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Spontaneous outbreak of *Senna occidentalis* poisoning in cattle after extreme flooding in southern Brazil[1]

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ABSTRACT.– Keil E., Menegatt J.C.O., Bertolini M., Perosa F.F., Sonne L., Pavarini S.P., Driemeier D. & Panziera W. 2026. **Spontaneous outbreak of *Senna occidentalis* poisoning in cattle after extreme flooding in southern Brazil.** *Pesquisa Veterinária Brasileira 46:e07837, 2026.* Setor de Patologia Veterinária, Departamento de Patologia Clínica Veterinária, Faculdade de Veterinária, Universidade Federal do Rio Grande do Sul (UFRGS), Av. Bento Gonçalves 9090, prédio 42505, Porto Alegre, RS, 91540-000, Brazil. E-mail: weldenpanziera@yahoo.com.br

Natural disasters can affect humans, livestock, and companion animals by increasing the risk of disease outbreaks, which may be infectious or non-infectious. This article documents an outbreak of spontaneous *Senna occidentalis* poisoning in beef cattle following the severe flooding that affected Rio Grande do Sul in May 2024. A group of 450 yearling Angus steers was confined to an area of approximately 300 hectares with forage scarcity and with high density of *S. occidentalis*. After one week, 16 of the 450 steers developed muscle-related clinical signs, characterized by incoordination, muscle tremors, and reluctance to move. Ten cattle died after a clinical course of 24–96 hours (morbidity rate 3.55%, mortality rate 2%, and lethality rate 62.5%). Blood samples from one clinically affected animal had markedly elevated serum levels of aspartate aminotransferase (4,989 U/L) and creatine kinase (12,171 U/L). One steer was necropsied and postmortem findings consisted of necrosis of skeletal muscles of the pelvic and thoracic limbs. After removal of the cattle from the area containing the plant, no new cases were observed. This study describes an outbreak of *S. occidentalis* poisoning in cattle under unusual epidemiological conditions, namely following an extreme climatic event involving flooding.

INDEX TERMS: Natural disasters, bovine diseases, myopathy, toxic plants, coffee senna.

RESUMO.- [Surto espontâneo de intoxicação por *Senna occidentalis* em bovinos após enchentes extremas no sul do Brasil.] Desastres naturais podem afetar humanos, animais de produção e animais de companhia e aumentar o risco de surtos de doenças, que podem ser infecciosas ou não infecciosas. Este artigo documenta um surto de intoxicação espontânea por *Senna occidentalis* em bovinos de corte após as severas enchentes que afetaram o Rio Grande do Sul em maio de 2024. Um lote de 450 bovinos, machos, Angus, de um ano de idade, foi confinado em uma área de aproximadamente 300 hectares, com escassez de forragem e alta densidade de *S. occidentalis*. Após uma semana, 16 dos 450 bovinos desenvolveram sinais clínicos relacionados à lesão muscular, caracterizados por incoordenação, tremores musculares e relutância em se movimentar. Dez bovinos morreram após um curso clínico de 24 a 96 horas (taxa de morbidade de 3,55%, taxa de mortalidade de 2% e taxa de letalidade de 62,5%). Amostras de sangue de um bovino clinicamente afetado apresentaram níveis séricos marcadamente elevados de aspartato aminotransferase (4.989 U/L) e creatina quinase (12.171 U/L). Um novilho foi submetido à necropsia, e os achados post-mortem consistiram em necrose dos músculos esqueléticos dos membros pélvicos e torácicos. Após a retirada dos animais da área contendo a planta, não foram observados novos casos. Este estudo descreve um surto de intoxicação por *S. occidentalis* em bovinos sob condições epidemiológicas incomuns, especificamente após um evento climático extremo envolvendo enchentes.

TERMOS DE INDEXAÇÃO: Desastres naturais, doenças de bovinos, miopatia, plantas tóxicas, coffee senna.

INTRODUCTION

Natural disasters can impact humans, livestock, and companion animals. An important concern during these events is the potential for disease outbreaks, which can be infectious and non-infectious (USGPO 2002, Cecco et al. 2022). In animals, notable issues include skin lesions (Taylor et al. 2020), traumatic injuries (USGPO 2002), and toxic causes, mainly induced by plants (Bandarra et al. 2010, Machado et al. 2023, Riet-Correa et al. 2023, Menegatt et al. 2025). The scarcity of food during extreme weather events, or access to fallen trees after storms, can lead to the consumption of potentially toxic plants by livestock. In South America, these epidemiological circumstances have predisposed to poisoning caused by various plant species (Bandarra et al. 2010, Machado et al. 2023, Riet-Correa et al. 2023, Menegatt et al. 2025).

