BIODIVERSITAS
Volume 18, Number 4, October 2017
Pages: 1638-1645

ISSN: 1412-033X
E-ISSN: 2085-4722
DOI: 10.13057/biodiv/d180444

Phenotypic, morphometric characterization and population structure of Pasundan cattle at West Java, Indonesia

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Manuscript received: 26 August 2017. Revision accepted: 21 October 2017.

Abstract. *Said S, Putra WPB, Anwar S, Agung PP, Yuhani H. 2017. Phenotypic, morphometric characterization and population structure of Pasundan cattle at West Java, Indonesia. Biodiversitas 18: 1638-1645.* Identification of phenotypic and morphometric characteristics in indigenous cattle is important in characterizing breeds of animals. This study was carried out to identify the phenotypic and morphometric characteristics of 813 indigenous Pasundan cattle from West Java Province of Indonesia. The coat color of Pasundan cattle is mainly solid reddish brown (>90%) with black color on hoof (>90%), switch of tail (>80%), eyelid (>90%), muzzle (>90%), horn (>90%) and whitish color on mouth lash (>80%) and reddish brown color on legs (>60%) and rump patch (>60%). The physical characteristic of Pasundan cattle mainly is the hump in males (65.23%) or humpless in female (74.91%), small dewlap size (>60%), presence of back line (>60%) and horned (>80%) with upper curved horn (>90%). The average of withers height (WH), body length (BL), chest girth (CG) and scrotal circumference (SC) of adult male Pasundan cattle were 128.94+16.69 cm; 128.72+15.98 cm; 159.36+15.84 cm and 17.68+3.51cm respectively. Therefore, the average of WH, BL, and CG of adult female Pasundan cattle was 122.56+11.40 cm; 115.63+19.06 cm and 140.13+12.16 cm respectively. Natural Increase (NI) and calf crop values were 18.46% (low category) and 20.40% respectively. Net Replacement Rate (NRR) values were 300% (male) and 507% (female) and indicated that West Java province was still capable to produce seed stock per year.

Keywords: Body measurement, Indonesian indigenous cattle, physical characteristics

INTRODUCTION

Pasundan cattle are one of Indonesian indigenous cattle which are well adapted to some regions of West Java province. The cattle were originally came from crossbreeding between *Bos javanicus* (Bali cattle) and *Bos indicus* (Ongole and Madura cattle) established in 1904 (Hardjosubroto, 1994) and were declared as an indigenous Indonesian cattle based on Ministerial Decree no. 1051/Kpts/SR.120/10/2014 (Ministry of Agriculture of the Republic of Indonesia, 2014).

The reproductive traits of Pasundan cows for first calving is at 30-40 months, sex maturity at (25-30 months), gestation length (8.5-10.0 months), first estrus (18-24 months), estrus periods (18-24 days) and calving interval (1.1-1.3 years). The slaughter weight, hot carcass and dressing percentage of Pasundan bull weights are 240.40 kg, 127.20 kg and 53.02%, respectively (Department of Animal Husbandry, 2013). The carcass traits of Pasundan cattle such as water holding capacity (23-30%), cooking loss (25-45%), tenderness (35-96 mm/10s/g) as reported by Department of Animal Husbandry (2013). Despite their well-known quality and adaptive capacity to harsh environment, this breed remains unrecorded making *in situ* conservation action and breeding program difficult. Due to its vital role in future, conservation program and breeding program for Pasundan cattle have recently been initiated by the Indonesian government. However such programs for the conservation and breeding of Pasundan cattle remain ineffective due to lack of scientific information on phenotypic and morphometric characteristics. As an indigenous crossbred cattle, the phenotypic and morphometric characteristics of Pasundan cattle are varied and need to be described.

There are few studies on morphometric characteristic in Pasundan cattle with a large number of animals. Morphometric characterization of Pasundan cattle has been reported by Nugraha et al. (2016) and Akbar et al. (2016).

The base line data will provide crucial information for establishment the standard breeds of Pasundan cattle. Furthermore, analysis of population structure in Pasundan cattle is important to identify the capability of some breeding tracts for supply a livestock. The present study was carried out to investigate the phenotypic and morphometric characteristics of Pasundan cattle and also population structure analysis to identify the potency of West Java province as breeding center of Pasundan cattle.

