Plant toxicity and plant selection

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- Toxicity considerations and strategies for plant selection
- Information and resources
- Examples

Gentle lemur (*Hapalemur griseus alaotrensis*)

When asked – *What do bandro eat?* – the majority of the 63 respondents answered papyrus *Cyperus madagascariensis*, reeds *Phragmites mauritianus*, or both (see Fig.5). Other plants mentioned included rice *Oryza sativa*, grass *Echinochloa* sp., and *Polyganum dichotonum*.

Feistner & Rakotoarinosy, 1993

Polygonum baldschuanicum

From Tierpark Dählhölzli Berne (Director: Dr M. MÜLLER FVH),
Institute for Animal Pathology, University Berne (Director: Professor M. SUTER)
and Jersey Wildlife Preservation Trust[2] (Director: J.J.C. MALLINSON)

POISONING OF ALAOTRAN GENTLE LEMUR (*HAPALEMUR GRISEUS ALAOTRENSIS*) BY RUSSIAN VINE (*POLYGONUM BALDSCHUANICUM*) AT THE JERSEY WILDLIFE PRESERVATION TRUST

By Nadia Robert and A. F. Allchurch[2]

Introduction

The Alaotran gentle lemur, *Hapalemur griseus alaotrensis*, is of very limited distribution, being confined to the papyrus and reed beds around Lac Alaotra, Madagascar. It is severely threatened with extinction due to the destruction of its natural habitat under the pressure of growing human population and hunting for pets or for food. Jersey has been involved in captive breeding of Alaotran gentle Lemur since 1990, with a founder group of 10 animals (FEISTNER and RAKOTOARINOSY, 1993). The first success of captive breeding was achieved in 1993 with the birth of a single infant and 1994 with the birth of twins.

Unlike all other *Hapalemur* species, which subsist primarily on bamboo, the Alaotran gentle lemur feeds mostly on papyrus (*Cyperus madagascariensis*) and reeds (*Phragmites mauritianus*) but has been seen to feed occasionally on other plants including rice (*Oryza sativa*), grass (*Echinochlea* sp.) and *Polygonum dichotonum* (FEISTNER and RAKOTOARINOSY, 1993). In Jersey they are principally fed vegetables, fruit, bamboo and a special cereal mixture.

Literature on clinical and pathological conditions arising from plant toxins in primates is extremely sparse. DREW and FOWLER (1991), for instance, refer to poisoning of black and white ruffed lemurs (*Varecia v. variegata*) by hairy nightshade (*Solanum sarrachoides*) containing an alkaloid glycoside. A number of plants of the family of *Polygonaceae*, including *Polygonum* spp. - knotweed, *Rumex* spp. - sorrel, dock and *Rheum* spp. - rhubarb, are known for their possible poisonous properties due to the oxalate content of the leaves (CLARKE and CLARKE, 1967; TEUSCHER and LINDEQUIST, 1994).

The purpose of this work is to describe the clinical and pathological features of poisoning following a single feed of Russian vine (*Polygonum baldschuanicum*) in a group of Alaotran gentle lemurs (*Hapalemur griseus alaotrensis*).

Animals, material and methods

After having been fed with Russian vine, all Alaotran gentle lemurs developed clinical symptoms, and one animal died after 10 days (M1635). A second animal was euthanasized 21 months later because of a progressively deteriorating condition (M1638). Detailed *post mortem* examination was carried out on both animals. Tissue samples of all major organs were taken, fixed in 10% neutral buffered formalin and processed for routine histological examination. Bacteriological and parasitological investigations of small and large intestine content were routinely performed.

In the course of illness, faecal samples of all gentle lemurs were submitted for bacteriological and parasitological examination. Urine samples were analysed using Combur 9-Test® sticks (Boehringer Mannheim).

