

SUSPECTED CYCAD (*CYCAS REVOLUTA*) INTOXICATION IN DOGS

C J BOTHA*, T W NAUDÉ*, G E SWAN*, MARCELLA M ASHTON* and J F VAN DER WATEREN*

ABSTRACT

Three dogs which ingested part of the stem of a Japanese cycad (*Cycas revoluta*) vomited repeatedly within hours after ingestion, showed marked depression, severely congested mucous membranes, increased thirst and profuse salivation. Subsequent haematological and blood chemical investigation revealed elevated serum concentrations of alanine transaminase, an initial mild lymphocytopenia, thrombocytopenia and a leucocytosis. The dogs recovered uneventfully.

Key words: *Cycas revoluta*, Japanese cycad, dogs, cycad poisoning, vomition, hepatotoxicity

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Cycads belong to the order *Cycadales* of which 3 families are recognised: Cycadaceae (with one genus: *Cycas*); Stangeriaceae (with only a single species: *Stangeria eriopus* (Kunze) Nash) and Zamiaceae (with 8 genera, including *Encephalartos*, *Zamia* and *Dioon*, amongst others)⁶⁻¹⁰. The indigenous cycads of southern Africa are *S. eriopus* and 28 species of *Encephalartos*⁶⁻¹⁰.

In South Africa members of the genus *Encephalartos* are also known as "broodbome" (literally bread trees), Hottentot- or Kaffirbread¹⁻¹⁰. The indigenous tribes used the starchy pith from the stems or trunks of *Encephalartos* species to bake bread. The pith was removed from the stem, wrapped in an animal skin and buried in the ground for a period of a month or 6 weeks to induce it to ferment partially^{1-10,12}. The fibrous mass was then ground to a flour (meal or sago), mixed with water to a paste and finally baked or roasted^{1-10,11,12}. Detoxification is probably due to fermentation and water-solubility of the toxin¹⁰.

The cycads are popular garden shrubs in South Africa, but due to strict nature conservation regulations to protect the indigenous cycads, the exotic cycads are frequently planted as substitutes. A further advantage of these exotic species is that they grow faster than the indigenous varieties.

The earliest and most well-known record of cycad toxicity occurring in South Africa was reported by Reitz⁷. He accounted his experiences in the eastern Cape Province during the Anglo-Boer war (1899-1902) after the hungry Boer soldiers ate the fruit (cone) of the "Hottentots bread" (*Encephalartos altensteinii*): "I had not eaten any, and returning to the firing-line, after going to tie up some horses that had broken loose, I was astonished to find more than half our men groaning and retching on the ground in agony, some apparently at their last gasp....." Dyer states that the species most likely to have caused this particular outbreak was probably *E. longifolius* (Jacq.) Lehm.¹.

Wells as cited by Dyer (1966)¹ (and personal communication 1991; Botanical Research Institute, Pretoria) reported the death of 2 head of cattle in the Riebeeck-East district of the eastern Cape Province in 1965. The autopsies by Rossiter (State Veterinarian, Regional Veterinary Laboratory, Grahamstown, 1965) showed that the forestomachs contained many seeds of *E. longifolius*.

Cycad or zamia poisoning in cattle and

sheep in Australia is well known and has been reported widely^{3,4}. There are 2 distinct syndromes, viz: acute severe gastro-intestinal disturbance and liver necrosis; and chronic partial paralysis. In cattle the latter is better known and is caused by degenerative lesions in the spinal cord that lead to posterior ataxia, commonly known in Australia as "wobbles", "rickets" or "staggers"^{2,3,4,12}.

Nishida, Kobayashi and Nagahama as cited by Laqueur & Spatz⁵ isolated an azoxyglycoside from the seeds of *Cycas revoluta* (Thunb.) and named the compound cycasin. Later the same group isolated new azoxyglycosides from *C. revoluta* and named them neocycasins. Yagi & Tadera¹³ determined the azoxyglycoside contents in various parts of *C. revoluta* and reported that the pith contained slightly less cycasin than the seeds on a percentage fresh weight basis. After ingestion, intestinal bacteria enzymatically convert cycasin to the hepatotoxic and carcinogenic aglycone, methylazoxymethanol (MAM)⁹. MAM is the common aglycone of all the different azoxyglycosides isolated from various cycad species².