MATERIALS AND METHODS

Study area

The present study was carried out from June until December 2016 at four regencies of West Java Province, Indonesia, Ciamis, Majalengka, Tasikmalaya, and Pangandaran (Figure 1). The West Java province is situated

at latitude 50°54' to 70°45'S and longitude 106°022' to 108°050'E. The humidity 65% to 90% with temperature 16°C to 28°C and rainfall 2000 - 5000 mm/year.

Procedures

A total of 813 animals consisting of 256 males and 557 females were used in this study. Data of animals consisted of age, qualitative traits, and body measurements. Identification of age was carried out based on a number of pairs of permanent incisors (PPI). Qualitative traits data were physical coloration (including coat, hoof, switch of tail, eyelid, mouth lash, muzzle, horn, legs, and rump patch color), presence of hump, dewlap size, strip along backbone, presence of horns and horn tips orientation. A measuring tape and vernier caliper were used for measuring animals. The body measurements consisted of withers height (WH: taken from the ground level to the highest point of withers), body length (BL: taken from the point of the shoulder to the pin bone), chest girth (CG: the circumference around the chest at the fourth rib) and scrotal circumference (SC: the circumference around the scrotum) especially for male animals. The chest girth of pregnant's animals was not included for analysis.

Population structure was calculated and analyzed according to Samberi et al. (2010), as follows:

$$\text{Number of adult cattle (\%)} = \frac{\text{Number of adult cattle}}{\text{Number of population}} \times 100\%$$

$$\text{Calving rate based on female adult female cattle or calf crop (\%)} = \frac{\text{Number of calves}}{\text{Number of adult female cattle}} \times 100\%$$

$$\text{Calving rate based on population (\%)} = \frac{\text{Number of calves}}{\text{Number of population}} \times 100\%$$

$$\text{Mortality (\%)} = \frac{\text{Number of death cattle}}{\text{Number of population}} \times 100\%$$

Natural increase (%) = Calving rate based on population (%) - Mortality (%)

$$\text{Number of young cattle (\%)} = \frac{\text{Number of young cattle}}{\text{Number of population}} \times 100\%$$

Requirement of cattle replacement (%) = Number of adult cattle (%) / Breeding length (years)

Remains of young cattle (%) = Percent of young cattle (%) - Requirement of cattle replacement (%)

Number of culled cattle (%) = Requirement of cattle replacement (%)

Output (%) = Number of culled cattle (%) + Remains of young cattle (%)

$$\text{Net Replacement Rate (\%)} = \frac{\text{Number of young cattle (heads)}}{\text{Remains of young cattle (heads)}} \times 100\%$$

