

Plants that can be Poisonous for Cows. A Review

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ABSTRACT

Romania is blessed with a rich spontaneous flora, but some of the plants are toxic by their consumption in cattle, affecting the health, productions and endangering consumer safety. Sometimes even the consumption of small amounts causes poisoning with a broad extension: from mild, moderate to severe and with chronic or acute manifestations. Plant action is not similar. *Taxus Buccata*, *Eupatorium spp.* (*E. rugosum*, *E. urticaefolium*, *E. ogeratoides*) are cardiotoxic plants, but, *Eupatorium spp.* also acts through depression of the central nervous system; *Datura stramonium* (Jimson weed), *Solanum spp.* (nightshades), *Atropa belladonna* (belladonna), are plants with cholinergic blocking; haemolytic anemia is caused by *Pteridium aquilinum* (Bracken fern) and *Equisetum* (horsetail). The poisoning with cyanogenic principles occurs at *Sorghum spp.* (Johnson grass, sudan grass); Elderberry consumption, *Senecio spp.* and *Hypericum* (*St John's wort*) induces liver toxicity. Plants containing alkaloids outside their toxicity also have teratogenic action: *Lupinus spp.*, *Nicotiana spp.*, *Conium maculatum*, *Veratrum album*. However, some of these plants can be used in certain cows' treatments.

Keywords: *ethnoveterinary, plants, poisonous, symptoms*

INTRODUCTION

Grazing, although it has many advantages, can expose the animals to a series of illnesses and accidents (Drăghici, 1991), especially when the green mass is reduced quantitatively and qualitatively, favoring the consumption of plants that cause intoxication (Voia *et al.*, 2009).

In the choice of plant species or parts of them, responses to chemical stimuli received by the animal through, smell, taste or touch and the existing components: carbohydrates, organic acids, tannins or alkaloids present (Arnold *et al.*, 1981) is the secret weapon in selecting forage. Ruminants use all the senses in selecting plants, and the smell seems to complement the taste that remains the primary factor. Unpalatable or non-swallowable feeds are discarded before being swallowed (Lyons *et al.*, 2000).

It is true that there are a number of factors that contribute to poisoning: the season and the weather conditions the animals are subjected to: transport, handling, when they are not regularly fed and the quality of the pasture is poor (Panter *et al.*, 2011).

It is necessary for the animals to receive appropriate and good quality feed which allows the animals to avoid the consumption of toxic plants, otherwise the cows, fed up with the same diet are tempted to consume toxic plants which grow along the pasture and the fence, although have low palatability (Baldwin *et al.*, 2011).

As a rule, poisoning occurs through the consumption of the whole plant or parts of it which is toxic, depending on the amount consumed, the period of the year and the stage of maturity of the plant, the quantity of water in the feed, the state of

health of the animals, their age and weight (www.co.lancaster.pa.us, 2010), physiological state (Cortinovis *et al.*, 2015), the nature of the toxic principles, the environmental conditions in which the plants live (Bosworth, 2006).

Although poisoning can occur throughout the year, because some plants by drying and present in the hay do not lose their toxicity (Puschner *et al.*, 2003), grazing the early pasture in the spring when the toxic plants make their first appearance, represent danger of poisoning (Panter *et al.*, 2011). In general, plant toxins are perceived by the brain in an interval of 4-12 hours after ingestion of the feed (Arnold G.W. *et al.*, 1981), but the identification of the causes is hard to analyze, which is why the detection of toxic plants, the understanding of the symptoms, the recognition of problem areas represent the strategy for minimizing the hazards (Hart *et al.*, 2001).

The toxic principles in plants are multiples: alkaloids, glycosides, cyanogenic glycosides, toxalbumin, but, most cases of poisoning in cows are due to plants containing alkaloids: *Colchicum autumnale* (meadow saffron), *Conium maculatum* (poison hemlock), *Datura stramonium* (jimson weed), *Equisetum palustre* (marsh horsetail), *Senecio spp.* (ragwort), *Taxus baccata* (European yew) after Cortinovis *et al.* (2015). A number of plants whose parts are toxic are generally avoided by animals, but not when they are found in the hay. The most common toxic plants present in hay: *Atropa belladonna*, *Conium maculatum*, *Datura stramonium*, *Euphorbia spp.*, *Veratrum album*, *Colchicum autumnale* (<http://agriculturaonline.blogspot.ro>, 2011). Some of the clinical signs of poisoning in cows are similar, the manifestations being nervous and reproductive: *Lupinus spp.*, *Nicotiana spp.*, *Veratrum album*, *Conium maculatum* (Forero *et al.*, 2011). Calf birth defects manifested by malformations of the legs, spine and throat as well as palate cleft are caused by the consumption of toxic plants during the gestation period of the cows in the range of 55-75 days (*Conium maculatum*, *Lupinus*); 45-75 days *Nicotiana spp.* (Panter, 1999).