The genus *Senna* (formerly called Cassia) has approximately 250-300 accepted species distributed throughout the world and located mainly in Africa, Asia, Latin America, North America, Central America, and Oceania (Oladeji et al. 2021, Yin et al. 2022), with *S. occidentalis* (coffee senna) and *S. obtusifolia* (sicklepod) being the main toxic species reported in veterinary medicine (Barth et al. 1994, Barros et al. 1999, Carmo et al. 2011, Furlan et al. 2014, Yin et al. 2022). *S. occidentalis*, formerly *Cassia occidentalis*, is an important plant associated with cases of toxic necrotic myopathy in livestock, mainly in cattle in Brazil (Barth et al. 1994, Barros et al. 1999, Carmo et al. 2011, Takeuti et al. 2011) and in the United States (Yin et al. 2022).

Poisoning by *S. occidentalis* and other toxic plants following extreme weather events is uncommonly reported in animals (Carmo et al. 2011). Droughts, floods, and heat waves have become more frequent and directly affect the balance of ecosystems, pastures, and the behavior of toxic plants. Thus, climatic disasters are also considered economic events, as they can result in mortality and reduced productivity of livestock. This article aims to report an outbreak of *S. occidentalis* poisoning in cattle in Brazil following the floods that occurred May 2024 in Southern Brazil.

MATERIALS AND METHODS

Ethical approval. The procedures described here were conducted in accordance with the Research Committee of the Faculty of Veterinary of the Universidade Federal do Rio Grande do Sul, Brazil (nº 37662). Samples were submitted as part of routine clinical diagnostic testing following institutional and national guidelines.

The epidemiological data, including management practices, feeding, number of affected animals, and clinical signs of the outbreak, were obtained through interviews with the veterinarian and the farm owner. A one-year-old clinically affected Angus steer was sent alive to the Setor de Patologia Veterinária of the Universidade Federal do Rio Grande do Sul (SPV-UFRGS) for necropsy. Blood samples from this steer were collected for biochemical analysis of aspartate aminotransferase (AST) and creatine kinase (CK). Samples of various organs were collected (skeletal muscles [semimembranosus, semitendinosus, biceps brachii, triceps brachii, longissimus dorsi, psoas major, pectus, sub-scapularis, supraspinatus, intercostalis, diaphragm], lymph nodes, spleen, liver, pancreas, rumen, reticulum, omasum, abomasum, small and large intestines, kidneys, adrenals, urinary bladder, lungs, heart, and encephalon), fixed in 10% buffered formalin, routinely processed, sectioned at 3-5 µm, and stained with hematoxylin and eosin (HE) for histopathological analysis. Samples of skeletal muscle were also stained using Masson's trichrome and Periodic Acid-Schiff (PAS) histochemical methods. Samples of *Senna occidentalis* were collected from the farm where the outbreak occurred and were subsequently identified (ICN 214941) at the Laboratório de Botânica of the Universidade Federal do Rio Grande do Sul, Brazil.

RESULTS

The poisoning outbreak occurred on a rural property in the municipality of Cachoeira do Sul (30° 02′ 20″ S, 52° 53′ 38″ W), in the central region of Rio Grande do Sul, Brazil. The farm was dedicated to beef cattle production and included different cattle categories (cows, calves, heifers, and steers). The property was affected by the severe floods that occurred in the state in May 2024 (EMATER/RS 2024), which led to the concentration of a group of 450 one-year-old male Angus cattle in a partially flooded native pasture area of about 300 hectares on the property, with limited access to food. The cattle in other categories (cows and calves) were removed from the flooded areas and were not affected (Fig. 1). After one week in this area, 16 animals showed clinical signs initially characterized by motor incoordination, muscle tremors in the pelvic limbs, and reluctance to move, with difficulty remaining in a standing position. These signs progressed to sternal and/or lateral recumbency, tympanism, and the death of nine animals (morbidity rate 3.55%, mortality rate 2%, and lethality rate 62.5%). The clinical course ranged from 24 to 96 hours. In the paddock where the cattle were kept, there was a large amount of Senna occidentalis in different developmental stages, with evidence of consumption of all parts of the plant (Figs. 2-3). The cattle were not

supplemented with feed or mineral salt. Blood samples from a clinically affected one-year-old Angus steer demonstrated elevated serum levels of AST and CK, with values of 4,989 U/L (reference value: <366 U/L) and 12,171 U/L (reference value: <540 U/L), respectively.