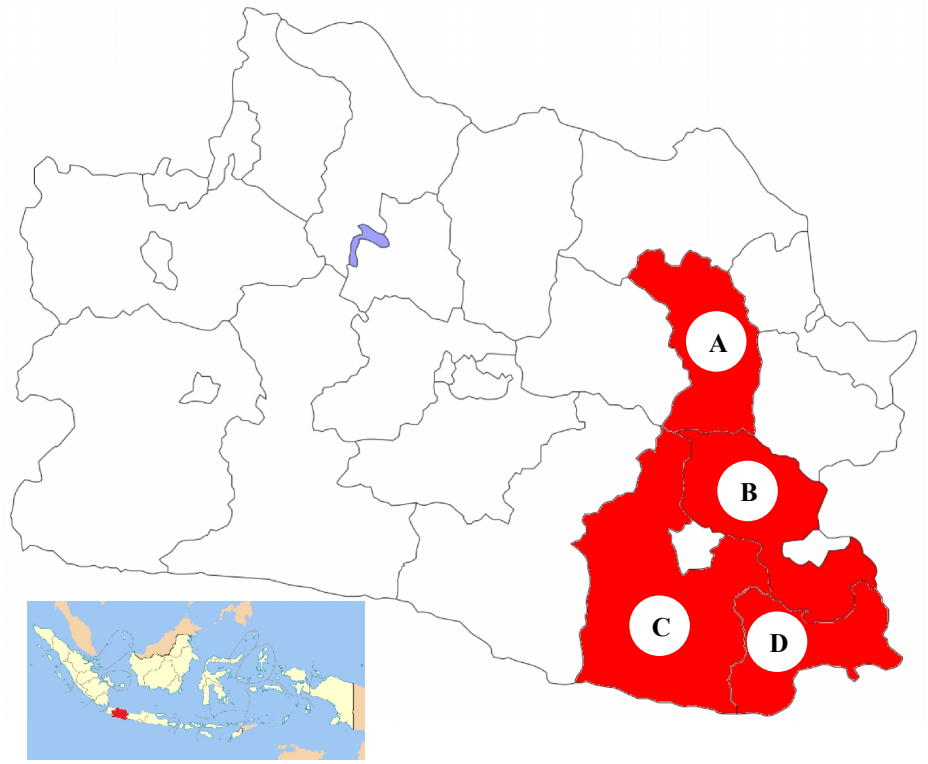

Figure 1. Location of the research site at four regencies at West Java Province, Indonesia consisted of: A. Majalengka, B. Ciamis, C. Tasikmalaya, and D. Pangandaran

Data analysis

Data were analyzed using Microsoft Office Excel 2007 computer program to obtain mean, standard deviation, coefficient of variation, minimum/maximum value and data percentage. All data were analyzed separately for male and female to avoid bias doe to sex effect. The NI value consisted of three categories such as low (NI<50%), moderate (51%<NI<80%) and high (NI>50%) as reported by Samberi et al. (2010).

RESULTS AND DISCUSSION

Colour characteristics

The color characteristics of Pasundan cattle are shown in Table 1. The dominant (more than 95%) coat color of Pasundan cattle found both in males and females to be solid reddish brown. The most common color of hoof, switch of tail, eyelid, horn, and muzzle both in males and females was found to be black. Whereas the whitish color was found on mouth lash, legs (stocking) and rump patch. The percentage of whitish color on legs and rump patch for male Pasundan was about 60%, lower than female Pasundan, more than 90%. (Figures 2 to 4).

Table 1. Proportion of color characteristics in Pasundan cattle

Variable	Colour	%	
		Male	Female
Coat	Solid reddish brown	95.31	96.59
	Black	4.69	1.97
	White	0.00	1.44
Hoof	Black	91.80	97.31
	Gray	8.20	2.69
Switch of tail	Black	85.94	92.80
	Reddish brown	11.33	5.22
	White	2.73	1.98
Eyelid	Black	91.37	95.51
	Reddish	8.63	4.49
Mouth lash	Whitish	85.94	80.25
	Reddish brown	14.06	19.75
Muzzle	Black	94.14	98.20
	White	3.91	0.90
	Spotted black-white	1.95	0.90
Horn	Black	95.20	90.28
	White	4.80	9.72
Legs (stocking)	Light brown	68.36	90.84
	Whitish	29.30	8.62
	Black	2.34	0.54
Rump patch	Light brown	67.19	92.10
	Whitish	30.08	7.90
	Black	2.73	0.00

Note: N = Number of observation

Based on phenotypic appearance, the coloration of Pasundan cattle was similar to some *Bos indicus* breeds such as Ponwar, Bachaur Dhesi (Gaur et al. 2003; Sarkar et al. 2007; Chandran et al. 2014) and Bali cattle (*Bos javanicus*). Panchung and Roden (1996) reported that the coat color of Siri cattle (*Bos indicus*) was black (69%), red (14%), spotted black-white (12%) and black colors (100%) on eyelids and muzzle.

The solid reddish brown coat color was the major color in several found in Indonesian local cattle such as Aceh (*Bos indicus*), Katingan (*Bos indicus* x *Bos javanicus*), Madura (*Bos indicus*) breeds and Pesisir breeds (Abdullah et al. 2007; Hartatik et al. 2009; Utomo et al. 2012; Hendri 2013). Two color types of hoof (black and gray) were found in Katingan cattle (Utomo et al. 2012) , similar to Pasundan cattle. Hartatik et al. (2009) reported that the black colour in Madura cows were found on muzzle (96.61%), absence of back line (77.97%), black color on hoof (100%) and reddish color on legs (50.85%) and whitish color on rump patch (91.53%).