Plants such as: *Equisetum*, *Pteridium aquilinum*, has the same antivitamin B1: thiaminase factor, with similar but also distinct symptoms depending on the other principles (Bosworth, 2006).

Digitalis sp., *Adonis vernalis*, *Convallaria majalis*, causes cardiac disorders due to its content

in cardiac glycosides (Pushner *et al.*, 2003, Chaney, 2015, Zanoschi *et al.*, 1981).

Consumer safety is endangered if milk comes from poisoned cows with: *Lupinus spp.*, *Equisetum spp.*, *Aconitum spp.*, *Atropa belladonna*, *Euphorbia spp.*, *Pteridium aquilinum* (Rasnovanu, 2013).

POISONING WITH PLANTS CONTAINING VARIOUS TOXIC PRINCIPLES

POISONING WITH PLANTS CONTAINING ALKALOIDS

Lupine can tolerate less fertile soils, due to the massive root system, which is why it has wide spread area (Markéta *et al.*, 2005).

The alkaloids present in lupine (*Lupinus luteus*, *L. albus*, *L. angustifolius*, *L. perennis*) lupinine and sparteine are found in large quantities. Spartulatine, lupanine, hidroxilupanine are other alkaloids present in lupine plants, but, especially in variety *L. angustifolius* (Zanoschi *et al.*, 1981). The plant is evaluated as having a moderate / high degree of toxicity (Glen, 2008).

Disorders of: nervous system, liver degeneration, heart, kidneys and muscles occur mainly by eating before the flowering of the plant and then, by eating lupine seeds (El Mahdy, 2015).

Intoxication, caused by *Phomopsis leptostromiformis*, fungus, called lupinosis, attacks *Lupinus luteus* seeds and grows saprofit along with the species *L. albus* and *L. Angustifolius*; the symptoms manifesting by high hepatotoxicity (Bhat *et al.*, 2010).

Signs of poisoning: changes in behavior, spasms, vomiting, abdominal pain, tremors, excitement, head pressure, difficulty breathing, loss of coordination, salivation, convulsions (Baldwin *et al.*, 2011; Chaney, 2015).

The reproductive sphere is also affected by cows' consumption of certain lupine varieties, because, not all species are equally toxic, and, bitter varieties that contain quite large amounts of alkaloids should not be administered as feed for animals (Baldwin *et al.*, 2011). The negative repercussions on future newborn calves are manifested through obtaining calves with multiple congenital deformations (D'Mello, 2002). Due to another present alkaloid, by quinolizidine type (Dąbrowski *et al.*, 2005) - anagyrin, with teratogenic effects (Markéta *et al.*, 2005), can

affect pregnant cows fed on lupine in the first 40-70 days of gestation can calving, calves, with deformations known as "crooked calf syndrome", similar to those caused by consumption of *Conium* (Glen, 2008). Contamination of milk is possible when large amounts of lupine are consumed (Meriçli, <http://docs.neu.edu.tr>).

Jimsonweed, thornapple (*Datura stramonium*), is an annual plant which we find it in uncultivated or cultivated places, in the field, especially among soy and corn crops. The plant prefers rich soils (www.co.lancaster.pa.us, 2010). Due to the fact that, fresh plant, has strong smell and unpleasant taste is not consumed by animals, just in case they are hungry or pastures has low value and infested with Jimsonweed (<http://www.welchproperty.com/>). In this case, poisoning occurs within few minutes or hours (Bosworth, 2006). Regardless that, the plant is green or dry, the toxicity remains the same, but the seeds and root are the most toxic parts (Glen, 2008; Wink, 2009). In green state, more than 0.7% of green leaf weight contains toxic alkaloids, and nectar also contains toxic principles (Bosworth, 2006). The seeds have low palatability, therefore it will not be consumed only if they are found in hay, silage or grain (Kerr, <http://extension.wsu.edu>).

Poisoning occurs mainly when the seeds of this plant reach in the freshly cut hay or corn intended for ensiling (Binev *et al.*, 2010), in which case, it is noted self-limiting consumption by ruminant atony and anorexia to prevent further intoxication until the level of alkaloids of the blood is reduced and allows the normal intestinal function of ruminants (Nelson *et al.*, 1982). Alkaloids present in the plant: atropine, scopolamine, hyoscyamine (Fuchs *et al.*, 2011), have strong anticholinergic properties (Soler-Rodríguez *et al.*, 2006). But the plant also contains: daturine, and may contain a large amount of nitrates (Mezzasalma *et al.*, 2016).

