

Semen characteristics and gross testicular morphometry in Timor deer (*Cervus timorensis*) stags during the annual antler cycle

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Intensive husbandry of several cervid species located in temperate environments has precipitated in our understanding of the stag patterns of reproductive cycles and in the development of artificial breeding technologies. Circannual patterns of antler cycle correlated with circannual patterns of testicular function and reflecting changes in semen production in red deer (*Cervus elaphus*; Asher et al. 1994; Gizejewski et al. 2002). The research on the reproductive biology of timor deer stag was aimed to provide basic information on the interrelationship between gross testicular morphometry and semen quality based on natural antler development stages i.e. the velvet and hard antler stages. Results of this research hopefully could be used to determine the active reproductive period as the basic strategy of the deer stag.

This experiment was conducted for 16 months (started from June 2002 until September 2003) on four adult timor deer stags (4 to 6 years, average body weight 80 to 105 kg). Ejaculates and morphometric measurements data (volume of testes and scrotal circumference) were collected at 21 days intervals during the annual antler cycle. The stags were immobilized with a combination of effective dose of 1 mg/kg body weight Xylaxin and 1 mg/kg body weight Ketamin, administered with a blow pipe (Drajat 2000). Semen characteristics were evaluated macroscopically i.e. volume, color, pH, consistency and microscopically i.e. motility, mass movement, concentration, live-dead percentages (referred to Gardner and Hafez 2000), abnormality (referred to Godrowe et al. 1998; Gardner and Hafez 2000), membrane integrity (described by Revell and Mrode 1994) and intact acrosomal cap (described by Nagy et al. 1999; 2001) at velvet and hard antler stages. The following parameters were analyzed using ANOVA.

Results of the experiment showed that the mean velvet antler period was 155.8 ± 7.1 days, hard antler period was 207.3 ± 2.8 days and casting stage was 16.25 ± 0.8 days. The complete antler cycle reached about 379.3 ± 8.8 days. The measurements of testes length and scrotum circumference were higher in hard antler stage than velvet antler ($P < 0.05$). The timor stag exhibited alternating periods of sperm production and incomplete spermatogenic arrest that reflected changes in seasonal testicular volume in both of velvet and hard antler. Semen quality at the hard antler stage was significantly ($P < 0.05$) higher compared to that at the velvet stage, particularly in some macroscopic parameters (volume: 1.88 ± 0.67 vs 1.17 ± 0.45 ml, color, consistency: +++ vs +) except pH and in all microscopic parameters (mass movement: 2.38 ± 0.55 vs 0.48 ± 0.28 , motility: 71.84 ± 5.31 vs 31.92 ± 17.57 percent, concentration: 985.07 ± 166.43 vs 202.46 ± 178.66 . 10^6ml^{-1} , live-dead sperm; 80.70 ± 5.34 vs 50.16 ± 40.56 percent, sperm abnormality: 9.80 ± 3.93 vs 35.59 ± 19.87 percent, membrane integrity: 70.66 ± 6.84 vs 40.72 ± 24.99 percent, intact acrosomal cap: 74.87 ± 6.05 vs 46.65 ± 25.74 percent).

The profile of semen quality reflected the interrelationship of the antler cycles with low quality occurring at casting and during velvet antler growth stages and it was higher at the hard antler stage. A large number of viable spermatozoa produced by the testes are present in ejaculates. This result also supports the finding that the sperm production in tropical species show fluctuations in spermatogenesis related to the stages of the antler cycle, with increased levels of production and optimum testis size during hard antler stage. Antler casts annually when testes regressed to their minimum dimensions, in agreement with previous report by Willard and Randell (2002) on the differences of antler stage growth period in tropical species (*Axis-axis*).

It is concluded that the best semen quality is produced and obtained at hard antler development stage which is the longest stage of the antler cycle in which the stag has active reproductive phase. Increase of testicular morphometry and semen quality corresponds with the hardening of antlers which started from June to February.

Keywords: Timor stags, semen characteristics, gross testicular morphometry, antler cycle,

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