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Poisoning by *Thiloa glaucocarpa* (Combretaceae) in cattle in the semiarid regions of Paraíba and Pernambuco, Brazil

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Abstract

The aim of this study was to describe the epidemiological, clinical and pathological aspects of spontaneous poisoning by *Thiloa glaucocarpa* in cattle in the semiarid region of Paraíba and Pernambuco, Brazil. Eight adult cattle were examined and of those, five were necropsied. The main clinical signs consisted of dehydration, dry nose, ascites and subcutaneous edema. Renal function tests resulted in significant changes. The gross macroscopy consisted of significant fluid accumulation in the abdominal and thorax cavities, and edema of lungs, subcutaneous tissues, perirenal tissue and abomasal folds. Histologically, the main lesions consisted of epithelial coagulation necrosis of renal convoluted tubules with presence of amorphous eosinophilic material in the lumen of the tubules. The diagnosis of poisoning by *T. glaucocarpa* was based on epidemiological data, clinical signs, necropsy findings, histopathological evaluation, renal serum biochemistry and plant identification in the areas of cattle pastures. After the start of the rainy season in this region, *T. glaucocarpa* is the main toxic plant responsible for significant economic losses. Since there is no effective treatment for animals with renal failure, it is recommended that the animals must be removed from the areas where the plant grows in the period immediately after the first rain.

Key words: *Thiloa glaucocarpa*, plant poisoning, nephrosis, cattle.

Introduction

Thiloa Eichl., is a small genus that belongs to the Combretaceae family. Species of *Thiloa* are endemic in tropical South America, mainly in Bolivia, Peru and Brazil (13). *T. glaucocarpa Eichl*., a shrubby tree, is a very common species of the Brazilian Caatinga Savanna (10) and in the semiarid regions of northeastern Brazil, *T. glaucocarpa* is an important nephrotoxic plant for cattle. Despite the presence of *Thiloa* species in South American countries, poisonings, until to date, were just reported in Brazil. When the leafs are ingested by cattle, cause a subacute disease, with evolution between 5 and 20 days, and the main clinical sign is the subcutaneous edema.

The first reports of *T. glaucocarpa* poisoning were made by Tokarnia et al. in 80`s (17), but despite the importance of poisonings in Brazil, recent detailed data have not been reported in northeastern. In other hand, according to several floristic surveys (7, 8, 10, 11) *T. glaucocarpa* is widely diffused in several northeastern states, such as Rio Grande do Norte, Paraíba, Alagoas, Maranhão and Sergipe. Despite its wide distribution, the poisonings have not yet been described in these regions (12). It is believed that outbreaks of poisonings by this plant in cattle are being underreported, especially in

regions where there are no veterinary diagnostic laboratories.

The aim of this work is to describe the epidemiological, clinical and pathological aspects of spontaneous poisoning by *T. glaucocarpa* in cattle in northeastern Brazil.

Material and Methods

All applicable national, and institutional guidelines for the care and use of animals were followed. The animal procedures were approved by the Ethics Committee on the Use of Animals (Register 175 CEP/UNIC).

The epidemiological survey to investigate cases of *T. glaucocarpa* poisonings in cattle was carried out in the semiarid region of Paraíba (districts of Salgado de São Félix and Itabaiana) and in the northern forest zone of Pernambuco (districts of Macaparana and Timbaúba). The predominant climate in these municipalities is the semiarid, with high temperatures and scarce or poorly distributed rainfall. For the study, 20 farms (5 farms in each district) were visited, where interviews were carried out with cattle breeders and professionals linked to agricultural activities, between 2011 to 2016. For the interviews, a form like the ones used previously (12) were used with questions about the occurrence of toxic plant and outbreaks in the affected regions.

Eight adult cattle, six females and two males (Bovine 1-8), naturally poisoned by *T. glaucocarpa* were examined in detail (2, 15). The general condition, appetite, mucosal coloration, rectal temperature, heart and respiratory rates, abdomen shape and ruminal motility were evaluated. In addition, whole blood samples were collected by venipuncture of the jugular using vacuum plastic tubes with 9mL of capacity, without anticoagulant. These samples were centrifuged for 10 minutes at 2,500 rpm for serum separation. Subsequently the serum was pipetted and packed in plastic tubes with a capacity of 1,5 mL and these were kept at -20°C until the analysis could be performed. Commercial kits were used to evaluate urea, creatinine and chloride concentrations.

