Brief communication

Testis size and spermatogenesis of tsessebes from Nylsvley Nature Reserve, Transvaal

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Testis mass of adult tsessebes (mean 45,3 g) and relative testis size (0,56) were consistent with the Class D social organisation of tsessebes. In single-male breeding systems, testes are relatively small. Spermatogenesis reached a peak in January, prior to the onset of the mating season.

Keywords: tsessebe, *Damaliscus lunatus*, testis, spermatogenesis.

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A functional relationship exists in many mammals between relative size of testes and mating system. Testes are relatively small in single-male breeding systems, and relatively large in multi-male breeding systems where several different males mate with each female at the same oestrus (Kenagy & Trombulak 1986). Tsessebes *Damaliscus lunatus* have a Class D social organisation (Jarman 1974), consisting of territorial males, breeding herds and bachelor herds (Skinner & Smithers 1990). Breeding herds of adult and yearling females and young are usually confined to the territory of a particular male all year round (Grobler 1973; Joubert 1972). One would therefore expect tsessebes to have relatively small testes.

Tsessebes are seasonal breeders in southern Africa. Mating takes place during March and April, followed by a restricted calving period of ca. 40 days during spring and early summer (Child *et al.* 1972; Fairall 1968). The male reproductive pattern of tsessebes has been described in some detail (Child *et al.* 1972; Grobler 1973).

Tsessebes are classified as rare in the Republic of South Africa (Smithers 1986) and research material is therefore not readily available. In view of this, all data from tsessebes should be documented, even though sample sizes may be small.

Tsessebes were introduced to Nylsvley Nature Reserve in 1977 from Percy Fife Nature Reserve, which had been stocked with animals captured in the Waterberg District, Transvaal (Parris & Smith 1980). By 1985 the population at Nylsvley had increased considerably and in accordance with wildlife management practices some males were identified for removal and made available for research. In this paper we report on testis size of these animals and describe seasonal occurrence of spermatogenesis in more detail. Other reports on the same animals were on chromosomes (van der Veen & Penzhorn 1987) and helminth burdens (Reinecke *et al.* 1988).

The 3120 ha Nylsvley Nature Reserve extends from latitude 24°36′S to 24°42′S, and

longitude 28°40′E to 28°44′E on the Springbok Flats, 10 km south of Naboomspruit in the central Transvaal. The climate is that of a hot, dry steppe with a dry winter; mean annual rainfall is 630 mm (Weather Bureau, Pretoria).

Eleven tsessebe males were shot between 8 May 1985 and 12 March 1986. With the exception of January, when one only was killed, two animals were shot every two months. The tsessebes were shot in the neck, bled, and the carcasses transported to a shed where they were skinned and eviscerated, and their ages estimated (Huntley 1973; Anthony & Lightfoot 1984). One each was estimated as being ca. 6 months, ca. 12 months and ca. 15 months old based on tooth eruption and replacement, while the rest were assigned to the adult group only as no tooth wear criteria for assigning adult tsessebes to absolute age classes were available in the literature. Live mass was estimated from dressed carcass mass, assuming the dressing percentage to be 58,1%, the mean reported by Child *et al.* (1972). Testes and epididymides were dissected out and their masses determined on a triple-beam balance accurate to 0,1 g. Testis volume was determined by displacement of water in measuring cylinders. Specimens, ca. 5 mm thick, of testis and epididymis (caput, corpus and cauda) were fixed in buffered formalin, embedded in paraffin wax, sectioned at 5 µm and stained by Mayer's haematoxylin and eosin technique. Changes in seminiferous tubule diameter were quantified by measuring two diameters at right angles in cross sections of 10 seminiferous tubules per testis. The measurements were made with an ocular micrometer.

The predicted paired testis mass was calculated by means of the power function $y = 0{,}035\ x^{0.72}$, where y is mean paired testis mass in grams and x is mean body mass in grams (Kenagy & Trombulak 1986). This is the function of the allometric relationship between mass of testes and body mass, based on data from 133 mammalian species. The relative testis size was then calculated, which is the ratio of the observed mass of testes to that predicted by the equation.