At necropsy of the steer submitted to the SPV-UFRGS, gross findings were predominantly located in the skeletal muscles of the pelvic and thoracic limbs, where multifocal to coalescing areas of pallor were observed, most evident on cut surfaces. Occasionally, slight deposition of mild yellow gelatinous material (edema) was seen between muscle bundles. These lesions were most evident in the semimembranosus, semitendinosus, and triceps brachii muscles (Fig. 4), but were also observed in the biceps brachii, longissimus dorsi, psoas major, pectus, subscapularis, and supraspinatus muscles. Upon opening the rumen, seeds compatible with *S. occidentalis* were found. No macroscopic lesions were evident in other organs.

Longitudinal and transverse histologic sections of skeletal muscle had rounded, swollen, hypereosinophilic myofibers with loss of cross striations (hyaline necrosis) (Fig. 5). Fragmented myofibers (floccular necrosis) were also present. Mild multifocal to coalescing inflammatory infiltrates composed of macrophages intermingled and infiltrated necrotic myofibers (Fig. 6). In some areas, mild fibrosis, myofiber regeneration, and satellite cell proliferation were also noted. Skeletal muscle samples submitted to Masson's trichrome histochemical staining revealed the presence of mild fibrosis between myofibers, especially in the semimembranosus, semitendinosus, and triceps brachii muscles (Fig. 7). Periodic Acid-Schiff (PAS) histochemical staining of the same samples revealed pallor and loss of glycogen granules in the myofibers, indicating glycogenolysis due to muscle necrosis (Fig. 8). After the removal of the cattle from the paddock with *S. occidentalis*, there were no new cases.

DISCUSSION

Based on clinicopathological and epidemiological findings, a diagnosis of muscular necrosis due to ingestion of *S. occidentalis* was established. The identification of the plant in the area where the cattle were kept was decisive in confirming the diagnosis. Notably, clinical cases ceased after the animals were removed from the affected paddock, and no other toxic plants or substances known to induce muscular lesions were identified.

Poisoning by *Senna* spp. occurs under two epidemiological conditions: ingestion of grains or hay contaminated with seeds and other parts of the plant, and ingestion of the plant during grazing (Barth et al. 1994, Barros et al. 1999, Carmo et al. 2011, Takeuti et al. 2011, Furlan et al. 2014, Yin et al. 2022). In the present case, the poisoning occurred during grazing, the most common form of exposure in cattle (Carmo et al. 2011), with a high fatality rate (56.25% - 9/16). The outbreak occurred under uncommon and poorly documented epidemiological conditions. The exposure occurred after a climatic disaster, during which an extreme period of rainfall and subsequent flooding forced the cattle to seek refuge in an area with limited availability of good-quality forage and with heavy infestation by the toxic plant.

Prior and during this outbreak, the state of Rio Grande do Sul experienced severe floods due to heavy rains, affecting multiple municipalities. Natural disasters, such as floods and hurricanes, typically increase risks and predispose humans, livestock, and companion animals to various diseases. Following such extreme weather events, infectious diseases such as leptospirosis are commonly observed (USGPO 2002). There are also reports of sudden livestock fatalities associated with massive attacks by dark rice field mosquitoes (*Psorophora columbiae*) following the passage of a hurricane (Cecco et al. 2022). However, there is limited discussion about the occurrence of poisonings from toxic plants after natural disasters. In South America, there are reports of *Trema micrantha* (Bandarra et al. 2010), *Myrocarpus frondosus* (Menegatt et al. 2025), and *Myoporum laetum* (Riet-Correa et al. 2023) poisoning associated with the consumption of leaves from branches that had fallen after storms. Another article reports an outbreak of *Lantana camara* poisoning in cattle under previously unknown epidemiological conditions, in which the animals ingested the plant as they sought shelter during stormy and cold days in a forest invaded by the plant and with little forage availability (Machado et al. 2023). In addition to direct economic losses, there are indirect impacts of extreme climatic effects, such as soil degradation and decrease in the availability of high-quality forage. Thus, the present occurrence raises awareness of toxic plant exposure following natural disasters in order to prevent future cases.

