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Morphometry of Male Reproductive Organ and Sperm Evaluation of Belgian Blue Crossbreed Cattle as a Candidate of Superior Bull

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ABSTRACT

The purpose of this study was to observe the size of reproductive organ and to evaluate the sperm quality of Belgian Blue (BB) crossbreed cattle. This cattle are the crossbreeding result between a female Brahman Cross (BX) cattle inseminated with frozen semen from pure male BB cattle, by Artificial Insemination (IB) method, as a candidate of superior bull. The samples of this study were 2.5 years old (BB1), (BB2), and (BB3) crossbreed cattle. Its process involved general physical examination, genital organ inspection, sperm production, and quality assessment. The data obtained were analyzed through descriptive analysis. The results of this study were the three BB crossbred cattle showed the good appearance of normal reproductive organs with scrotum circumferences of each bull were 40.2 cm, 38.6 cm, and 39.8 cm respectively, and sperm quality of the good and the normal motility values of each bull were 82%, 81% and 80%, viability 84%, 83%, and 86%, and the sperm concentrations of each bull were 2.218 million/ml, 1.986 million/ml and 2.120 million/ml respectively. As a result, it could be concluded that those three BB crossbreed cattle are suitable for being used as a superior bull.

Keywords: Belgian Blue crossbred cattle, Morphometry, Motility, Sperm, Viability

Introduction

Increasing the productivity of cattle continues to be carried out for achieving Indonesian meat self-sufficiency. One of the improvement efforts is to improve the genetic quality of Indonesian local cattle by crossing local cows with European bull, because European bull have a greater posture compared to local Indonesian cattle.

Belgian Blue (BB) is one of the cattle originating from Belgium. The advantage of Belgian Blue cattle compared to other European cattle is that Belgian Blue cows have double muscle or double muscular producing genes (Aji *et al.,* 2017). Belgian Blue cattle has a unique phenotype of "double muscle" due to the deletion of 11 bases in exon three of the myostatin gene (Agung *et al.*, 2016). Mutations in the Belgian Blue gene occurs naturally in genes that encode the MSTN protein involved in muscle development. Myostatin is a member of the superfamily that transforms growth factors (TGF) -β and plays an important role in muscle growth and meat quality. The myostatin gene has been mapped on the chromosomes of two cattle and consists of three exons and two intron regions (Batubara, 2017).

The crossing between Belgian Blue cattle and Brahman Cross (BX) produces cattle breeds that have a good adaptation in the tropics, and also produce twice as much meat production compared to another crossbreed cattle like Limousine and Simmental, but morphometric of reproductive organs and sperm quality are unknown. So, it is necessary to do research on the measurement of reproductive organs and the quality of its sperm, both *macroscopically* and microscopically, so that it can be a reference whether this crossbreed is suitable to be used as a candidate for a superior bull. The purpose of this study was to determine the sperm quality of Belgian Blue crossbreed cattle for the selection of superior bull.

Materials and Methods

Materials

The material used in this study consisted of livestock, tools, and materials. The animals used in this study were 3 male BB crossbreed cattle aged 2,5 years. Artificial vagina, hematoxylin-eosin solution, hayem solution, distilled water, pH paper, aluminum foil, sperm tubes 10ml, 2 Erlenmeyer, microscopes (brand: Tension, Germany), optilab viewer, pipette

hemocytometer (brand: Assistant, Germany), Neubauer rooms counting, drop pipette, a counting device, object-glass, coverslip, measuring tape.

Methods

The method used in this study was Breeding Soundness Examination (BSE) which physical examination of genital organs included measurement of diameter/circumference, length and width of the testes, and also sperm quality test.

Measurement of testicular diameter

Measurement of testicular diameter was carried out using a measuring tape looped on both testicles simultaneously at the base of the scrotum, then down to the middle in the widest part of the scrotal circumference.

Measurement of the length and width of the testis

Measuring the length and width of the testis was done by measuring each testis left and right using a measuring tape.

The sperm quality test

An artificial vagina used to collect the sperm. The sperm was collected 3 times/each cattle, the sperm that had been collected was tested macroscopically (volume, pH, color, consistency) and microscopically (motility, viability, concentration and abnormality).

Results and Discussion

Morphometric reproductive organs of BB crossbreed cattle

Morphometric reproductive organs are important because the size of the testis is positively correlated with the amount of sperm produced. The results of morphometric reproductive genital organs are presented in (Table 1). Measurement of the reproductive organs also is needed to be done to determine the size of the testis for the diameter, length, and width of the testes. Based on the table above it could be seen that the size of the testicular circumference of each BB crossbreed cattle is in the normal range. The normal size of European bull testicular circumferences is ranged from 36.57±2.20 for Limousine cattle, and 40.58±2.11 cm for Simmental cattle (Prayogo *et al.*, 2013). This is not much different from the report of Kuswahyuni (2009) who stated that the average testicular circumference in Limousine and Simmental cattle was 35.60, and 45.42 cm respectively was 35.60, and 45.42 cm respectively.

