Variability of yellow tulp (*Moraea pallida* Bak.) toxicity

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ABSTRACT

Yellow tulp (*Moraea pallida* Bak.), collected predominantly during the flowering stage from a number of sites in South Africa, showed large variation in digoxin equivalent values, indicating variability in yellow tulp toxicity. Very low values were recorded for tulp collected from certain sites in the Northern Cape.

Keywords: digoxin equivalent, *Moraea pallida,* toxicity, yellow tulp.

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Fig. 1: **Yellow tulp (*Moraea pallida* Bak.).**

Poisoning with cardiac glycoside-containing plants, of which yellow tulp (*Moraea pallida* Bak.) (Fig. 1) is the most important member, is collectively the most important plant-associated poisoning of livestock in southern Africa[2]. The cardiovascular, gastrointestinal, nervous, and respiratory systems are affected[1,2], with posterior paresis as the most usual and outstanding nervous sign[5]. Yellow tulp is widely distributed and occurs under a variety of climatic conditions, topographical situations and soil types in most provinces of South Africa as well as in Botswana[1] and Namibia (Fig. 2). In the present study, fluorescent polarisation immuno-assay[3] analyses of yellow tulp, collected predominantly during the flowering stage from a number of sites in the country, indicate large variation in toxicity The toxin concentrations, expressed as digoxin equivalents, are indicated in Table 1.

The concentrations of digoxin equivalents for yellow tulp, recorded at the Onderstepoort Veterinary Institute from an artificially established, irrigated, grass and tulp plot and from a site at Middelburg, Mpumalanga, were high while those collected from the majority of sites in the Griekwastad district were very low. This might explain the apparent absence of yellow tulp poisoning in the Northern Cape[2]. The reason for the large variation in toxicity among the different collections is unknown. Identification of the factors responsible for the variation might be useful in predicting yellow tulp poisoning under various conditions.

The low toxicity of yellow tulp collected from the Griekwastad district was exploited for easy preparation of an identification (ID) factor, used to avert cattle to yellow tulp[6]. Conditioned aversion to some toxic plants has been successfully induced in livestock by the oral administration of an ID factor together with the aversion factor for that particular plant – in the case of yellow tulp this aversion factor is the toxic principle, epoxyscillirosidin[1,4,5]. The extremely low toxicity of the yellow tulp collected at Site 4 was exploited by preparing ID factors from this – instead of the local tulp for use in

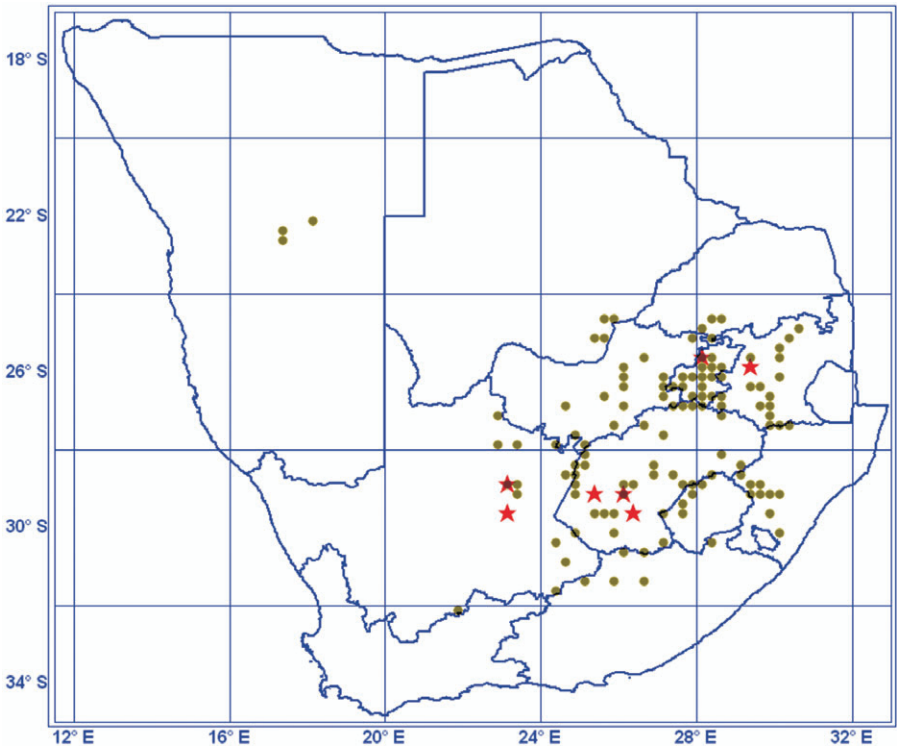

Fig. 2: **The distribution of yellow tulp (*Moraea pallida*) in southern Africa. • *M. pallida*; ★ collection sites.** (Courtesy of SANBI, Pretoria.)

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Table 1: **Digoxin equivalents** (cardiac glycoside content) **of yellow tulp collected from various sites in South Africa. Mean ± SD for each district is given in bold.**

Province	District	Site	Date collected	Digoxin equivalent (n moles/ℓ)
Northern Cape	Griekwastad	1 (veld)	March 2006	72
		2 (veld)	August 2008	6 658
		3 (veld)	August 2008	2 048
		4 (veld)	September 2008	0
		2 (veld)	June 2009	512
		3 (veld)	June 2009	1 024
		4 (veld)	June 2009	1 024
		4 (veld)	August 2010	717
				1 507 ± 2 179
	Hopetown	1 (veld)	August 2007	3 585
		2 (veld)	September 2007	7 170
		3 (disturbed veld)	September 2008	8 706
		4 (irrigated land)	September 2008	4 097
		5 (disturbed veld)	September 2008	17 413
				8 194 ± 5 575
Free State	Petrusburg	1 (roadside)	September 2006	4 609
		2 (roadside)	September 2008	5 634
				5 121 ± 724
	Bloemfontein	1 (roadside)	September 2006	4 097
		2 (roadside)	September 2008	1 024
				2 560 ± 2 173
	Brandfort	1 (roadside)	September 2006	4 097
		2 (roadside)	September 2008	1 536
				2 816 ± 1 811
Gauteng	Established at Onderstepoort*	a (irrigated grass pasture)	August 2007	5 121
		a	September 2008	10 755
		b (irrigated grass pasture)	October 2006	22 535
		b	August 2007	12 548
		b	October 2007	16 389
		b	October 2008	22 203
				14 925 ± 6 814
Mpumalanga	Middelburg	1	August 2007	**18 438**

*Yellow tulp collected from ARC-OVI Onderstepoort was established from plants growing in the (a) Dullstroom and (b) Vrede districts.

areas such as the Highveld where *M. pallida* is very toxic. The simplified method for extracting the ID factor[6] allows for some contamination with the aversion factor (epoxyscillirosidin); which is potentially dangerous, as the ID factor is administered in conjunction with the toxic aversion factor (epoxyscillirosidin) during the process of inducing aversion. Using relatively less toxic tulp for preparing the ID factor could therefore significantly reduce the risk of inadvertent poisoning during the aversion process.

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