Most of coat colors in non-descript cattle in some region of India were white with dominant black color on muzzle, eyelid, and hoof (Khirari et al. 2014; Biswas et al. 2015). Kayastha et al. (2011) reported that the coat colors of local cattle of Assam, India were brown (31.18%), white (28.53%), fawn/light grayish (15.29%), gray (13.53%), black (4.41%) and mixed (7.06%). The majority, the black colors in local cattle of Assam were found on muzzle (86.47%), switch of tail (90.88%), hoof (84.71%), horn (100%) and similar to Pasundan cattle. The coat color of local cow at Chhattisgarh Plains (India) according to Dahariya (2011) were red (60.80%), white (33.00%) and black (6.20%). Therefore, the major black color (88.70%) characteristics were found on muzzle and switch of tail in local cow at Chhattisgarh Plains and similar to Pasundan cattle. However, there is no information for their genetic distance. It may that the black color on horn, eyelids, hoof, muzzle, horn and tail switch in Pasundan originated from *Bos indicus* (Madura or Ongole). The coat color of solid reddish brown that found in the Pasundan cattle was derived from Madura or Bali cattle. The light brown colors on legs and rump patch in the Pasundan cattle were derived from Bali cattle or Madura (Indrijani et al., 2012).

Physical characteristics

The physical characteristics of Pasundan cattle are shown in Table 2. The characterization is given separately for males and females. The majority, the humped animal were found in male (65.23%), and humpless animal was found in female (74.91%). The dewlap size in Pasundan cattle was small in male (62.89%) and female (91.56%) with horned status (>80%) of both sexes. Commonly, the back line was observed in male (60.55%) and female (81.96%). Most of Pasundan cattle were horned (>80%) with horn tips orientation of upper curved/stumpy (>90%). The major physical characteristics of back line and horn tips orientation are shown in Figure 5.

Figure 2. The major coat color (solid reddish brown) of Pasundan bull (A) and cow (B)

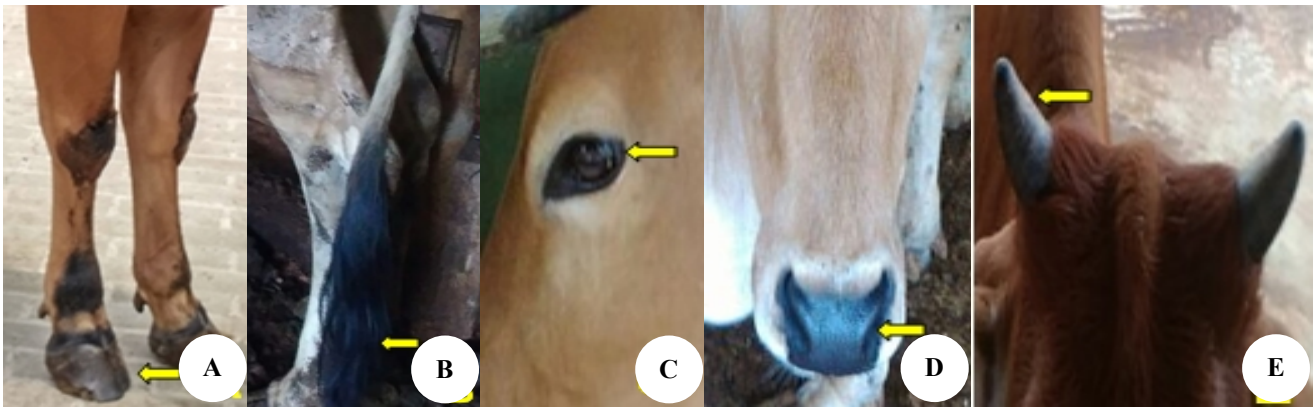

Figure 3. The major black colors of Pasundan cattle were found on hoof (A), switch of tail (B), eyelid (C), muzzle (D) and horn (E)

