

The principal plants which poison cattle in Brazil

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In Brazil, poisonous plants cause large economic losses of cattle and are considered to be as important as rabies and botulism. In this country there are approximately 70 plants of interest to animal husbandry which have had their toxicity confirmed by experiments with animal species affected under natural conditions. The great majority of these plants are only found in Brazil and neighbouring countries. A few of them are forage plants, which can be toxic under certain conditions.

The main data on these poisonous plants will be presented. These include their appearance, distribution and habitat, the conditions under which poisoning occurs, the toxic part of the plant, their toxicity, the clinical-pathological picture these plants provoke, the diagnostic means, the differential diagnosis, its toxic principles, treatment and prophylaxis.

The plants were divided according to the clinical-pathological picture they cause in cattle, as shown in Table 1. Only three groups of plants were divided by their toxic principles. These are the cyanogenic plants, those which cause nitrate/nitrite poisoning and those which cause oxalate poisoning. Additionally, data is presented on some plants that have been shown to be poisonous in experiments but whose practical importance is unclear. Finally, some data is given also on plants that were poisonous in experiments but are known to be of no significance to animal husbandry.

Plants which affect the heart

These plants can be subdivided in those which cause “sudden death” (a peracute poisoning, without significant alterations of the heart) and those which cause a subacute to chronic poisoning (with severe regressive alterations and fibrosis of the heart).

Plants that cause “**sudden death**” are the most important in Brazil. Twelve of the 70 poisonous plants of known practical importance in Brazil, belong to this group. They are responsible for half of cattle deaths caused by poisonous plants. Bovines are the main animals affected under natural conditions. These plants cause a poisoning that can be reproduced by the administration of single doses at either low (0.6 to 2 g/kg), or at medium levels (5 to 20 g/kg). It is characterized by a peracute course. The animals, apparently healthy, suddenly drop down to the ground, especially when exercised, and die in minutes. Post-mortem findings are practically non existent. Histopathology reveals inconsistent slightly regressive and circulatory alterations, in heart and liver. Regressive alterations in the kidney consisting of a hydropic-vacuolar degeneration of the epithelial cells of the distal convoluted tubules, are found more frequently. The clinical-pathological picture suggests that these plants possess toxic principles that interfere with the functioning of the heart, as all available data indicate that the animals die of an acute heart insufficiency.

Monofluoroacetic acid has been shown to be the poisonous principle of *Palicourea marcgravii* (fam. Rubiaceae). It is known, that this substance interferes with the Krebs cycle, having a strong toxic effect on the functioning of the heart and the central nervous system; the animals die from either ventricular fibrillation or excessive stimulation of the central nervous system. A predominance of nervous or cardiac symptoms depends on the species affected. In bovines, the predominant effect is on the heart. (Allcroft & Jones 1969, Hall 1972, Robinson & Maxie 1993)

The plants of this group belong to three different botanical families:

Rubiaceae: *Palicourea marcgravii*
 Palicourea aeneofusca
 Palicourea juruana
 Palicourea grandiflora

Bignoniaceae: *Arrabidaea bilabiata*
 Arrabidaea japurensis
 Pseudocalymma elegans

Malpighiaceae: *Mascagnia rigida*
 Mascagnia elegans
 Mascagnia pubiflora
 Mascagnia aff. rigida
 Mascagnia sp

Three other plants are known to have the potential to cause **subacute to chronic poisoning** (with severe regressive alterations and fibrosis of the heart). These are *Tetrapteryx acutifolia*, *Tetrapteryx multiglandulosa* (Malpighiaceae) and *Ateleia glazioviana* (Papilionoideae). The first two are important poisonous plants of the Southeastern Region and the last one is an important poisonous plant of the Southern Region of Brazil. The effect of these plants is quite different from those causing “sudden death”. *Tetrapteryx* spp, ingested in medium doses (5 g/kg/day) during long periods (about 60 days), cause subacute to chronic poisoning in cattle. This is characterized by ingurgitated and pulsing jugulars and brisket edema. Post-mortems reveal heart lesions consisting of whitish areas and streaks over much of the cut surface of the myocardium. The liver frequently has a nutmeg appearance, and there is generalized edema, including ascitis and hydrotorax. Histological examinations show that the heart lesions are characterized by necrosis of the heart fibers and fibrosis of the myocardium. Death can be provoked sometimes by exercise, especially when the poisoning is at an advanced stage. The poisonous principle of these plants are still unknown. Case histories and pathological data strongly suggest that *Tetrapteryx* spp are also responsible for stillbirths in cattle. *Ateleia glazioviana* also causes subacute to chronic poisoning in bovines when ingested in daily doses of at least 2.5 g/kg to reach or exceed 40 g/kg. It causes a similar clinical-pathological picture to *Tetrapteryx* spp in some cases. Other animals die of “sudden death”, in spite of showing similar heart lesions. Still, frequently the consumption of *A. glazioviana* causes a subacute to chronic poisoning, characterized by lethargy and a predominance of regressive alterations in the heart. It is also an important cause of stillbirths in cattle.

