Notes on reproduction of Trachylepis species in Namibia

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NOTES ON THE REPRODUCTION OF *TRACHYLEPIS* SKINKS IN NAMIBIA

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INTRODUCTION

Of the approximately 11 690 reptile species in 1 226 genera and 92 families, 7 144 are lizards, and among the lizards, 1 742 are skinks (Scincidae; Uetz et al. 2021). It is, therefore, the largest reptile family, and *Trachylepis* is one of the largest genera within the family with 87 species, most of which (83 species) occur in Africa (Uetz et al. 2021).

Most skinks are oviparous, while 45% are viviparous to some extent, and few are ovoviviparous (Branch 1998; Alexander and Marais 2007; Blackburn and Flemming 2010). In ovoviviparous species, young develop lecithotrophically in eggs that hatch inside the female's reproductive tract, emerging as live young (Metallinou et al. 2016). Regular lecithotrophy is characteristic of the Striped Skink *T. striata* and Cape Skink *T. capensis*, while the Damara Variable Skink *T. damarana* and Western Three-striped Skink *T. occidentalis* are oviparous or viviparous (Vitt and Blackburn 1983; Branch 1998; Alexander and Marais 2007; Weinell and Bauer 2018). Weinell et al. (2019) provide insight into *Trachylepis* reproductive mode evolution based on a species-level phylogeny.

There is a paucity of reproductive data for many *Trachylepis* skink species in Africa. The Kalahari Tree Skink *T. spilogaster* is the only well-studied species - Pianka (1986) studied 74 individuals, while Goldberg (2006) analysed 29 specimens. Other species that have been investigated are *T. capensis* (Flemming 1994), *T. striata* (Simbotwe 1980; Patterson 1990), Rainbow Skink *T. margaritifer* (Visser 1975; Simbotwe 1980) and Red-sided Skink *T. homalocephala* (Visser 1975). Here we provide data on timing of reproduction, mode of reproduction and clutch/brood size of 10 skink species from Namibia.

MATERIAL AND METHODS

For this study, we used specimens that are housed in the reptile collection of the National Museum in Windhoek, Namibia, and which were collected in different vegetation types in Namibia (Figs. 1–3) and in different seasons (Table 1). The specimens were measured in the laboratory, with two morphological characters being measured to the nearest 0.1 mm with the aid of a Vernier calliper: 1) snout-vent length (SVL), measured from the anterior end of the snout to the anterior edge of the vent; and 2) tail length (TL), measured from the anterior edge of the vent to the end of the tail. Tail length was not measured in specimens with freshly autotomized tails.

Each specimen was dissected and their reproductive organs closely examined for sexing and ageing with the help of a stereo microscope. Individuals were sexed by assessing the presence of gonads (testes in males and ovaries in females). Specimens