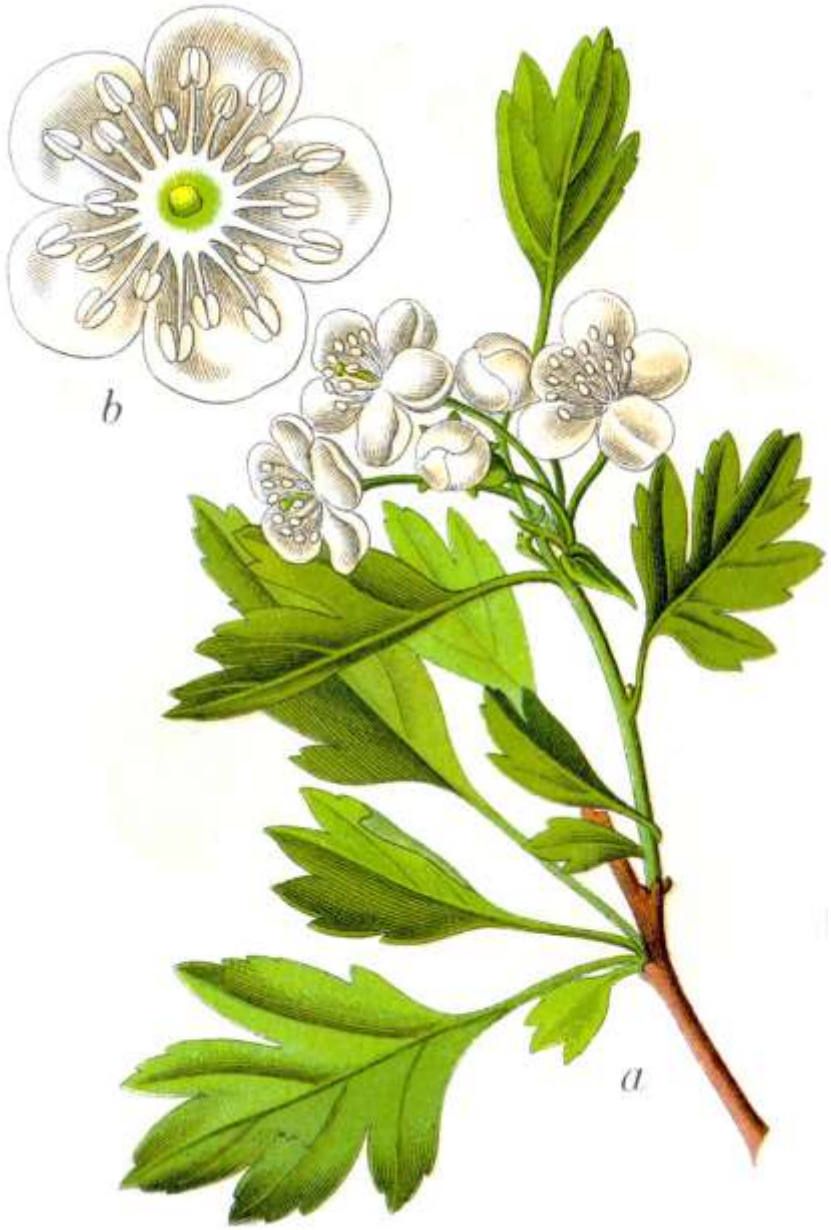
Russian vine leaves were submitted to the Official Analyst's Laboratory in Jersey and were examined for oxalic content.

Robert & Allchurch, 1995

Paracelsus (Philippus Aureolus Theophrastus Bombastus von Hohenheimborn 1493-1541)

Alle Ding sind Gift und nichts ohn' Gift; allein die Dosis macht, das ein Ding kein Gift ist.

All things are poison and nothing (is) without poison; only the dose makes that a thing is no poison.



- Identify plants to species level
- If you can’t - acknowledge the uncertainty **and** be certain that you can still assess a plant’s toxicity

When asked – *What do bandro eat?* – the majority of the 63 respondents answered papyrus *Cyperus madagascariensis*, reeds *Phragmites mauritianus*, or both (see Fig.5). Other plants mentioned included rice *Oryza sativa*, grass *Echinochloa* sp., and *Polyganum dichotonum*.