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Plants that affect the digestive tract

Contrary to the popular believe that associates the action of poisonous plants with digestive problems (especially with diarrhea and tympanism), there are only a few which produce such symptoms under practical conditions.

These plants can be subdivided into those that cause **lesions in the digestive tract** and those which cause **acute tympanism**. The more important plants in the first group are *Baccharis coridifolia* (fam. Compositae) and *Stryphnodendron coriaceum* (Mimosoideae). Other plants in this group are *Baccharis megapotamica*, *Sisyrinchium platense* (Iridaceae) and *Ricinus communis* (Euphorbiaceae).

Trifolium repens (Papilionoideae) belongs to the second group. Cyanogenic plants may sometimes also cause acute tympanism.

There are some plants that cause digestive disorders as well as other more serious symptoms of poisoning. Thus, in poisoning by *Polygala klotzschii* (Polygalaceae), besides the nervous disorders that dominate the clinical-pathological picture, there is severe liquid diarrhea later on. In poisonings by *Thiloa glaucocarpa* (Combretaceae) and by some species of *Amaranthus* (Amaranthaceae), both nephrotoxic plants, digestive disorders with pasty feces containing mucus and blood are seen as well as subcutaneous edemas. In acute poisoning by *Pteridium aquilinum* (Polypodiaceae), a plant of radiomimetic effects, bovines may have fetid and dark diarrhea. Together with the probable involvement of *P. aquilinum* in the pathogenesis of carcinomas in the upper digestive tract, digestive disorders such as deglutition errors with coughing, regurgitation of food, chronic intermittent tympanism and diarrhea, may also occur.

Hepatotoxic plants

In Brazil, the hepatotoxic plants of practical importance, belong to three families:

Solanaceae: *Cestrum laevigatum*
 Cestrum parqui
 Cestrum corymbosum var. *hirsutum*
 Cestrum intermedium
 Sessea brasiliensis

Compositae: *Vernonia mollissima*
 Vernonia rubricaulis
 Xanthium spp
 Senecio brasiliensis
 Senecio cisplatinus
 Senecio heterotrichius

Senecio selloi
Senecio oxyphyllus
Senecio tweediei

Borraginaceae *Echium plantagineum*

In general, ingestion of these plants in large single doses, causes severe **hepatic dystrophic lesions**. The repeated ingestion of smaller doses causes **hepatic cirrhosis**. This has been confirmed with *Cestrum laevigatum*, *Sessea brasiliensis* and *Senecio brasiliensis*.

However, when *Cestrum laevigatum* and *Sessea brasiliensis* are ingested in repeated sublethal doses, they can provoke either chronic poisoning or acute poisoning, in this last case due to its cumulative effect. Ingestion of *Cestrum corymbosum* var. *hirsutum*, in repeated doses, only causes acute poisoning (cumulative effect), whilst *Vernonia mollissima* causes subacute poisoning. Curiously, *Senecio brasiliensis* when ingested in one medium dose, can cause chronic poisoning with hepatic cirrhosis.

Current knowledge of poisonings under natural conditions show that they are acute with *Cestrum laevigatum*, *C. parqui*, *C. corymbosum* var. *hirsutum*, *C. intermedium*, *Sessea brasiliensis*, *Vernonia mollissima*, *V. rubricaulis* and *Xanthium* spp, but generally chronic with *Senecio brasiliensis*, *Senecio* spp and *Echium plantagineum*.

Not included in this group are the plants that cause hepatic photosensitivity, but a special type of hepatic disturbances; they are treated apart, under "Plants that cause photosensitivity". Some hepatotoxic plants, as *Senecio brasiliensis*, *Senecio* spp and *Echium plantagineum* can in its chronic form of poisoning cause photosensitivity in a few animals.

Nephrotoxic plants

Thiloa glaucocarpa (Combretaceae) is the most important toxic plant of this group. The other nephrotoxic plants of practical importance are *Amaranthus* spp.