Macroscopic test of fresh sperm of BB crossbreed cattle

The result of macroscopic test of fresh sperm BB crossbreed cattle are presented at (Table 2). Based on the results of the macroscopic tests of fresh sperm of the three BB crossbreed cattle are used well. Ismaya (2014) states that the color of a good sperm is cream with a thick consistency and not mixed with impurities. For the volume of bull, sperm is ranging from 5-8 ml with a normal pH. Mentari *et al.* (2014) also stated that the volume of cattle sperm was ranging from 7.21-9.03 ml while Nyuwita *et al.* (2015) stated that the average volume in cattle was in the range of 6.9-9.2 ml.

Macroscopic observation of sperms is important to do to find out whether there are other objects mixed or not, like blood spots, feces, and urine. Due to other objects will cause the quality of sperm will be damaged and decreased. Color of sperm normally looks like milk, yellowish, or cloudy cream, caused by riboflavin pigment which is carried by an autosomal gene recessive and does not affect fertility. The presence of Pseudomonas aeruginosa germs in cattle sperm could cause yellowish-green when the sperm is left at the temperature room. Clots and pieces in sperm show the presence of pus which generally originates from the glands complement of the ampulla. Sperm that is dark to pink indicates the presence of fresh blood in different amounts and is originated from the genital tract of the urethra or penis. The brownish color indicates the presence of blood which has experienced decomposition. Light brown or greenish colors indicate the possibility of contamination with feces (Toelihere, 1993).

Table 1. Result of testicular measurement of BB crossing cattle

Bulls (Age 30 month)	Parameter testicular size				
	Circumference (cm)	Length (cm)		Width (cm)	
		left	right	left	right
BB1	40.2	17.5	17.6	6.4	6.3
BB2	38.6	16.8	16.9	5.8	5.6
BB3	39.8	17.2	17.2	5.9	6.2
Average	39.53±0.83	17.16±0.35	17.23±0.35	6.03±0.32	6.03±0.37

Table 2. Result of macroscopic test of fresh sperm of BB crossing cattle

Parameter	Belgian Blue crossing cattle			Average
	BB1	BB2	BB3	
Volume (ml)	10.2	8.3	10.4	9.63±1.15
pH	7.0	7.2	7.2	7.13±0.11
Color	Cream	Cream	Cream	-
Consistency	Thick	Thick	Thick	-

Table 3. Result of microscopic test of fresh sperm of BB crossing cattle

Parameter	Belgian Blue crossing cattle			Average
	BB1	BB2	BB3	
Motility (%)	82	81	80	81.00±1.00
Viability (%)	84	83	86	84.33±1.52
Concentration (x million/ml)	2.218	1.986	2.120	2.108±0.11
Abnormality (%)	12.3	17.5	13.7	14.5±2.69

Microscopic test of fresh sperm of BB crossbreed cattle

The result of microscopic test of fresh sperm BB crossbreed cattle are presented at (Table 3). Based on the results of fresh sperm microscopic examination of BB crossbreed cattle above, it can be seen that the sperm quality of the three crossbreed BB cattle is used well and under normal conditions. Ismaya (2014) states that fresh sperm motility of cattle is in the range of 40-75% for dairy cows and 60-85% for beef cattle, and its concentrations range from 800-2000 million/ml.

The sperm concentration is the number of spermatozoa per milliliter of semen which is ejaculated. High-level concentrations range from 2000-2200 million/ml. The concentration of spermatozoa in semen is in line with the sexual development and maturity of bulls, the quality of feed provided and the effect of reproductive health (Salisbury and Van Demark, 1985).

Spermatozoa abnormalities are classified into two groups, namely primary abnormalities, and secondary abnormalities, primary abnormalities occur due to abnormalities in the seminiferous tubules and testicular disorders, characterized by a head that is too small (microcephalic) or too large (macrocephalic), a wide, longitudinal head and shaped like per-fruit (pyriformis), tail or circular middle, and abbatial interconnections, while secondary abnormalities occurred after cells or talents of male sex cells leave epithelial sprouts on seminiferous tubules or manipulation of ejaculates including excessive agitation and heating, cooling too fast, because of the contamination with water, urine or antiseptics (Toelihere, 1993).

Conclusions

Based on the research conducted, it could be concluded that the three BB crossbreed cattle at PT. Pandanaran Artha Perkasa Klaten is in good and decent condition to be used as superior bulls, this is because the three bulls show good adult behavior or appearance of libido, good and normal size of reproductive organs, normal and good sperm quality.

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