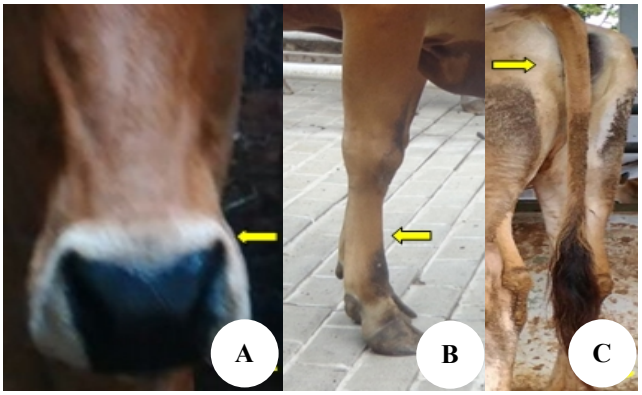

Figure 4. The major colors characteristics on several body parts of Pasundan cattle such as: whitish color on mouth lash (A); light brown color on legs (B) and rump patch (C)

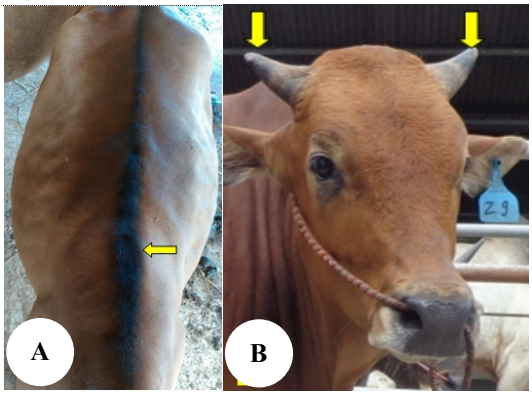

Figure 5. The major physical characteristics of back line (A) and stumpy horn (B) of Pasundan cattle

Table 2. Frequencies (%) of each level of the five physical characteristics assessed in Pasundan cattle

Variable	Characteristics	Percent (%)	
		Male	Female
Hump	Humpless	34.77	74.91
	Humped	65.23	25.09
Dewlap size	Small	62.89	91.56
	Large	37.11	8.44
Backline	Presence	60.55	81.96
	Absence	39.45	18.04
Horn status	Horned	87.11	87.07
	Hornless	12.89	12.93
Horn tips orientation	Upper curved (stumpy)	93.73	93.44
	Forward curved	4.71	0.36
	Downward curved	1.56	6.20

Note: N = Number of observation

In this study, the stumpy horn in Pasundan cattle is similar to many Indonesian indigenous cattle breeds such as Aceh (20%), Ongole grade (32.30%) and Madura (69.49%) (Abdullah et al. 2007; Hartatik et al. 2009; Sudrajad et al. 2011). Therefore, the horn tips orientation of forwarding curved was the major characteristic (78.40%) in Katingan cow and the stumpy horn was the major characteristics (98.30%) in Katingan bull (Utomo et al. 2012). The small of dewlap size was the major characteristic (78%) in Madura cattle (Setiadi and Diwyanto, 1997) and similar to Pasundan cattle. The large of dewlap size was found in Kenana cattle (97%) and 55.38% for Deshi cattle (Sarkar et al. 2007; Aamir et al. 2010).

Morphometric characteristics

Data of morphometric traits in Pasundan cattle were shown in Table 3 (for male) and Table 4 (for female). These data shown that morphometric traits on male were higher than female in each category. Gunawan and Jakaria (2011) reported that sex factor had significant effect on yearling weight of Bali cattle ($p<0.01$) which male was higher than female. According to Table 5, the WH of Pasundan cattle (4 PPI) were higher than some adult Indonesian indigenous cattle such as Aceh, Katingan, Madura, Pesisir, and Bali. The BL in Pasundan cattle (4 PPI) were similar to Katingan cattle. The BL of Pasundan bulls (4 PPI) were highest than Aceh, Madura, Pesisir and Bali bulls. Therefore, the BL of Pasundan cows (4 PPI) were highest than Aceh, Pesisir, and Bali cows. Thus, The BL of Pasundan cows were lower than Madura cow. The CG of Pasundan bulls (4 PPI) were highest than Aceh, Katingan, Madura, Pesisir and Bali bulls. Therefore, the CG of Pasundan cows (4 PPI) were highest than Aceh, Katingan, Madura and Pesisir cows. Thus, the CG of Pasundan cows were similar to Bali cows. The WH, BL, and CG of Pasundan cattle were lower than Ongole grade cattle as presented in Table 5.