Incipient symptoms are manifested by rapid pulse and increased heart rhythm, pupil dilatation, vision impairment, dry mouth and other mucosae, animals looking for a source of water to quench thirst (Hansen *et al.*, 2002; Everest *et al.*, 2005). Later, the symptoms are transposed by: decreased body temperature, nausea, loss of muscle coordination, aggressive behavior, violent, tremors, breathing disorder manifested by slow breathing, rapid and weak pulse, fever,

delirium (www.envbop.govt.nz, 2003), the cattle appear to be hallucinating, have convulsions, become comatose, and possibly die (Fishel, 2001). Poisoning occurs at the consumption of 0.250-0.453 Kg of green plant (Zanoschi *et al.*, 1981), and, after Boyd *et al.* (<https://www.uaex.edu/>), ingestion of an amount of seed between 0.06 to 0.09 % of animal weight can be fatal in cows.

Both, *Datura stramonium* and *Colchicum autumnale* cause dysphagia, toxic dystrophy of the liver and sometimes cardiac lesions, cardiopulmonary collapse (Mezzasalma *et al.*, 2016). Milk from poisoned cows is contaminated (Jonker, 2015).

Nicotiana tabacum (lowland region), *N. rustica* (higher areas in the northern region of the country) (Zanoschi *et al.*, 1981), contains especially in leaves and seeds 2-3% of the most toxic principle, nicotine (Nellis, 1997), which affects the nervous system along with another alkaloid, pyridine (<https://www.coursehero.com/>, 2015). But the number of alkaloids from the leaves is much higher: methylanabasine, acetylnornicotine, acetylanatabine, acetylanabasine (Garland *et al.*, 1998).

Although poisoning with *Nicotiana spp.* are infrequent, the effects of nicotine consumption consist of: hair scarring, trembling, restlessness, salivation, nausea, bloating, constipation followed by feverish, diarrhea, accelerated breathing and gasping, heartbeat rare at first that become accelerated and irregular, cardiac arrhythmia, extremity cooling, dizziness, loss of sensitivity, strong ptialism, catarrhal gastro- - enteritis, polyuria, tonic convulsions followed by muscle paralysis, and death (Zanoschi *et al.*, 1981; <http://poisonousplants.ansci.cornell.edu/>, 2015; Forero *et al.*, 2011).

Hassine *et al.*, (2013) describes the sequential stages of intoxication in cows, the first phase consisting of generalized tremor, hypersalivation, conjunctivitis, rapid loss of sensitivity, sphincter relaxed and palidity of mucous membranes, followed by the second stage, the imbibition, manifested by hypotension, bradycardia and dyspnea, eventually leading to coma and respiratory insufficiency (Schep *et al.*, 2009). Coma it's installing depending on the form of intoxication: 1-2 hours after ingestion (acute poisoning) and 1-3 days (subacute poisoning)

(Zanoschi *et al.*, 1981).

According to the same author, animals should not have access to tobacco plants, and 0.5-2 Kg leaves induce state of toxicity in cattle.

The teratogenic effect of *Nicotiana* it is considered to be identical to that of *Lupinus* and *Colchicum*, by induction of malformations and cleft palate on calves, result of reduced fetal movement (Welch *et al.*, 2012), during critical stages of gestation (Dąbrowski *et al.*, 2005).

Colchicum autumnale (Meadow saffron, Autumn crocus), plant whose presence indicates grassland or hayfields with high ecological quality are found in hayfields, wet soils rich in substances important for plant growth (www.rndr.ro/documente/, 2015).

Colchicine, alkaloid, is present in the whole plant being, capillary toxic and paralyzing effect of the nervous system. In the category of animals susceptible to poisoning, ranging from moderate to severe toxicity (Glen, 2008) includes cattle which grazes surfaces in whose floral composition the plant is found, or in the field (Seceleanu, 2015), especially in spring when, the leaves are in young stage and, autumn through the ingested flowers (Anadón *et al.*, 2012).