Feistner & Rakotoarinosy, 1993

Polygonum dichotumum
Blume

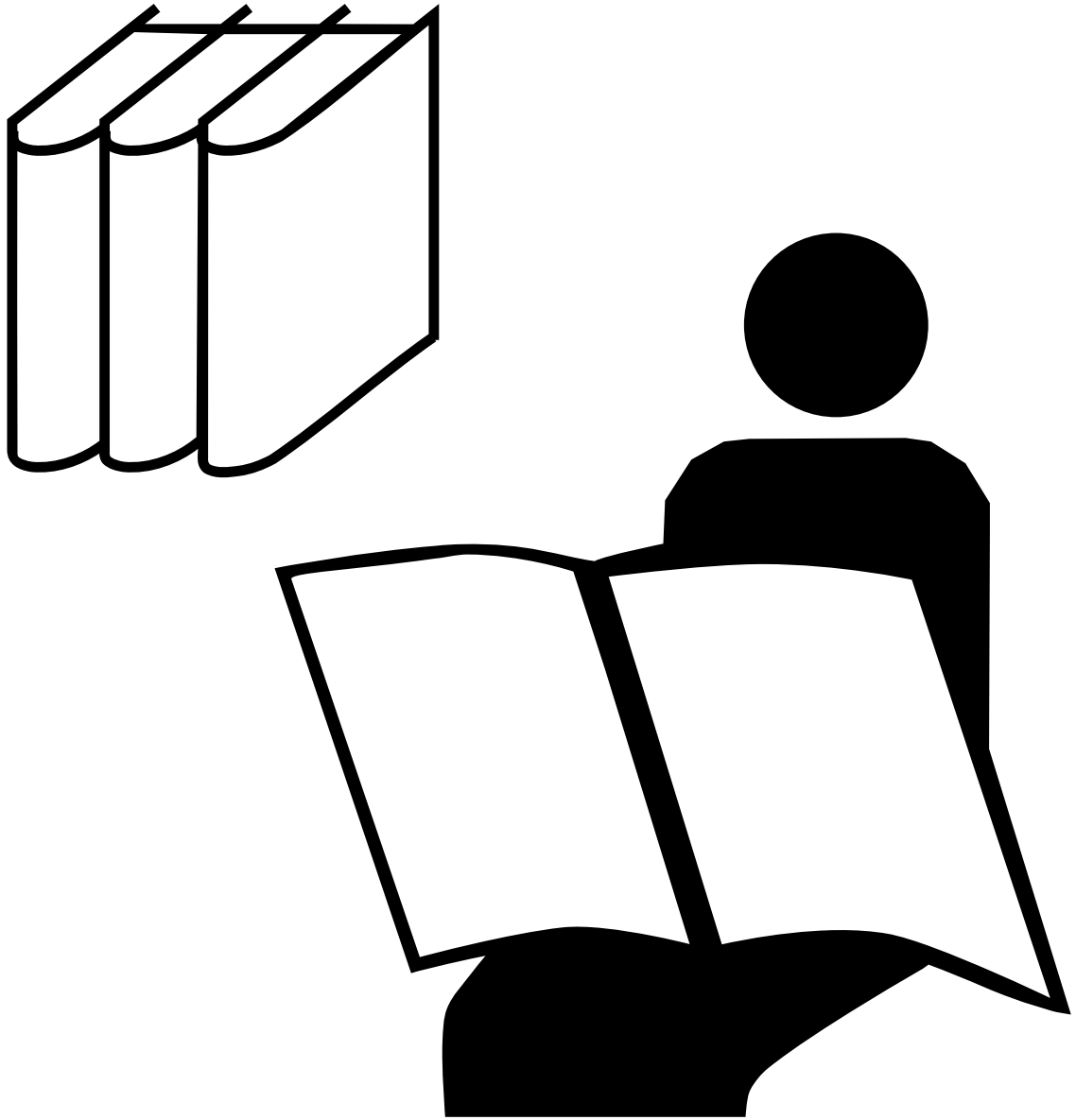
Persicaria dichotoma (Blume)
Masam.