Table 3. Mean, standard deviation, and the coefficient of variance for withers height, body length and chest girth of Pasundan bulls with different ages

Measurement	N	Mean (cm)	SD	CV (%)
PPI				
Withers height	23	111.13	11.34	10.20
Body length	23	113.39	13.45	11.86
Chest girth	21	132.33	9.56	7.22
Scrotal circumference	31	14.72	2.90	19.71
PPI				
Withers height	63	120.95	12.11	10.01
Body length	67	121.73	12.39	10.18
Chest girth	99	138.22	13.63	9.86
Scrotal circumference	95	15.45	2.80	18.15
PPI				
Withers height	23	124.87	8.90	7.13
Body length	20	126.40	7.40	5.86
Chest girth	36	146.86	14.20	9.67
Scrotal circumference	37	17.09	3.67	21.45
PPI				
Withers height	53	128.94	16.69	12.94
Body length	53	128.72	15.98	12.42
Chest girth	53	159.36	15.84	9.94
Scrotal circumference	50	17.68	3.51	19.84

Note: Ages of cattle were determined by the appearance of pairs of permanent incisors (PPI); PPI: pairs of permanent incisors; N: number of observation; SD: standard deviation; CV: coefficient of variation; Min: minimum value; max: maximum value

Table 4. Mean, standard deviation, and the coefficient of variance for withers height, body length and chest girth of Pasundan cows with different ages

Measurement	N	Mean (cm)	SD	CV (%)	Min.	Max.
1 PPI						
Withers height	40	106.93	11.72	10.96	75.00	125.00
Body length	40	109.63	14.65	13.36	70.00	131.00
Chest girth	40	130.28	11.76	9.03	100.00	145.00
2 PPI						
Withers height	71	116.07	14.82	12.77	89.00	160.00
Body length	71	115.73	15.75	13.61	85.00	175.00
Chest girth	71	136.59	12.18	8.92	100.00	163.00
3 PPI						
Withers height	97	120.90	14.33	11.86	81.00	185.00
Body length	95	125.45	25.67	20.46	86.00	185.00
Chest girth	97	140.75	10.11	7.18	118.00	164.00
4 PPI						
Withers height	251	122.56	11.40	9.30	100.00	197.00
Body length	227	115.63	19.06	16.49	85.00	189.00
Chest girth	250	140.13	12.16	8.68	102.00	195.00

Note: Ages of cattle were determined by the appearance of pairs of permanent incisors (PPI); PPI: pairs of permanent incisors; N: number of observation; SD: standard deviation; CV: coefficient of variation; Min: minimum value; Max: maximum value

Tabel 5. The morphometric measurements (cm) of some adult indigenous cattle in Asia and Africa