Plants that cause neurological disorders

This group of poisonous plants is well represented in Brazil. Two of them, *Ipomoea fistulosa* and *Ipomoea asarifolia*, belong to the Convolvulaceae family. The leaves of *Ricinus communis* (Euphorbiaceae) cause neuromuscular disturbances where as their seeds provoke digestive disorders. *Polygala klotzschii* (Polygalaceae), *Solanum fastigiatum* var. *fastigiatum* (Solanaceae) and *Halimium brasiliense* (Cistaceae) are three other poisonous plants causing nervous symptoms that are of interest to animal husbandry. In recent years, prolonged ingestion of the pods of *Prosopis juliflora*, (Mimosoideae), have been shown to cause a disease in cattle known as "cara torta" (distorted face).

The mycotoxicosis caused by *Claviceps paspali* has been observed in cattle kept on pastures of *Paspalum notatum* and *Paspalum dilatatum*.

In the case of *Equisetum* spp (fam. Equisetaceae), there are only case histories showing that they cause nervous symptoms in horses.

Apart from producing radiomimetic effects in cattle, ingestion of *Pteridium aquilinum* in horses leads to nervous disorders as it possesses an enzyme that destroys thiamine.

Some hepatotoxic plants, especially *Cestrum laevigatum*, *Sessea brasiliensis*, *Senecio* spp and *Echium plantagineum*, can also provoke nervous symptoms (hepatocerebral disease) in some poisoned animals.

Baccharis coridifolia, which mainly produces disorders of the digestive tract, can also provoke nervous symptoms.

Plants that cause degeneration and necrosis of muscle

The plants of this group mainly affect the skeletal muscles, but they also may cause less severe lesions in the heart and in other organs.

So far, the only known poisonous plant in this group that has practical importance in Brazil, is *Cassia (Senna) occidentalis*.

Plants that cause photosensitivity

There are very few plants in the world that cause **primary photosensitivity**. Two of them occur in Brazil. One is *Fagopyrum esculentum*, which is grown in Southern Brazil. The other is *Ammi majus*, which was recently shown to be responsible for an outbreak of primary photosensitivity in cattle in Rio Grande do Sul.

Photosensitivity in domestic animals in Brazil, as in most areas of the world, is of a **secondary** nature.

Plants of practical importance that have been studied in Brazil are *Lantana* spp (Verbenaceae), *Myoporum laetum* (Myoporaceae) and *Brachiaria* spp (Gramineae).

The few bovines that survive the gastrointestinal effects of eating the pods of *Stryphnodendron coriaceum*, may show photosensitivity.

The plants that cause hepatic cirrhosis may, in a small number of animals, provoke hepatogenous photosensitivity. This has been seen with *Senecio* spp and *Echium plantagineum*.

There are reports from other countries on hepatogenous photosensitivity caused by plants that are also found in Brazil but not studied there. Examples are *Panicum* spp, *Cynodon dactylon* and *Lupinus* spp. Others in which it is still not clear if the photosensitivity is primary or secondary that have not been studied in Brazil, are: *Trifolium platense*, *Trifolium subterraneum*, *Medicago sativa*, *Brassica* spp, *Vicia* spp, *Sorghum vulgare* var. *Sudanense* and *Avena sativa*.

The etiology of some outbreaks of photosensitivity in Brazil has not been established. Some examples that we have observed or obtained case histories for, have occurred in the marginal areas of the Pantanal (county of Aquidauana), in the São Francisco river valley (counties of Coripós, PE, Ibotirama, BA), in the boundary region of Rio Grande do Sul with Uruguay (county of Forquilha, RS), in coastal areas of Piauí and Ceará, in the “Serra da Ibiapaba” (Ceará and Piauí) and in the north of the State of Espírito Santo (county of São Mateus).

Plants with radiomimetic action

The only plant in this group is *Pteridium aquilinum*. This plant is well known as an invader plant but few people know or accept that *P. aquilinum* is one of the most important poisonous plants in the country.

In view of the economical losses which it causes to cattle farms, and in view of its interesting clinical-pathological aspects and possible importance as a carcinogen for man, *P. aquilinum* has been well studied. The work of I. Antice Evans and W. Charles Evans must be mentioned.

Plants that cause systemic calcification (calcinosis)

In various regions of the world there are diseases characterized by systemic calcification or calcinosis. The etiology of these diseases has generally been attributed to imbalances in mineral nutrition of the animals.

Carrillo & Worker (1967) demonstrated that “enteque seco”, a calcinosis which occurs in Argentina, is caused by the ingestion of the leaves of *Solanum malacoxylon*. Soon after this, a number of other diseases characterized by systemic calcification were shown to be due to the ingestion of certain plants. Two diseases of this group were studied in Brazil. “Espichamento”, a disease of cattle that occurs in the Pantanal of Mato Grosso, was shown to be caused by the ingestion of *S. malacoxylon*. The calcinosis of sheep found in Rio Grande do Sul, is due to the ingestion of *Nierembergia veitchii*.