Five cattle were necropsied after spontaneous death. Samples of the central nervous system, liver, kidneys, heart, lung, lymph nodes, spleen, rumen, reticulum, omasum, abomasum and intestines were collected. Samples were fixed in 10% buffered formalin solution, processed routinely, embedded in paraffin, sectioned to a thickness of 5µm, stained with hematoxylin-eosin (HE) and analyzed by light microscopy.

Results

The poisonings reported by the interviewees occurred on farms with similar livestock farming characteristics. The management adopted was semi-extensive and the pastures were formed mainly by *Brachiaria* spp. In the semiarid region of Paraíba, *T. glaucocarpa* was mentioned in all properties as responsible for annual bovine deaths and in the northern forest zone of Pernambuco, *T. glaucocarpa* was mentioned in three farms. Those districts have similar climate characteristics. The vegetation is formed by sub-deciduous and deciduous forests, typical of wilderness areas. The climate is tropical and rainy, with a dry summer. The rainy season starts in March/April ending in September.

During investigations two outbreaks of poisoning were followed in Paraíba. The first outbreak occurred in May 2011, 27 days after the start of the rainy season. The pasture on this property was wild; the cattle was released during the day in an area of native vegetation with remaining caatinga areas. On the visit to the grazing sites, it was observed that there was many shoots of *T. glaucocarpa* (Fig. 1). From a total of 14 cattle at risk, three cows with an average age of five years became sick and died. The second outbreak occurred in June 2012 and affected a flock of 50 adult Nelore cattle. Of this flock, nine cattle become sick and 6 died. In Pernambuco, an outbreak occurred in June 2013 at the end of the rainy season and resulted in five deceased adult cattle. No outbreaks of poisoning were reported during 2014-2016 in those farms. During the period of outbreaks, the average rainfall indexes between March and July was 150 mm. After these months (between August and December) the average rainfall indices was 35 mm.

The evaluation of renal biochemistry in poisoned cattle resulted in significant changes. The values are summarized in Table 1. The intensity and the main clinical signs of poisoning observed in eight bovines are set out in Table 2. In the cattle that died, the evolution of the disease was between 8-12 days. Three cattle with mild clinical signs recovered fully between 45-51 days after the first clinical signs were observed. According to field observations, the clinical signs of *T. glaucocarpa* intoxication begin mainly with apathy, anorexia, dehydration, dry nostrils and progressive loss of weight. As the disease worsens, hydroelectrolytic changes such as ascites, subcutaneous edema, dryness of the rumen content, reticulum, omasum and rectal ampules, with feces in the form of cymbals. In the cattle examined, the most evident clinical manifestation was severe abdominal distension. Edema of the posterior part of the pelvic limbs and foreskin were only observed in two cattle.

The intensity of the main lesions observed in five necropsied cattle can be observed in Table 3. At necropsy, the main lesions consisted of a significant accumulation of fluid in the abdominal, thoracic and pericardial sac (Fig. 2A). There was pulmonary edema, and evident edema in the subcutaneous tissues (Fig. 2B), mesentery, perirenal tissue and abomasal folds (Fig. 2C). The rumen contents were very dry and formed large masses of compacted matter. The colon was distended by the presence of parched feces that took the form of cymbals (Fig. 2D). Areas of petechial hemorrhage were observed mainly in

the epicardium, endocardium and various segments of the digestive tract. The kidneys were marked pale both on the capsular surface and on the cut surface (Figs. 2E and 2F). Histologically, the main lesions were observed in the kidneys and consisted of coagulation necrosis of the epithelium of the renal contorted tubules with presence of amorphous eosinophilic material in the tubule lumen and interstitial infiltrate of mononuclear cells (Figs. 2G and 2H). In the submucosa of rumen, reticulum, omasum abomasum and duodenum there were significant areas of congestion, edema and discrete lymphocytic infiltrate. In the large intestine, changes in submucosa were discrete and also consisted of edema.

Figure 1. **A.** *T. glaucocarpa,* Adult Tree. **B.** Detail of mature winged fruits. **C.** *T. glaucocarpa* in bud stage (Salgado de São Félix, PB).