The leaves are toxic at a consumption of 0.1% of the animal's weight (<http://poisonousplants.ansci.cornell.edu/>, 2015). Clinical manifestations and signs that typically occur 48 hours after ingestion are: pain in the mouth and throat, vomiting, salivation, dysphagia, lethargy, low blood pressure, abdominal pain, colic, diarrhea and faeces foul-smelling, tenesmus (Cortinovis *et al.*, 2015). In more serious cases, following the consumption of large quantities of the plant: shock, convulsions and coma precede the end, that is, the death of animals (Chaney, 2015). The alkaloid is heat-resistant, is not destroyed at high temperatures, the silage and hay being toxic as well, when they have many leaves of *Colchicum autumnale* in their composition because colchicine is able to withstand storage and drying (Voia *et al.*, 2009). The calves fed with milk coming from poisoned cows leads to their intoxication (<http://poisonousplants.ansci.cornell.edu/>, 2015). Colchicine, another alkaloid, is manifested by diarrhea, black-green bloody feces, hepato-renal disorders, polyuria and haematuria, nervous disorders, bulbar respiratory paralysis, cattle

mortality may be between 25-50%. (Zanoschi *et al.*, 1981).

Equisetum arvense, *E. palustre*, *E. fluviatile* (field horsetail), is not one of the plants preferred by cows, due to the large amount of silicon which reduces its palatability. Of the *Equisetum* species, *E. palustre* which grows around the marshes is the most poisonous, but, the spreading area of the plant is much wider (Popescu *et al.*, 1981). We meet on drained soils, sandy soil or gravel with proper drainage (Zanoschi *et al.*, 1981). The toxicity of the plant is given by its aerial parts (Wink, 2009). Regardless of the form under which it is consumed: a green or dry plant has a toxic character through principles existing in the plant: alkaloid- equisentin; enzyme thiaminase (Cramer, *et al.*, 2015) with antivitamin B₁ action, palustrine, palustridine and other alkaloids in a ratio greater than 0.3%, as well as saponins (Wink, 2009).

Symptoms of poisoning assessed as having a moderate rate of intoxication in cows is manifested by: lack of appetite, emaciation, decrease in milk yield, digestive problems, diarrhea (Glen N., 2008). According to the same author, the poisoning caused by the prolonged administration of horsetail, causes respiratory and heart problems, cardiac arrhythmias and, in some cases convulsions. And because, young animals are more susceptible to poisoning than adults, Aboling *et al.*, (2014) reports cases of haemorrhagic enteritis in pregnant heifers. Calves that consume contaminated milk will present convulsions, the head arched straight back and prefers the lying down position (Forero *et al.*, 2010). The hay which contain this plant is toxic (Forero *et al.*, 2010). Because both, horsetail and bracken fern, present the same antivitaminic factor B₁- thiaminase, the symptoms are similar. Difference consists in the fact that horsetail does not exhibit bone marrow toxin found in bracken fern and that affects the ruminants (Bosworth, 2006). At autopsy, it is not noticeable changes in organs but only diffuse lesions in the cerebral cortex, involving different nuclei of the brain, in similar to those in encephalomalacia or cerebro-cortical necrosis (<http://poisonousplants.ansci.cornell.edu/>, 2015).

Aconitum paniculatum, *A. napellus* *A. moldavicum* kind of very poisonous herbaceous plants commonly known as aconite, monkshood,

wolf's bane, leopard's bane, mousebane, women's bane, devil's helmet, queen of poisons (<https://en.wikipedia.org/>) grows in wetlands, rocky places and mountain meadows (<http://www.biaplant.ro>, 2015). All parts of the plant are toxic, but the concentration of toxic principles at wild species is higher in the roots and root tubers (Chan T.Y., 2009), and at *A. napellus* the roots, the seeds and the pre-flower leaves are especially toxic (<https://csuvth.colostate.edu>, 2017). Poisoning in cows is manifested through: disorders of the nervous system, paralysis of bulb nervous centers, cardiac and respiratory (Nualláin, 2014) due to the high content of aconitine, the strongest poison of the nervous system that activates the sodium channels being a powerful toxin of the nerves and muscles that cause it numbness and paralysis (Wink, 2009); aconin and benzoliconine (<https://www.scribd.com/>), mesaconitine, lycotoxine; are other toxic principles that are also part of the terpenoid alkaloids category (Zanoschi *et al.*, 1981). Aconitin is easily absorbed in the digestive tract and is slowly eliminated by the kidney. The manifestations of poisoning are accompanied by vomiting, colic, constipation, slowing of heartbeats and breathing, pupil dilation, muscle tremors and weakness (Gintaras, 2012), polyuria, hypothermia and death, in severe cases. After Constable *et al.*, (2017), the diarrhea that can accompany poisoning is attributed to the existence of other additional toxic principles.

Apart from neurotoxic principles, cardiotoxic agents act by increasing the sodium ions permeability and membrane excitability (Acamovic *et al.*, 2004). Toxins can also be absorbed through the skin (<http://www.realgardeners.co.uk/>).