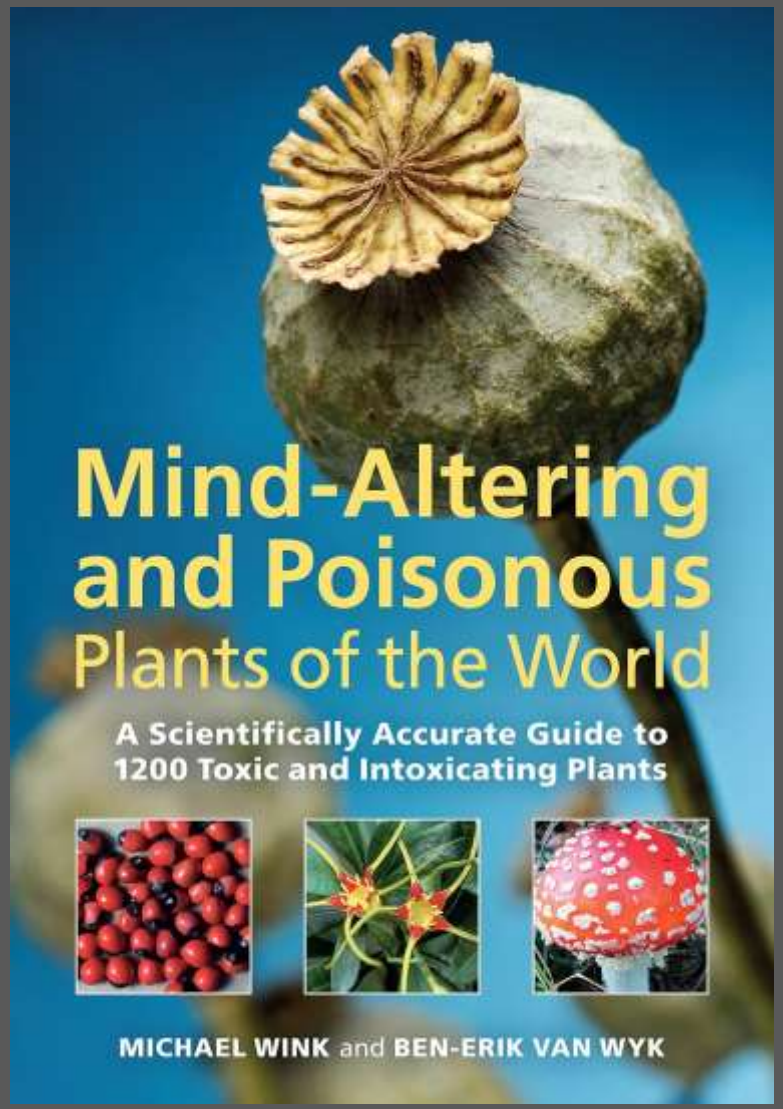
Polygonum baldschuanicum
Regel

Fallopia baldschuanica (Regel)
Holub

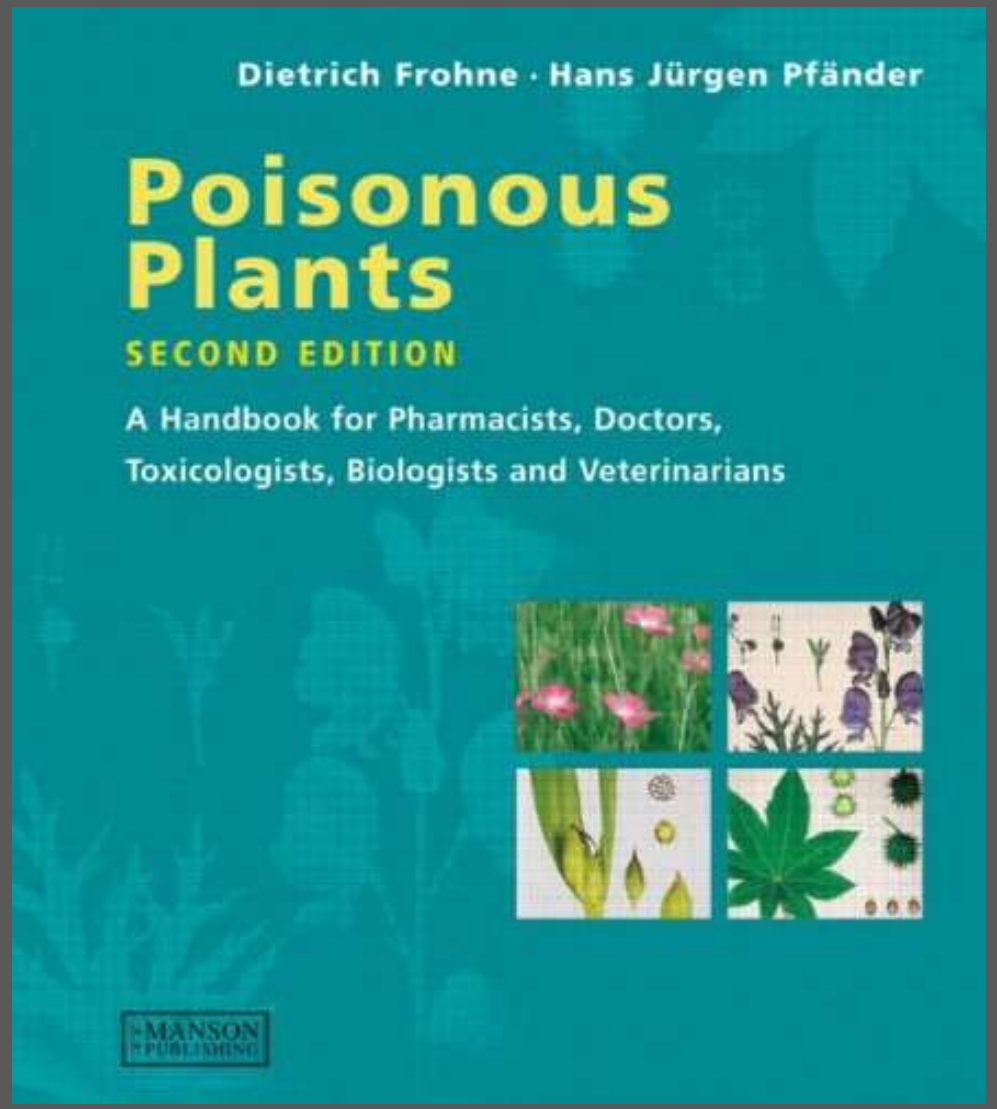
Kew Science, 2023