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Table 1. Concentrations of urea and creatinine from cattle spontaneously poisoned by *Thiloa glaucocarpa.*

	Cattle number							
	1	2	3	4	5	6	7	8
Urea (mg/dL) [a]	96	124	209	91	43	80	31	32
Creatinine (mg/dL)[b]	8.4	5.5	5.9	7.1	1.0	2.6	0.6	0.8

[a]Reference= 6-22 mg/dL;
[b]Reference= 0,5-1,10 mg/dL

Discussion

In the areas where this study was developed, *T. glaucocarpa* had never been described as an important toxic and recently, an outbreak of poisoning was described in a flock of cattle in the central region of Tocantins (northern of the country) where the vegetation is the Brazilian cerrado, another kind of savanna (4). Because of its large distribution, farmers and veterinarians must consider *T. glaucocarpa* when cattle present disseminated edemas and renal failure. In these cases, renal biochemistry should be evaluated (serum values of urea and creatinine would be significantly increased in most poisoned cattle).

In several countries of South America *Amaranthus hybridus*, *A. thus blitum*, *A. spinosus*, *A. quitensis* and *A. retroflexus* (3, 6, 14, 16) and *Metternichia princeps* (9) are important nephrotoxic plants to livestock.

Those plants must be considered into a differential diagnosis because they cause clinical signs and lesions very similar to those observed in cases of poisoning by *T. glaucocarpa* in cattle. In all these cases, the most important findings at postmortem examination are excessive cavitary fluid accumulation and edemas, especially if the perirenal tissue and most importantly the microscopic lesion is the coagulative necrosis of the epithelial tubules in the renal cortex with hyaline cylinders in the lumen of the tubules.

There is no effective treatment for animals that present renal failure, it is recommended that cattle be removed from areas where the plant vegetates in the period of rain.

Table 2. Intensity of clinical signs associated with *T. glaucocarpa* poisoning in cattle.

Clinical signs	Cattle number							
	1	2	3	4	5	6	7	8
Apatia	++ [a]	+++	++	+	-	++	+	+
Anorexia	++	+++	++	+	+	++	+	+
Dehydration	++	+++	+++	+	+	++	+	+
Polydipsia	++	++	+++	-	+	-	-	-
Mucosal congestion	+	++	+	-	+	-	-	-
Dry nostrils	+	++	+	-	-	-	-	-
Catarrhal nasal discharge	-	+	-	-	-	-	-	-
Pulmonary scarring	+	+++	+	-	-	-	-	-
Ruminal atonia	++	+++	++	+	-	+	+	+
Pasty stools	-	-	-	-	+	-	-	-
Dry stools	++	+++	+	-	-	-	-	-
Mucus in feces	+	-	-	-	+	-	-	-
Dark brown stools	+	-	-	+	+	+	+	+
Fetid Stools	+	-	-	+	+	+	+	+
Gnash of tooth	-	++	++	-	-	-	-	-
Abdominal distension	+++	+++	++	-	-	+	-	-
Weakness	++	+++	++	-	+	++	-	-
Brittle hair	++	++	++	+	+	++	+	+
Tearing	+	++	-	-	-	-	-	-
Weight Loss	+++	+++	+++	+	+	+++	+	+
Subcutaneous edemas	+++	+++	++	-	+	++	-	-
Prolonged recumbency	+++	+++	+++	+	+	+++	+	+

[a] + Mild clinical signs, ++ moderate, +++ severe, - absent.

Table 3. Intensity of Main Lesions Associated with *T. glaucocarpa* Poisoning in Cattle.

Gross and Histological Lesions	Cattle number				
	1	2	3	4	5
Subcutaneous edema	++ [a]	+++	++	+	-
Hydropericardium	++	+++	++	+	-
Hydrothorax	++	+++	+	+	-
Pulmonary edema	++	+++	++	+	+
Ascites	++	+++	+++	+	+
Edema of abomasum folds	+	++	+	+	+
Dry rumen contents	++	++	+++	-	+
Parched feces	+	++	+	-	+
Pale and enlarged kidneys	-	+	-	-	-
Necrosis of kidney tubular epithelia	+	+++	+	-	-
Interstitial nephritis	-	++	+	+	++
Congestion of blood vessels in digestive tract	++	+++	++	+	-
Edema of submucosa's in digestive tract	+++	+++	+++	+	+
Infiltrate of mononuclear cells in the digestive tract Submucosa	+++	+++	+++	+	+

[a] + Mild lesions, ++ moderate, +++ severe, - absent.

