unrooted, is not possible to deduce the phylogeny (Figure 4).

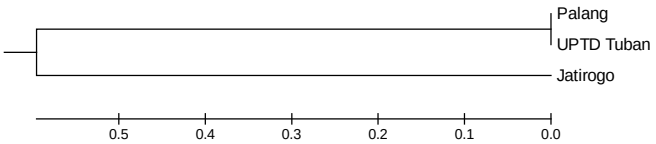

Figure 4. The phylogenetic tree of PO cattle in Tuban Regency

Therefore, the trees are used as a descriptive tool in this paper, not for evaluating the time of separation, which is not important as the populations divided recently. Ongole Grade cattle in Technical Implementation Unit of Ongole Grade Cattle and Palang have a similar morphological parameter. This result suggest that Ongole Grade cattle in Palang and Technical Implementation Unit of Ongole Grade Cattle from similar ancestor. Ongole grade cattle in Jatirogo more different than palang and Technical Implementation Unit of Ongole Grade Cattle in morphology parameter because the cattle were farm on Tuban forestry. At Tuban forestry not only the Ongole Grade cattle but also the other cattle strain such us limosin. In evolution, the segregation of species is presumed, so that selection, mutation and drift cause further differentiation, while in breed making, crossing occurs very often. Thus, clustering and potential differences from expectations are to be evaluated in connection with the development of breeds and all the circumstances influencing their relationships.

V. CONCLUSION

The Ongole grade cattle in Palang has a closely relationship with Ongole grade cattle in Technical Implementation Unit of Ongole Grade Cattle Tuban according to Mahalanobis distance. The Ongole grade catlle in Jatirogo has a different relationship with the Ongole grade catle in Palang and Technical Implementation Unit of Ongole Grade Cattle Tuban. The Ongole Grade cattle in Technical Implementation Unit of Ongole Grade Cattle and Palang have similar morphological parameters.

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