The toxic principle of *S. malacoxylon* is a steroidal glycoside, which after hydrolysis, acts biologically and chromatographically like 1,25(OH)₂D₃, the active metabolite of vitamin D₃. Similar activity has been shown for *N. veitchii*, but additional studies are necessary to establish the exact nature of its toxicity.

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Plants that affect reproduction

The plants that affect reproduction can be divided into those with oestrogenic activity and those that cause abortion. Very little is known about the occurrence of oestrogenic plants and problems caused by them in Brazil. On the other hand, there is a lot of information on the abortive effects claimed for many plants.

Plants with oestrogenic activity. Only one observation on hyperoestrogenism caused by pasture phyto-oestrogens has been reported. Pimentel et al. (1977) observed hyperoestrogenism in a herd of Friesian heifers kept in artificial pasture composed of 95% of *Trifolium subterraneum* L. var. Yarloop and 5% of *Lolium multiflorum* in southern Brazil.

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Plants that provoke abortion. Three Brazilian plants: *Tetrapteryx* spp, *Ateleia glazioviana* and *Stryphnodendron obovatum* have experimentally been confirmed to cause abortion in cows.

Tetrapteryx spp and *Ateleia glazioviana* also affect heart function and cause subacute to chronic poisoning, with severe regressive alterations and fibrosis of the heart.

The pods of *Dimorphandra mollis* and *Enterolobium contortisiliquum* also are frequently blamed for abortion, but this could not yet be confirmed.

Many heifers aborted during an outbreak of poisoning by *Lantana glutinosa* in cattle, in Santa Catarina. Although this effect is not mentioned in the international literature on *Lantana* spp, Riet-Correa et al. (1984) believe that it can occur.

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Plants that affect skin and adnexa

The only toxic agent of practical importance in this group in Brazil, is *Ramaria flavo-brunnescens*, a mushroom that affects the keratinization process.

Ingestion of *Leucaena leucocephala* is known to affect the skin and adnexa, but there are no reports on it becoming a problem in Brazil.

Plants that cause hemolytic anemia

Two plants in this group have caused poisonings in Brazil. One is the pasture grass *Brachiaria radicans*, which contains a toxic principle responsible for the hemolytic anemia and may also have high content of nitrates. Another cause of anemia is *Ditaxis desertorum*, (Euphorbiaceae).

Cyanogenic plants

The most important are *Manihot* spp. Other cyanogenic plants of less importance are *Prunus sphaerocarpa*, *Piptadenia macrocarpa*, *P. viridiflora*, *Sorghum vulgare* and a *Cynodon* sp. However, confirmed poisoning by cyanogenic plants is not as common and important as believed by many Brazilian ranchers.

Plants that cause nitrate/nitrite poisoning

There are few reports of nitrate/nitrite poisoning of farm animals in Brazil. Some years ago, they were suspected of being the cause of severe mortalities in cattle in various parts of the country. It is now known that these were due to epizootic botulism.

On one occasion in Rio Grande do Sul, a diagnosis of nitrate/nitrite poisoning was presumed in cows that were placed in a field of corn stubble heavily invaded by *Amaranthus* spp. (Schild et al. 1996).

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Plants that cause oxalate poisoning

There are many Brazilian plants that belong to families rich with species containing oxalates. But little is known about problems eventually caused by them.

Acute/subacute poisoning. A few rare cases have been reported. In the county of Ribas do Rio Pardo, Mato Grosso do Sul, oxalate poisoning was reported in milking cows in a pasture of *Setaria anceps* cv. Kazungula (Schenk et al. 1982).

In another case in the county of Santa Vitoria do Palmar, Rio Grande do Sul, oxalate poisoning was suspected in sheep that had spent the day in a stubble field containing considerable amounts of a red flowered *Oxalis* sp (Ferreira et al. 1991).

Chronic poisoning. Information was obtained in July of 1969 from the county of Rondonópolis, Mato Grosso, that horses kept exclusively on pastures of *Panicum maximum*, suffered a lot from “cara inchada” (enlarged face). Clinical examination showed these horses suffered from fibrous osteodystrophy. At that time, the occurrence of this disease in horses kept exclusively on pasture was thought strange. It was learned from Australian research, that oxalate values are often high in *Panicum* pastures.