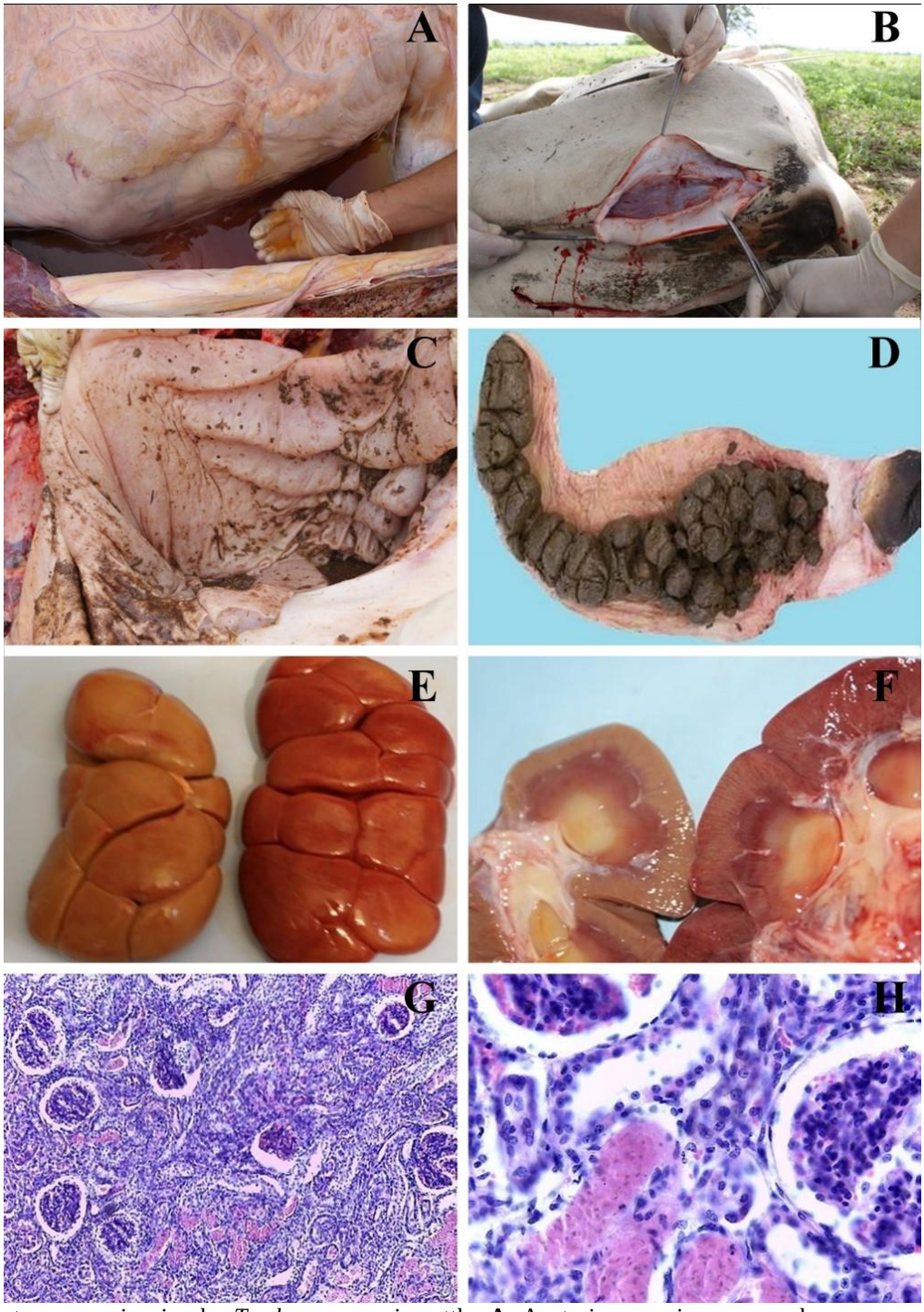

Figure 2. Spontaneous poisoning by *T. glaucocarpa* in cattle. **A.** Acute increase in rumen volume, congestion of serosa vessels, and significant amount of serous effusion in the abdominal cavity. **B.** Clear edema of the subcutaneous tissue of the posterior part of the left pelvic limb. **C.** Abomasal folds with marked mucosal edema. **D.** Colon with accumulation of feces dry and in the form of cymbals. **E.** Gross macroscopy of cattle kidney with pallor on the capsular surface (left) beside a normal kidney (right). **F.** Pallor on the cut surface (left) beside a normal kidney (right). **G.** Coagulation necrosis of the renal tubules cortex, which are filled with amorphous eosinophilic material. There is also atrophy of renal glomeruli and moderate diffuse mononuclear cells infiltrate in the renal parenchyma. **H.** Increased capsular space, dilated lumen of the renal tubules, flattened and lysing epithelial cells. Staining: HE

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Conflict of interest

The authors declare that they have no conflict of interest.

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