Breed	Group	Origin	Bull			Cow		
			WH	BL	CG	WH	BL	CG
Aceh[1]	*Bos indicus*	Indonesia	105.56±4.76	107.69±5.68	138.69±2.28	99.32±4.59	103.95±6.98	129.09±6.62
Katingan[2]	-	Indonesia	121.10±13.30	128.40±9.90	157.10±18.10	100.60±5.00	115.60±7.40	137.00±6.60
Madura[3]	*Bos indicus*	Indonesia	113.50±16.26	111.00±8.48	144.50±8.06	114.50±6.14	116.75±10.24	142.50±7.00
Pesisir[4]	*Bos indicus*	Indonesia	98.20±5.20	107.00±3.10	124.20±9.10	97.80±4.00	106.70±6.10	122.60±6.50
Bali[5]	*Bos javanicus*	Indonesia	107.59±6.11	103.84±13.49	139.06±12.39	107.29±6.32	106.00±11.31	140.65±15.19
Ongole grade[6]	*Bos indicus*	Indonesia	132.90±5.50	132.10±7.60	163.30±11.00	125.70±5.10	134.30±7.60	157.10±12.50
Begait[7]	*Bos indicus*	Ethiopia	136.99±0.10	135.96±0.09	168.91±0.10	131.48±0.25	128.13±0.16	159.55±0.24
Ankole[8]	*Bos taurus*	Uganda	144.60±3.40	210.30±5.70	182.60±2.80	139.50±1.70	201.40±3.00	171.30±1.30
Oulmes-Zaer[9]	*Bos taurus*	Marocco	-	-	-	116.80±0.76	139.60±1.37	161.20±1.28
Tidili[9]	*Bos taurus*	Marocco	-	-	-	108.20±0.84	127.50±1.50	147.70±1.41
White Fulani[10]	*Bos indicus*	Nigeria	101.11±2.19	152.29±4.63	125.62±4.35	100.48±2.70	154.34±7.52	113.71±3.04
Kenana[11]	*Bos indicus*	Sudan	-	-	-	122.69±0.35	131.50±0.28	151.97±0.69
Native cattle of Sylhet[12]	-	Bangladesh	85.26±0.94	114.01±1.51	106.66±1.60	93.36±0.49	126.41±0.72	118.97±0.59
Red Chittagong[13]	*Bos indicus*	Bangladesh	-	-	-	107.41±0.19	100.08±0.72	128.91±0.42
Siri[14]	*Bos indicus*	Bhutan	138.00±2.60	108.00±2.40	170.00±4.80	121.00±2.10	98.00±2.20	152.00±1.50
Achai[15]	*Bos indicus*	Pakistan	-	-	-	-	112.00±4.78	142.00±0.98
Bachaur[16]	*Bos indicus*	India	119.23±0.47	116.99±0.48	150.88±0.55	112.53±0.25	109.71±0.25	140.46±0.32
Deoni[17]	*Bos indicus*	India	134.36±2.03	129.59±2.28	163.55±1.55	122.22±1.23	120.11±2.16	151.82±1.92
Native cattle of Assam[18]	-	India	98.09±0.76	91.20±0.82	121.69±1.02	85.79±0.70	76.14±0.75	104.60±0.94
Ponwar[19]	*Bos indicus*	India	115.60±0.40	102.50±0.50	158.80±0.90	108.90±0.40	97.10±0.50	140.60±0.50
Native cow of Manipur[20]	-	India	-	-	-	111.34±0.92	103.92±0.33	135.34±0.47
Kankrej[21]	*Bos indicus*	India	-	-	-	124.49±0.28	123.44±0.37	162.56±0.56
Native cow of Chhattisgarh[22]	-	India	-	-	-	103.09±0.24	102.70±0.26	125.30±0.62

Note: [1)] Abdullah et al. (2007); [2)]Utomo et al. (2012); [3)]Setiadi and Diwyanto (1997); [4)]Adrial (2010); [5)]Tonbesi et al. (2009); [6)]Hartati et al. (2009); [7)]Ftiwi and Tamir (2015); [8)]Kugonza et al (2011); [9)]Boujenane (2015); [10)]Yakubu et al. (2009); [11)]Aamir et al. (2010); [12)]Koirala et al. (2011); [13)]Hadiuzzaman et al. (2010); [14)]Phancung and Roden (1996); [15)] Khan et al. (2015); [16)]Chandran et al. (2014); [17)]Singh et al. (2002); [18)]Kayastha et al. (2011); [19)]Gaur et al. (2003); [20)]Tolenkhomba et al. (2012); [21)]Pundir et al. (2011); [22]Dahariya (2011)

Table 6. Technical coefficient for output estimation of Pasundan cattle at West Java Province of Indonesia

Component	Value
Number of adult females (%)	10.46
Calving rate based on adult female cattle (%)	20.40
Calving rate based on population (%)	10.46
Mortality (%)	2.00
Natural increase (%)	18.46
Percentage of adult cattle (%)	
Male	13.25
Female	51.25
First mating age (years)	
Male	3
Female	2
Breeding length (years)	
Male	3
Female	5
Sex ratio (male/female)	32/68
Number of population observed (heads)	679