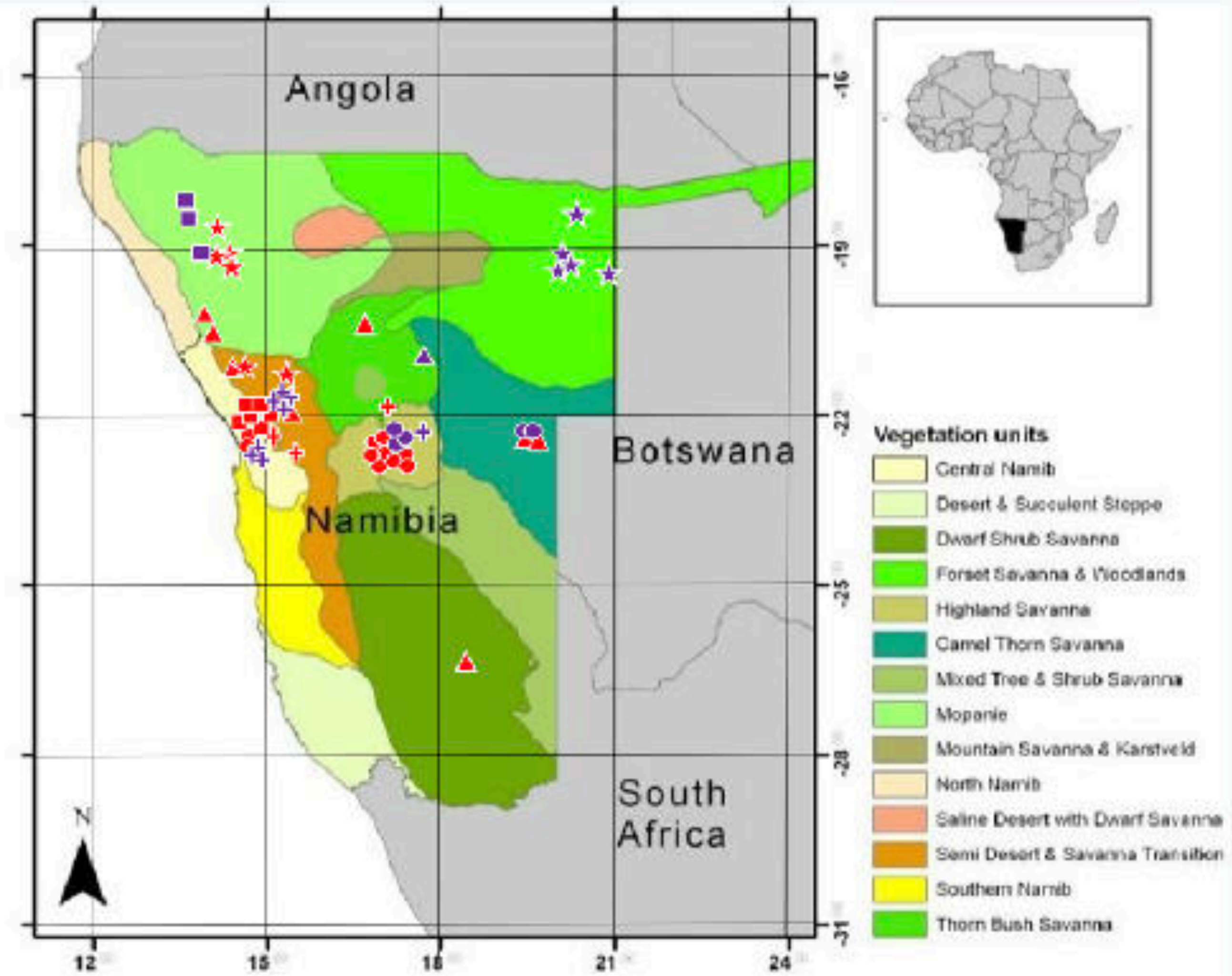

Figure 1. Sampling localities of the *Trachylepis* specimens examined during this study. a = Western Rock Skink *T. sulcata*, b = Hoesch's Skink *T. hoeschi*, c = Western Three-striped Skink *T. occidentalis*, d = Wedge-snouted Skink *T. acutilabris*, e = Kalahari Tree Skink *T. spilogaster*, f = Cape Skink *T. capensis,* g = Ovambo Tree Skink *T. binotata,* h = Wahlberg's Skink *T. wahlbergii*, i = Damara Variable Skink *T. damarana,* j = Speckled Sand Skink *T. punctulata.*

Figure 2. Ovambo Tree Skink *Trachylepis binotata* in Ogongo area, Omusati Region, Namibia. Photo: Grzegorz Kopij.

Figure 3. Dry savanna (semi-desert and savanna transition) near Omaruru, Omaruru region, Namibia. Photo: Grzegorz Kopij.

were classified as adults (well-developed gonads) or juveniles (under-developed gonads). The reproductive status of each female was determined using the following scale: inactive follicles, enlarged follicles, oviductal eggs or neonates. Oviductal eggs and neonates, when present, were counted.

RESULTS AND DISCUSSION

Most specimens originated from places in Namibia where there are two distinct seasons, viz. dry (May–October) and wet (November–April) seasons (Figs. 1 & 3). Overall, there is no clear pattern in the timing of breeding in *Trachylepis* species collected in these places. Most species bred in both the dry and wet seasons, and there was a slight peak at the end of the dry and the beginning of the wet season in some species (Table 1). This is probably because their main diet, i.e., beetles, ants and termites, are available throughout the year, with an emergence of ant and termite alates taking place at the onset of the wet season (Bauer et al. 1990; G. Kopij, pers. obs.).

No Namibian *Trachylepis* species are truly viviparous in the sense that they provide mostly maternal nutrition (matrotrophy; Metallinou et al. 2016). If females can breed throughout the year, or at least more than once per year, then we expect to find full-term eggs or neonates in females collected at the same site at different times of the year. Similarly, the only way to infer that both oviparity and ovoviviparity are present in a single species at a site based on museum material is to demonstrate that both shelled eggs and full-term embryos are present in that species. Among three Western Rock Skink (*T. sulcata*) specimens investigated, two were oviparous (shelled eggs were present) and one was ovoviviparous (neonates were present). Branch (1998) states that *T. sulcata* is ovoviviparous and mentions unconfirmed reports of oviparity. This presented record is therefore the first confirmed case of oviparity in *T. sulcata*. Similarly, both oviparous and ovoviviparous *T. capensis* were recorded in this study. According to Branch (1998) this species is usually ovoviviparous, but in some regions it can be oviparous. These records suggest that both *T. sulcata* and *T. capensis* use both oviparity and ovoviviparity in Namibia.