The toxic principle of coffee senna has not yet been well established, but several toxic compounds have been isolated, including diantroene, an anthraquinone-derived compound found in *S. occidentalis* seeds that can cause myopathy associated with mitochondrial damage (Carmo et al. 2011). In cattle, the clinical presentation of toxic myopathy is characterized by an afebrile condition, presenting with muscle weakness, muscle tremors, and reluctance to move. The affected animal typically exhibits sternal recumbency, is mostly alert, and has partially preserved appetite, eventually progressing to lateral recumbency and death (Barth et al. 1994, Carmo et al. 2011, Yin et al. 2022), similar to the findings in the present case. Additionally, myoglobinuria may be observed secondary to myofiber degeneration, with release of myoglobin into circulation and subsequent excretion in the urine (Carmo

et al. 2011, Takeuti et al. 2011). This clinical sign was not found in the present report, as well as in another study (Carmo et al. 2011). Nonetheless, its absence does not rule out a toxic myopathy.

Serum biochemistry findings include marked elevation in CK and AST levels resulting from skeletal muscle necrosis (Carmo et al. 2011, Takeuti et al. 2011), especially in the final phase of the disease. The significant increase in CK is the most prominent laboratory finding and serves as an important diagnostic indicator of myonecrosis. AST can also indicate muscle injury, especially in animals with severe muscle lesions (Takeuti et al. 2011). However, because this enzyme can also increase due to injury to other organs (e.g., liver), it should be evaluated together with other hepatic markers. In this regard, it is worth noting that poisoning by *S. occidentalis* (Carmo et al. 2011) and *S. obtusifolia* (Furlan et al. 2014) may also cause liver lesions; however, because high toxic doses are required, such lesions are uncommon in spontaneous outbreaks (Carmo et al. 2011).

At necropsy, gross findings were predominantly located in the skeletal muscles of the pelvic and thoracic limbs, where multifocal to coalescing areas of pallor were present, most evident on cut surfaces. These findings align with those documented in the literature for *Senna* spp. poisoning in cattle (Barth et al. 1994, Carmo et al. 2011, Takeuti et al. 2011, Furlan et al. 2014, Yin et al. 2022). Cardiac necrosis may also be occur in some cases, although it is typically less severe (Carmo et al. 2011). In the present case, toxic cardiomyopathy was not observed.

In the current scenario, *S. occidentalis* ingestion occurred for a week until the onset of clinical signs, which resulted in polyphasic muscular necrosis, with myofibers at different stages of injury and repair (hyaline necrosis, floccular necrosis and satellite cell proliferation). These different stages of muscular necrosis, together with the presence of fibrous connective tissue highlighted by Masson's trichrome staining, are consistent with a subacute polyphasic necrotic myopathy and suggest that the animals consumed smaller doses of the plant for several days.

Masson's trichrome and PAS histochemical stains are not usually used to characterize the muscle lesions in cases of *S. occidentalis* poisoning. Masson's trichrome staining is used to differentiate fibrous connective tissues from other soft tissues, aiding in the identification of interstitial fibrosis in skeletal muscle in older lesions. PAS staining highlights the sarcoplasmic deposition of glycogen granules, which in normal tissue have a homogeneous distribution at the periphery of the myofibers. In muscle tissue with lesions, even if subtle, this stain can therefore be useful for diagnosis because tissue injury changes the normal distribution of glycogen within myofibers (Schaart et al. 2004).

Among the main differential diagnoses, other causes of toxic myopathy should be considered, such as ingestion of ionophores, gossypol, toxic plants (mainly *S. obtusifolia*), and vitamin E/selenium deficiency (Carmo et al. 2011). The differentiation between poisoning by *S. obtusifolia* and by *S. occidentalis* is based on identifying one of these plants in the grazing area or by the presence of seeds in the feed. In this case, there was no history of exposure to ionophores or cotton seed (gossypol) before or during the illness, and vitamin E and selenium supplementation was considered unlikely given the age of the calves and supple-mentation practices at the farm.