- Evidence-based information
- Scientific names
- Sources

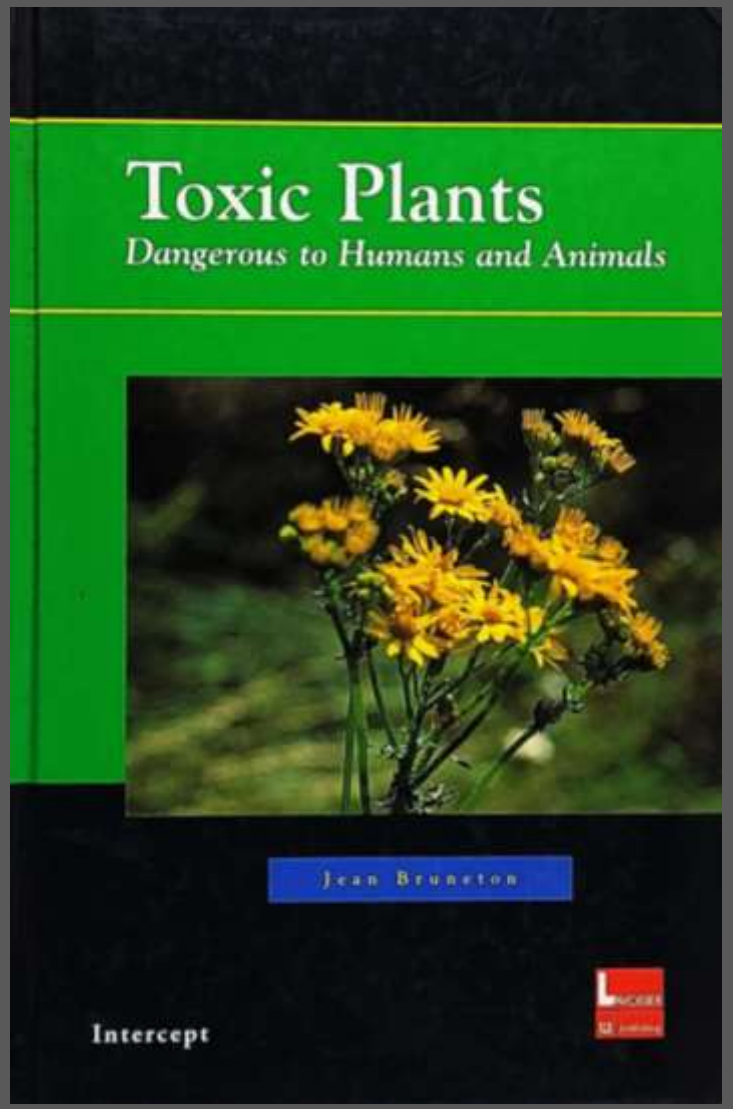




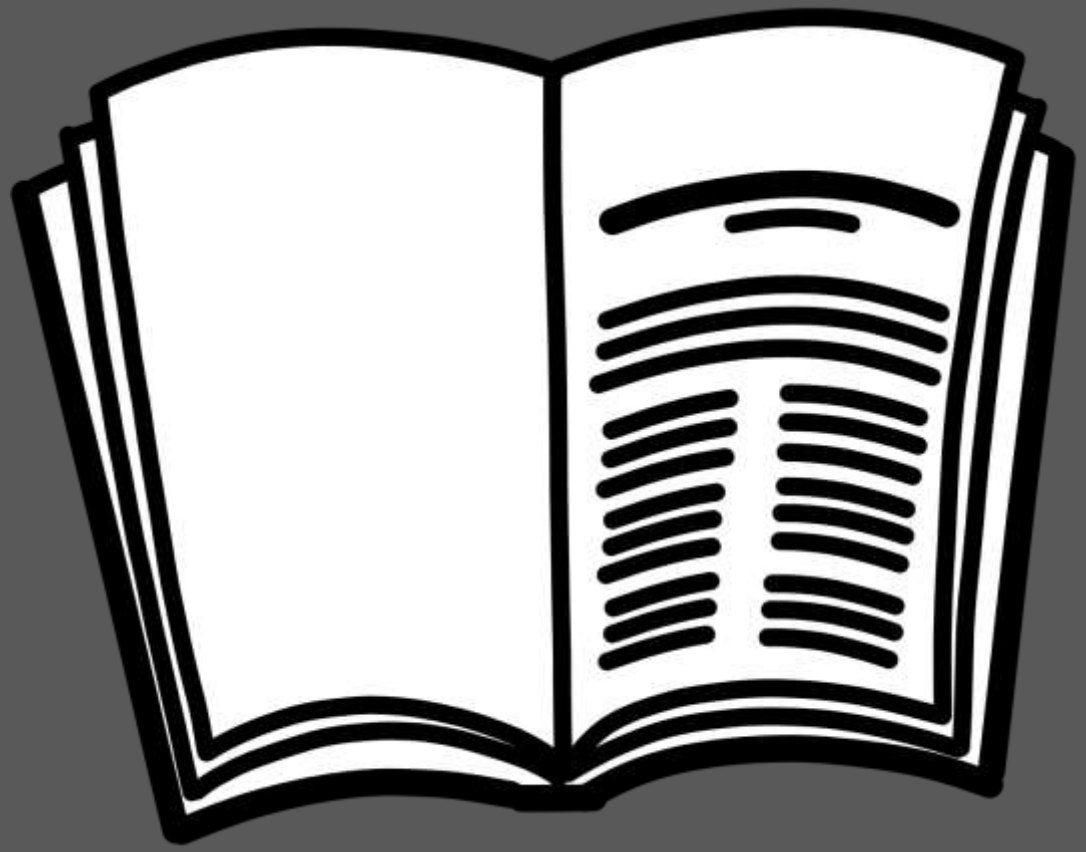
Wink & Van Wyk, 2008