Mean testis mass and volume, epididymis mass, mean seminiferous tubule diameter and spermatogenic activity of the 11 animals are given in Table 1. Seasonal differences were found in spermatogenesis; the epididymides of adults invariably contained spermatozoa. The seasonal pattern in the Nylsvley population was not as evident as in northern Botswana (Child *et al.* 1972), probably due to small sample size, but maximum testis mass and seminiferous tubule diameter were also attained in January, immediately prior to the rut.

Mean dressed carcass mass of adult animals was 71,1 kg (range: 65–78 kg), and mean calculated live mass was 122,4 kg (range: 112–134 kg). The predicted paired testis mass calculated by means of the equation of Kenagy & Trombulak (1986), assuming an adult body mass of 122,4 kg, was 161,2 g. If this is compared to the calculated mean paired testis mass of 90,7 g, the relative testis size is 0,56.

Estimated mean live mass of adult Nylsvley tsessebe males was less than the 140+ kg reported from northern Botswana (Child *et al.* 1972), but agreed closely with a mean of 123,4 kg (range 98,1–144,9 kg) on Essexvale Ranch, southeast of Bulawayo, Zimbabwe (calculated from data in Grobler [1973]). Mean paired testis mass of tsessebes from Nylsvley (90,7 g) was substantially less than that reported from northern Botswana (Child *et al.* 1972), but exceeded that found on Essexvale Ranch, Zimbabwe (73,7 g, calculated from data in Grobler [1973]).

The small relative testis size is consistent with the mating system of tsessebes, in which the breeding herd remains with the territorial male all year round. This male therefore does all the mating and copulatory frequency will be low. Size of testes has undoubtedly evolved in each species in response to a variety of additional factors beyond the first-

Table 1

Mean testis mass and volume, epididymis mass, mean diameter of seminiferous tubules and spermatogenic activity of juvenile and adult tsessebe males, Nylsvley Nature Reserve, May 1985 - March 1986 (SD=standard deviation)

Month	Testis		Epididymis mass (g)	Diameter sem.tub. (µm)		Spermatogenic activity
	Mass (g)	Vol. (ml)		Mean	SD	
Juveniles						
May (6 m.)	4,0	-	0,5	73,6	3,5	Spermatogonia present.
November (12 m.)	9,2	9,5	3,1	126,1	9,5	Some primary spermatocytes present.
March (15 m.)	12,1	5,75	3,7	142,6	12,9	Primary spermatocytes, inactive spermatids, a few spermatozoa; epididymis empty.
Adults						
May	41,3	40,0	9,5	192,1	13,3	Pre-leptotene primary spermatocytes; some spermatozoa present; no other activity.
July	40,9	40,0	8,3	225,7	17,2	A few primary spermatocytes, spermatids and spermatozoa present; Leydig cells slightly active; degenerating spermatozoa in the epididymis.
	32,8	31,0	10,4	222,2	20,6	Pre-leptotene primary spermatocytes, plus a few secondary spermatocytes, spermatids, spermatogonia and spermatozoa; degenerating spermatozoa in epididymis.
September	40,5	38,0	11,0	208,8	14,6	In both specimens: Active spermatogenesis; entire spermatogenic series of cells present – primary and secondary spermatocytes, spermatids and some spermatozoa; many spermatozoa and sloughed cells in epididymis.
	48,6	49,0	11,7	222,8	15,6	
November	38,8	37,5	9,4	223,6	25,8	Spermatogonia, primary spermatocytes, spermatids and a few spermatozoa present; many spermatozoa and macrophages in epididymis.
January	82,7	-	15,3	247,1	20,0	Active spermatogenesis; spermatogonia, primary and secondary spermatocytes, spermatids and many spermatozoa present; Leydig cells large and active; epididymis contains densely-packed spermatozoa.
March	37,4	36,0	11,1	185,7	16,9	Active spermatogenesis, but less so than in the January specimen; spermatogonia, primary and secondary spermatocytes, spermatids and many spermatozoa; Leydig cells smaller than in the January specimen; epdidymis packed with spermatozoa.

order influence of body size, for instance seasonality of breeding (Kenagy & Trombulak 1986).

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