CONCLUSION

This report describes an outbreak of *Senna occidentalis* poisoning in cattle under unusual epidemiological conditions, namely following an extreme climatic disaster involving floods. The diagnosis was supported by consistent epidemiological findings, clinical signs, necropsy, histopathology, and ancillary diagnostic techniques. Masson's trichrome and Periodic Acid–Schiff (PAS) stains were valuable in further characterizing the skeletal muscle lesions and supporting the diagnosis. The environmental disaster in Rio Grande do Sul led to the emergence of several animal diseases, with livestock being particularly affected. Toxic plant poisoning represented a significant health issue during this period, as exemplified by the outbreak described in this report.

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Conflict of interest statement. - The authors have no competing interests.

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Data availability statement. The data presented are available in the report archives of the "Setor de Patologia" of the "Universidade Federal do Rio Grande do Sul" (SPV-UFRGS) and will be made available upon request.

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Figures

Fig. 1-4. Spontaneous poisoning by *Senna occidentalis* in cattle following floods. (1) Pasture area on the property affected by the floods. (2) Large amount of *Senna occidentalis* in the paddock where the clinical case occurred, with evidence of consumption. (3) Specimen of *Senna occidentalis* collected from the property showing the seeds. (4) Cut surface of skeletal muscle from the thoracic limb (triceps) showing marked pallor (necrosis).

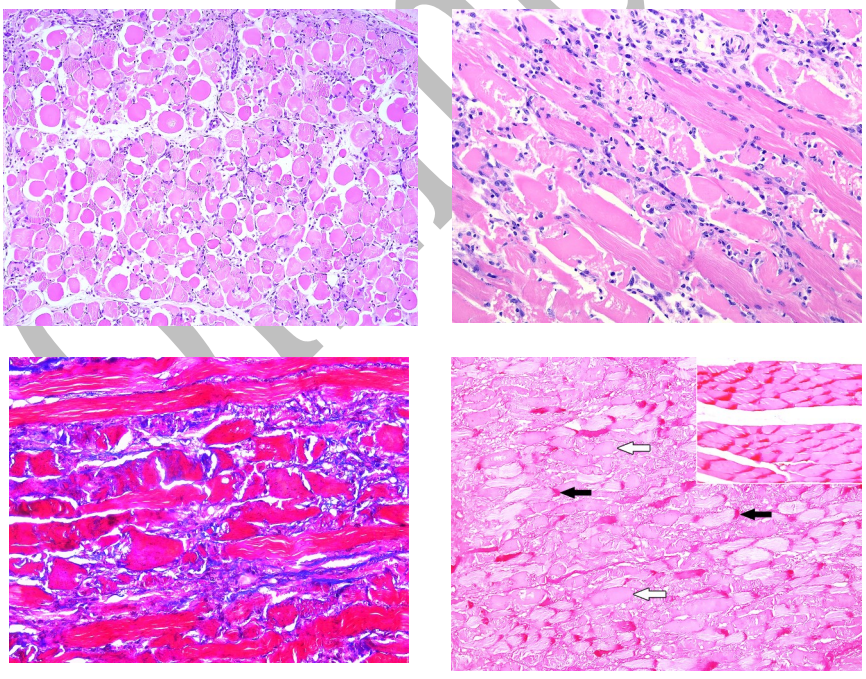

Fig. 5-8. Spontaneous poisoning by *Senna occidentalis* in cattle following floods. (5) Transverse section of skeletal muscle with hypereosinophilic swollen myofibers that lost cross striations, consistent with hyaline necrosis. Hematoxylin and eosin (HE), 100x. (6) Longitudinal section of skeletal muscle displaying fragmented fibers (floccular necrosis), occasional regenerative activity, and macrophage infiltrates. HE, 200x. (7) Interstitial fibrosis between myofibers, demonstrated by Masson's trichrome staining. 200x. (8) Skeletal muscle from Figure 7 with

extensive loss of sarcoplasmic staining with Periodic Acid–Schiff (PAS) stain (white arrows). Scattered myofibers with retained PAS staining are indicated by the black arrows. Inset: Intercostal skeletal muscle with the granular and peripheral staining pattern typical of unaffected myocytes. PAS stain, 100x.