Frohne & Pfänder, 2004

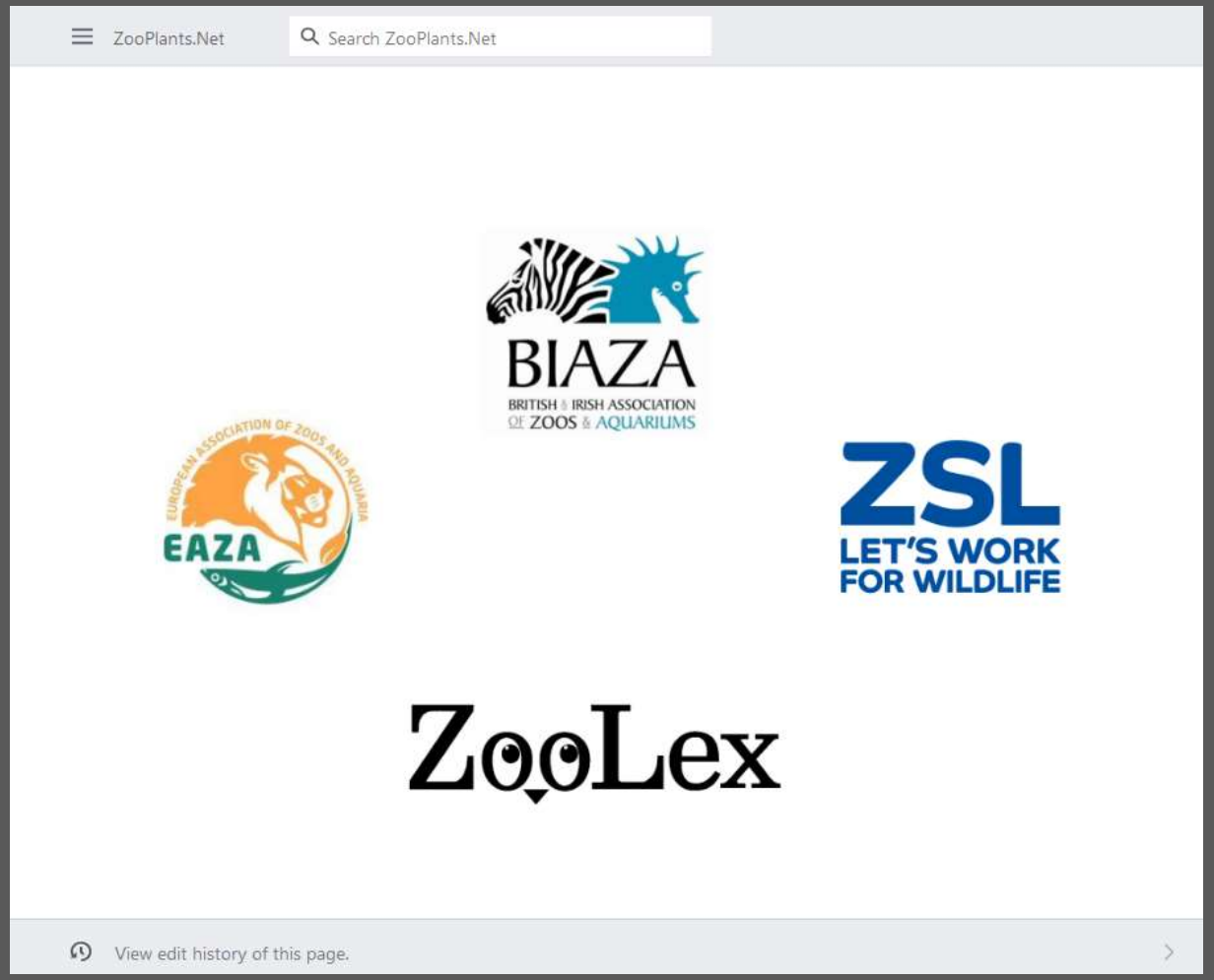


Bruneton, 1999



- Google Scholar
- Researchgate
- JSTOR
- ….

ZooPlants.Net



Gewöhnl. Ahornbaum.