The only published report that we could find of cycad intoxication in dogs, is the article published by Senior et al⁸. Two dogs in Florida (USA) ingested seeds of *Zamia floridana* and died. Both dogs vomited persistently, and developed severe liver necrosis followed by icterus and a haemorrhagic syndrome.

Recently we investigated a suspected case of cycad poisoning in dogs after they ingested parts of the stem of *Cycas revoluta* (Thunb.).

Three Bull Terriers, a 3-year-old bitch and 2 of her offspring (a dog and bitch, 16 months old), uprooted and destroyed a potted exotic cycad, *C. revoluta* (Thunb.) (Fig. 1). They tore off the leaves and chewed at the 30 cm diameter, fibrous stem and ingested an unknown quantity of plant material. Shortly after ingestion, the old bitch started vomiting. The male subsequently, ingested the vomitus (containing plant material) and then also started showing signs of nausea and vomited repeatedly. The other female started vomiting within an hour of ingesting the material. The dogs then became depressed and prostrated. They all salivated profusely and drank water repeatedly.

*Department of Pharmacology and Toxicology, Faculty of Veterinary Science, University of Pretoria, P/Bag X04, 0110 Onderstepoort, Republic of South Africa

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Four hours after exposure, the dogs were presented to the Department of Pharmacology and Toxicology, Faculty of Veterinary Science, University of Pretoria. On clinical examination, both

thrombocytopenia and a leukocytosis.

Increases in the serum concentration of ALT and in the total white blood cell count were the most prominent changes observed in all dogs. An increase in

neutrophil left shift could denote an inflammatory reaction and was also reported by the same authors. In addition they also described a severe coagulopathy with thrombocytopenia and a lymphopenia⁸. In this case the 2 females also developed an initial mild thrombocytopenia and lymphopenia.



Fig. 1: An example of *Cycas revoluta*, Japanese cycad or sago palm

females were markedly depressed and the mucous membranes of all the dogs were severely congested. Although all the dogs had slightly elevated temperatures, we concluded that this was probably caused by transport during the heat of the day. The respiratory and heart rates were within normal limits. All 3 dogs were treated with magnesium sulphate (Elvet Epsom Salts, Elvet) as a laxative and were taken home.

The next day all 3 dogs were moderately depressed and their mucous membranes were still congested. The older bitch exhibited a tender abdomen on palpation. During the following days their habitus and colour of the mucous membranes returned to normal and they all made an apparently uneventful recovery. The young female showed pro-oestrus 18 d after exposure and was later successfully mated. On Day 31 of gestation, pregnancy was confirmed by sonar scanning. On Day 60 of gestation one stillborn puppy with a cleft palate was born.

Haematological and blood chemical investigations revealed elevated serum concentrations of alanine transaminase (ALT), an initial mild lymphocytopenia,

immature neutrophils and a mild lymphocytopenia and thrombocytopenia, in the female dogs only, also occurred. The haemoglobin and mean corpuscular haemoglobin concentrations and monocyte counts showed only slight deviations from the norm.

Morton as cited by Senior et al⁸ observed vomiting, lethargy, anorexia and increased thirst beginning 2 h after a dog had ingested seeds of *Dioon edule*. All clinical signs disappeared within 12 h and no complications were reported⁸. Following ingestion of parts of the stem of *Cycas revoluta*, severe vomiting and prostration occurred, but was not fatal in this case and the dogs made an uneventful recovery. The conception and birth of a still-born puppy with a cleft palate to the young bitch subsequent to exposure, is probably incidental. In view of the known carcinogenicity of this plant family, the exposed dogs will be closely observed for possible future development of neoplasms.

The rise in serum ALT concentration encountered is indicative of possible liver necrosis and is consistent with that reported by Senior et al⁸. The increases in the white blood cell counts with the

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