The clutch/brood size in most species ranged from 3–7 (Table 2). Only one *T. sulcata* contained two neonates. A case of exceptionally large brood size (n = 12 neonates) was recorded in *T. capensis*, and exceptionally large clutch sizes in *T. occidentalis* (n = 12 eggs) and Wahlberg's Skink *T. wahlbergii* (n = 11 eggs). Such large clutch/brood sizes have not been previously recorded (Visser 1975; Vitt and Blackburn 1983; Pianka 1986; Goldberg 2006).

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Table 1. Seasonal distribution of samples (reproductive status and number of specimens analysed). Blue – wet season, orange – dry season. Symbols: + = inactive, A = enlarged follicles, E = oviductal eggs, N = fully developed neonates. Numbers refer to the number (>1) of specimens examined (e.g., 2A means two specimens with enlarged follicles).

Month→ Species↓	J	F	M	A	M	J	J	A	S	O	N	D	Number of specimens examined
T. acutilabris	+		2E							2A		+	6
T. binotata									2	+			3
T. capensis			+				A					A ; 2E	5
T. damarana									3+ ; 2A				5
T. hoeschi			A				2			3A			6
T. occidentalis							+			+ ; E			3
T. punctulata								+ ; E	A	E ; N	3E		8
T. spilogaster			+				+		A				3
T. sulcata	E		3+ ; N		+ ; 2A						E	N	10
T. wahlbergii												E	1
Total:	**2**	**0**	**9**	**0**	**3**	**0**	**5**	**2**	**9**	**10**	**4**	**6**	**50**

Table 2. Clutch/brood size in *Trachylepis* species recorded in various habitats and seasons in Namibia. Each entry refers to a single examined specimen. Clutch/brood sizes from Branch (1998) are listed with the most common reproductive mode listed first. SVL = Snout-vent length; TL = Tail length.

Species	Parity mode	Habitat	SVL + TL (mm)	Site	Date	Clutch size (this study)	Clutch size (Branch 1998)
T. acutilabris	Oviparous	Dry savannah	55.8 + 82.9	Kohero, Omaruru District	1965/03/11	5 eggs	—
		Semi-desert	55.5 + 32.7	Uis, Damaraland	1966/03/03	4 eggs	
T. capensis	Oviparous / Ovoviviparous	Dry savannah	116.1 + 79.6	Eava, near Gobabis	1983/12/13	12 neonates	5–18 neonates / eggs
		Dry savannah	120.2 + 91.4	Eava, near Gobabis	1983/12/13	7 eggs	
T. damarana	Oviparous?	Kalahari Woodland	56.0 + 30.6	Kaudum, Kavango	Unknown	10 eggs	4–12 neonates / eggs**
T. occidentalis	Oviparous / Ovoviviparous	Dry savannah	96.5 + 14.6	Hughes, Gobabis District	1963/10/13	12 eggs	5 – 7 eggs / neonates
T. punctulata	Ovoviviparous	Semi-desert	52.9 + 68.2	Karibib District	1972/11/03	3 eggs	2–4 neonates
		Semi-desert	53.8 + 80.8	Karibib District	1972/11/03	4 eggs	
		Semi-desert	49.3 + 9.4	Karibib District	1972/11/03	3 eggs	
		Namib Desert	53.8 + 10.8	Swakopmund District	1973/08/31	3 eggs	
T. sulcata	Ovoviviparous	Namib Desert	76.5 + 125.4	Swakopmund District	1974/03/28	2 neonates	3–5 neonates (unconfirmed oviparity)
		Highland savanna	81.6 + 130.5	Avis Dam, Windhoek	1984/01/27	7 eggs	
		Highland savanna	60.6 + 115.8	Windhoek District	1984/11/30	3 eggs	
T. wahlbergii	Oviparous?	Dry savannah	80.1 + 109.0	Okakarara, Hereroland	1988/12/13	11 eggs	—*

* Branch (1998) only provided data for "southern populations", presumably referring to what are now *T. striata* and *T. punctatissima*.
**There is uncertainty regarding the reproductive mode given that this taxon was recently realised to represent a species complex (Weinell & Bauer 2018).

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