Acer pseudoplatanus

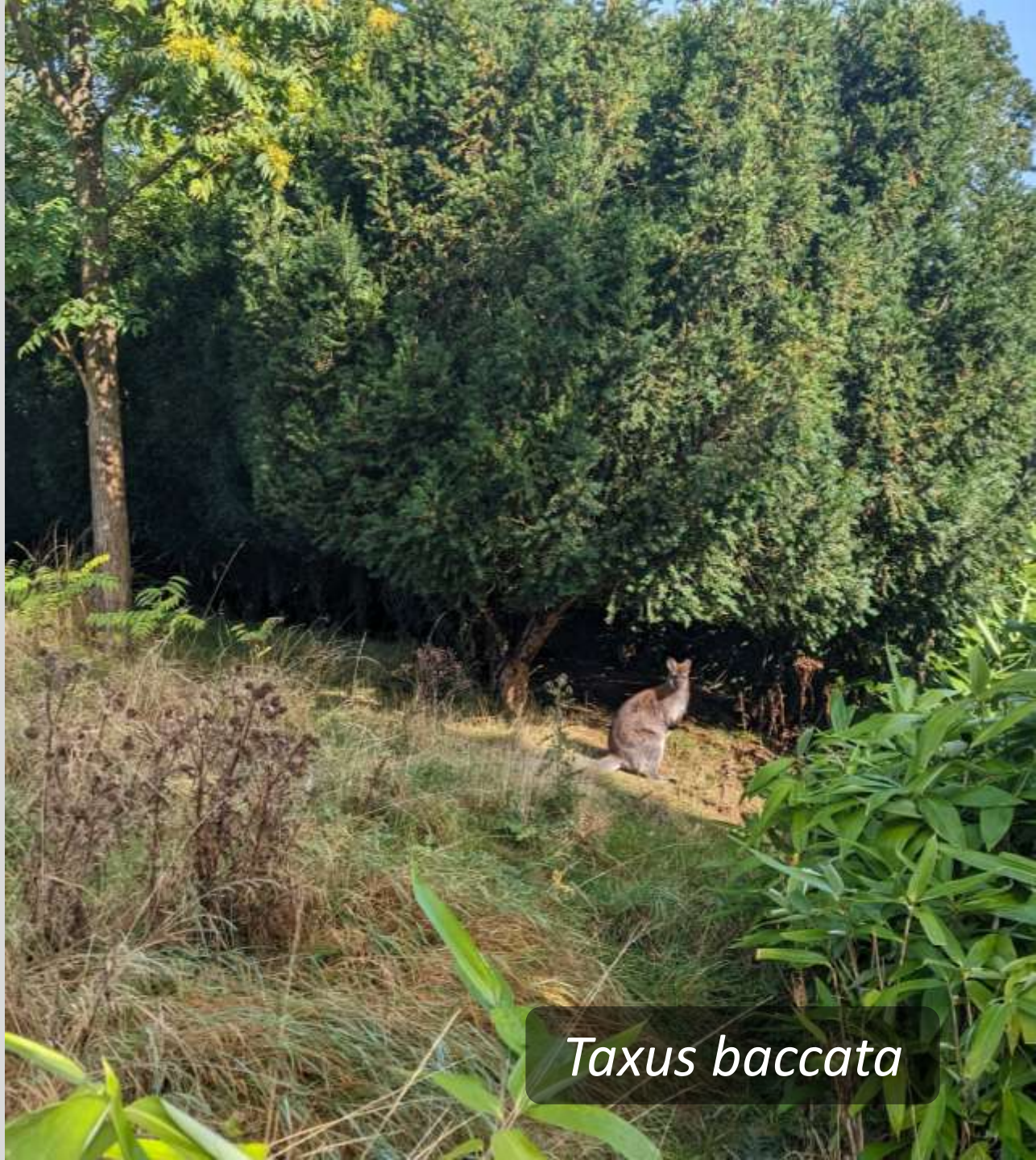
- Equine atypical myopathy - seasonal disease in domestic horses (74% fatality) (Votion *et al.*, 2014)
- Death of Pzsewalski's horse (*Equus ferus przewalskiil*) at Whipsnade Zoo in 2014 (Molenaar *et al.*, 2016)
- Death of two Bactrian camels (*Camelus bactrianus*) in a German Zoo (Hirz *et al.*, 2019)
- Toxic parts: seeds, sprouts, leaves (Westermann *et al*., 2016)
- Toxic agent: Hypoglycin A (Westermann *et al*., 2016)
- Also found in *A. negundo* (Valberg *et al*., 2013), but not in *A. platanoides* and *A. campestre*) (Westermann *et al*., 2016)
- Used as browse for wide range of species (ZooPlants.Net, 2023)