Table 7. The output estimation of Pasundan cattle at West Java Province of Indonesia

Component	Heads	Percent (%)
Number of young cattle (2 years age)		
Male	99	14.58
Female	71	10.46
Total	170	25.04
Requirement of cattle replacement		
Male	33	4.86
Female	14	2.09
Total	47	6.95
Remains of young cattle (2 years age)		
Male	66	9.72
Female	57	8.37
Total	123	18.09
Number of culled cattle		
Male	33	4.86
Female	14	2.09
Total	47	6.95
Net Replacement Rate		
Male	-	300
Female	-	507
Total	-	807
Output estimation	99	14.58
Male	73	10.82
Female	172	25.40
Total	99	14.58

The comparison of morphometric measurements between breeds cattle of Asia and Africa are shown in Table 5. The morphometric measurements (WH, BL, and CG) of Pasundan bulls (4 PPI) in this study were lowest than Begait bulls, Ankole bulls and Deoni bulls (Table 5). Therefore, the morphometric measurements of Pasundan bulls (4 PPI) were higher than native bulls of Sylhet, Bachaur bulls, native bulls of Assam and Ponwar bulls. The WH of Pasundan cows (4 PPI) were similar to Kenana and Deoni cows. The CG of Pasundan cows were similar to Bachaur and Ponwar cows. Commonly, the morphometric measurements of Pasundan cows were higher than Red Chittagong cows and native cows of Assam and Chhattisgarh Plain. The variation of morphometric measurements between indigenous cattle breeds in Asia and Africa are caused by the difference of genetic, climate, management systems and feeds quality (Falconer and Mackay 1996).

Population structure

In this study, the Natural Increase (NI) value was in low category (18.46%) as presented in Table 6. The NI value consisted of three categories such as low (NI<50%), moderate (51%<NI<80%) and high (NI>50%) as reported by Samberi et al. (2010). Low NI value was reported in the several Indonesian native cattle in 2015 such as Bali (16,35%), Pesisir (27.80%) and 16.22% for Ongole grade (Putra et al. 2015; Susanti et al. 2015). The NI value depends on the calf crop and mortality values. Increasing calf crop and decreasing mortality values will cause the increasing of NI value. Calf crop in the present study was 20.40%. This value was very different to those reported by Chase et al. (2004), that calf crop value in Senepol x Angus, Brahman Angus and TulixAngus were 76.9%, 89.0%, and 94.7%, respectively. Putra et al. (2015) reported that the calf crop at 2015 years in native cattle at West Sumatera Province was Bali 51.27% (Bali), 62.29% (Pesisir) and 25.00% (Ongole grade). Moreover, the calf crop at 2015 years in Madura and Madura cross cattle at Tambelangan District were 85.60% and 82.20% respectively (Umam et al. 2015). Calf crop value can be increased with reducing mortality rate and increasing conception rate. Net Replacement Rate (NRR) in male and female at West Java Province were more than 100% (showed in Table 7) and indicated that the surplus population occurred in West Java province. The NRR value in bull was 300% and indicated the number of bull was three folds from total bull needs. According to Table 7, total ideal livestock output per year were 99 heads (14.58%) for male and 73 heads (10.82%) for female.

We conclude that the appearance of cattle Pasundan cattle is a combination of *Bos indicus* and *Bos javanicus*. However, phylogenetic investigation of Pasundan cattle is necessary to describe their origins. The population structure in Pasundan cattle in West Java showed that the calf crop and natural increase values were low but itwas still capable to produce the seedstock per year.

ACKNOWLEDGEMENTS

This work was funded by the Ministry of Research, Technology and Higher Education of the Republic of Indonesia (RISTEKDIKTI) through the INSINAS Program. Authors wish to thank Center for Research and

Development of West Java Province (BP2D) to conduct the research. We would like also thank Research Center for Biotechnology, Indonesian Institute of Sciences for awarding of the research permit. Special thanks to Artificial Insemination (AI) technicians for measuring and recording the cattle in this study.

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