Tosi (1979), cited by Pupo (1984, 1986), observed osteodystrophy in horses kept on pastures of *Brachiaria humidicola*, *Panicum maximum* and *Penisetum purpureum* in the State of São Paulo.

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Table 1. The poisonous plants of Brazil

Poisonous plants of importance to animal husbandry

1. Plants which affect the heart:

Plants that cause "sudden death" (peracute poisoning): *Palicourea marcgravii*, *P. aeneofusca*, *P. juruana*, *P. grandiflora*, *Arrabidaea bilabiata*, *A. japurensis*, *Pseudocalymma elegans*, *Mascagnia rigida*, *M. elegans*, *M. pubiflora*, *M. aff. rigida*, *Mascagnia* sp.

Plants that cause subacute to chronic poisoning: *Tetrapteryx* spp, *Ateleia glazioviana*.

2. Plants that affect the digestive tract:

Plants which cause lesions in the digestive tract: *Baccharis coridifolia*, *B. megapota mica*, *Stryphnodendron coriaceum*, *Sisyrinchium platense*, *Ricinus communis* (seeds).

Plants which cause acute bloat: *Trifolium repens* and cyanogenic plants.

3. Hepatotoxic plants: *Cestrum laevigatum*, *C. parqui*, *Cestrum corymbosum* var. *hirsutum*, *C. intermedium*, *Sessea brasiliensis*, *Vernonia mollissima*, *V. rubricaulis*, *Xanthium* spp, *Senecio* spp, *Echium plantagineum*.

4. Nephrotoxic plants: *Thiloa glaucocarpa*, *Amaranthus* spp.

5. Plants that cause neurological disorders: *Ipomoea fistulosa*, *I. asarifolia*, *Ricinus communis* (leaves and pericarp), *Polygala klotzschii*, *Solanum fastigiatum* var. *fastigiatum*, *Halimium brasiliense*, *Prosopis juliflora*, *Claviceps paspali* (fungus on *Paspalum* spp), *Equisetum* spp, *Pteridium aquilinum*.

6. Plants that cause degeneration and necrosis of muscle: *Cassia (Senna) occidentalis*.

7. Plants that cause photosensitivity:

Plants that cause primary photosensitivity: *Fagopyrum esculentum*, *Ammi majus*.

Plants that cause secondary (hepatogenous) photosensitivity: *Lantana* spp, *Pithomyces chartarum* (fungus) / *Brachiaria* spp.

8. Plants with radiomimetic action: *Pteridium aquilinum*.
9. Plants that cause systemic calcification (calcinosis): *Solanum malacoxylon*, *Nierembergia veitchii*.
10. Plants that affect reproduction:
Plants with oestrogenic activity: *Trifolium subterraneum*
Plants that provoke abortion: *Tetrapteryx* spp, *Ateleia glazioviana*, *Stryphnodendron obovatum*.
11. Plants that affect the skin and adnexa: *Ramaria flavo-brunnescens* (mushroom).
12. Plants that cause hemolytic anemia: *Brachiaria radicans*, *Ditaxis desertorum*.
13. Cyanogenic plants: *Manihot* spp, *Prunus sphaerocarpa*, *Piptadenia macrocarpa*, *P. viridiflora*, *Sorghum vulgare* and other toxic grasses (*Cynodon* sp).
14. Plants that cause nitrate/nitrite poisoning: *Brachiaria radicans*.
15. Plants that cause oxalate poisoning: *Setaria anceps* cv. Kazungula, *Brachiaria humidicola*.

Plants causing experimental poisoning but of unclear practical importance

Plants that affect the digestive tract: *Coutoubea ramosa*, *Schultesia guianensis*, *Humirianthera* spp, *Plumbago scandens*, *Vernonia nudiflora*, *Enterolobium contortisiliquum*, *Stryphnodendron barbatimao*.

Hepatotoxic plants: *Vernonia squarrosa*, *Crotalaria anagyroides*.

Nephrotoxic plants: *Dimorphandra mollis*, *Dimorphandra gardneriana*.

Plants that cause neurological disorders: *Aspidosperma pyricollum*, *Conium maculatum*.

Plants that cause photosensitivity: *Enterolobium gummiferum*.

Plants that affect skin and adnexa: *Leucaena leucocephala*.

Cyanogenic plants: *Holocalyx glaziovii*.

Plants of yet undetermined action: *Crotalaria mucronata*.

Plants causing experimental poisoning but of no significance to animal husbandry

Asclepias curassavica, *Abrus precatorius*, *Solanum aculeatissimum*, *Daphnopsis* spp and other "embiras".