- Poisoning reported in horses, cattle, sheep, and domesticated birds (Bruneton, 1999; Cooper *et al*., 2003)
- Ingestion of 150 g bark can be fatal in horses (Landwirtschaftskammer Nordrhein-Westfalen, 2003)
- Possible gastrointestinal problems reported in okapis (*Okapi johnstoni*) (Huisman *et al., 2008*, B. Harman, pers. comm., 16 January 2009).
- Used as giraffe (*Giraffa camelopardalis*) browse at Barcelona Zoo, Zoo Budapest, and Tiergarten Nürnberg (ZooPlants.Net, 2023).
- EEP recommended browse species for sifaka (*Propithecus verreauxi*) (ZooPlants.Net, 2023)

- All parts contain cyanogenic glucoside (Wink & Van Wyk, 2008)
- Release of hydrogen cyanide is caused by crushing, insect damage, frost, and wilting (Burrows & Tyrl, 2006; Wink & Van Wyk, 2008)
- Fatal poising of three cows reported after feeding on leaves and flowers that had grown through a fence (Sarginson *et al*., 1996)

- All parts except the fleshy fruits contain cyanogenic glucoside (Dauncey *et al*., 2002)
- Fatal dose for bovines and sheep: 2 mg/kg (Bruneton, 1999)
- Planted in the chimp (*Pan troglodytes*) enclosure at Chester Zoo with no reported adverse effects despite the animals occasionally chewing the leaves (Wehnelt *et al.*, 2006; ZooPlants.Net, 2023)

- Complex mix of alkaloids, including highly toxic taxins, in all parts of the plant except the fruits (Cooper *et al*., 2003)
- Poisoning reported in equines, cows, goats, deer, emus, sheep, and pheasants (Bruneton, 1999; Cooper *et al*., 2003)
- Fatal dose in cows in 500 g, fatal dose in horses is 100-200 g (Bruneton, 1999)
- Fatal poisoning for three Przewalski's horses (*Equus przewalskii*) after material mistaken for *Pinus* sp. and fed as browse (Rietschel, 2006)



- Needles contain high levels of isocupressic acid (Gardner & James, 1999)
- Ingestion causes abortions in cattle (Gardner, 1999)
- Other species of concern: *P. jeffreyi*, *P. ponderosa*, *Juniperus communis*, *J. scopulorum*.

- Widely used as animal fodder and as browse in zoos (ZooPlants.Net, 2023)
- Fruits are edible but seeds contain 40 mg hydrocyanic acid/100 g fruit (Zappi & Turner, 2001)
- Fatal poisoning of two Asian short-clawed otters (*Amblonyx cinereus*) after ingesting seeds from a tree in their exhibit (Weber & Garner, 2001)
- Poultry poisoning after the ingestion of seeds (Morton, 1987)

- All parts, including the flower and roots, are highly poisonous (Frohne & Pfänder, 2004; Wink & Van Wyk, 2008; Severino, 2009)
- Poisoning has been reported in horses, cattle, pigs, sheep, goats, and possibly dogs (Frohne & Pfänder, 2004; Severino, 2009)
- Ingestion of 0.5 kg seeds lethal in horses (Wink & Van Wyk, 2008)
- Consumption of 15-20 seeds lethal in children (Wink & Van Wyk, 2008)

- All parts, including sap and flowers contain glycosides and are highly toxic (Dauncey *et al.*, 2002; Cooper *at al.*, 2003)
- Remains toxic after drying and boiling (Cooper *et al.* 2003)
- Poisoning has been reported in horses, cattle, sheep, dogs, cats, Guinea pigs, birds, geese, buffaloes, and giraffes (Alfonso *et* al.*, 1994;* Bruneton, 1999; Cooper *et al.*, 2003; Frohne & Pfänder, 2004; Quigley, 2011; Truelsen, 2011)

- There is no such thing as a non-toxic plant
- The risk a poisoning is determined by a plant’s toxicity properties and the biology, ecology, and behaviour of the animal it is used with
- Plant toxicity should be assessed by using scientific plant names and evidence-based information

Thank you for listening and questions ….

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IMAGE CREDITS

Gentle lemur – Jotaguru

Map Madagascar - Alex Dunkel (Maky)

Phragmites mauritianus – bat (Maria Vorontsova)

Cyperus papyrus – Roger Culos

Polygonum balschuanicum – Katrin Schneider

Tiger – ZSL

Giraffe – ZSL

Gentle lemur – Jotaguru

Polygonum dichotomum specimen– Kew Science

Polyognum baldschuanicum specimen – Kew Science

Information gathering – Clemenspool

Journals – Julian Kücklich

Robinia pseudoacacia – Leonhard Lenz

Prunus padus – Christian Kahle.

Chimp – Mark Sparrow/ZooPlants.Net

Wallaby – ZSL

Pinus contorta – MPF

Eriobotrya japonica – Jean-Pol GRANDMONT

Laburnum anagyroides – Ввласенко