Pastures in whose vegetation is more than 10% monkshood need to be cleaned because the plant toxicity is high, both, green and dry state (<http://www.triplecrownhorsefeeds.com/>). It is not allowed to consume milk from poisoned animals with monkshood (Rasnoveanu, 2013).

Taxus buccata (European yew) known as "the tree of death", is a arboretums much more widespread in the past, but, should not be overlooked because it is extremely toxic (Zanoschi *et al.*, 1981). In Romania it appears disseminated from the hills to the mountainous area, in the beeches or mixtures of beech with resin on rugged relief, rocky areas, screes, in the form of isolated

specimens, or bouquets (<http://www.plantpedia.ro>, 2010). All parts of the tree, less the fleshy part of the red fruit, dead or alive, are toxic, but especially leaves, the toxicity rate being high throughout the year (Wright *et al.*, 2007). The plant contains a number of toxic principles: alkaloids (taxin A, B and C) that suppress the activity of the heart; glycosides (taxicotine), hydrocyanic acid esters, ephedrine, taxol, and other principles (<http://poisonousplants.ansci.cornell.edu>, 2015). Taxin A and B are cardio-depressant, death occurs suddenly, and, oil found in the sap has irritating action on the gut, being incriminated in colic and diarrhea.

Consumption of moderate amounts causes digestive discomfort from mild to severe when the animal can succumb. Schivera, (2011) is of the opinion that, small quantities can kill the animal. Consumption of 0.5% of the weight of ruminants is sufficient to show signs of poisoning (Wilson *et al.*, 2001). On the other hand, Cortinovis *et al.*, (2015) suggests that ingestion of 0.5% of body weight for ruminants is fatal.

Manifestations of poisoning, which occur in cows at 24-48 hours after ingestion, consist of: ataxia, diarrhea, hypotension, colic, hypothermia, seizures, weakness, respiratory failure, bradycardia, coma and death, cardiac and/or respiratory collapse (Bosworth, 2006).

Senecio vulgaris and *S. jacobea* (Ragwort and Groundsel "stinking willie), grows throughout the country, in uncultivated places, besides walls, roads, or fields (<https://ro.wikipedia.org/>). Contains alkaloids of which: senecionine, senecine, senecifidine, are the most toxic (Zanoschi *et al.*, 1981).

But the plant is much more rich in alkaloids: jacidine, jacobine, jacoline, jaconine, jacozone and retrorsine (Anadón *et al.*, 2012), existing over 50 principles with cumulative hepatotoxic properties (El Mahdy, 2015). Poisoning with *Senecio* extends from moderate to severe, all parts of the plant being toxic (Chaney, 2015). Manifestations of poisoning may occur within 2-8 months after ingestion, not just immediately, period in which animals lose their physical condition and jaundice is installed, caused by liver failure. In some cases, the cows present photosensitivity (Puschner *et al.*, 2003).

All farm species are susceptible to

consumption of *Senecio*, but especially cows and horses, where the plant consumption produces fatal liver damage. Extending the effect, however, is much wider due to the mutagenic and carcinogenic action, and inhibition of peripheral nerves (Wink, 2009). Nervous system disorders are due to the high amounts of ammonia present in the blood (Cortinovis *et al.*, 2015) which has as manifestations: staggering, circling and head pressing (<http://www.thecattlesite.com>).

In the first stage of poisoning cows manifested as symptoms: lethargy, loss of appetite, reduction in the body condition score, crusting around the eyes and nose, red eyes and tears, gastroenteritis, diarrhea, constipation, weakness manifested by wobbling and dragging rear feet (<https://www.ars.usda.gov>, 2016). Walsh *et al.*, (2007) has also noticed other changes to bulls poisoned with *Senecio*: depressive behavior, ears bent, gait, the absence of ruminal contractions, ascites. Sometimes the symptoms are accompanied by, diarrhoea, with straining, as well as jaundice – yellowing particularly of the whites of the eye. Cows may develop a pig-like odor that has a somewhat sweetish quality (<http://www.thecattlesite.com/>). The silage contaminated with less than 5% *Senecio*, administered in ration in cows is considered unsafe (Forero *et al.*, 2010). Not all species in this category are toxic but, *S. jacobaea* yes, which is why it should be removed from the floral composition, because, all parts of the plant are toxic and remain toxic and after they are preserved in the form of hay (www.defra.gov.uk/, 2009).

Conium maculatum- poison hemlock has as a spreading area: dry ditches, depreciated land surfaces (www.calivitavelcu.ro, 2009). The alkaloids: coniine and γ -coniceine are present throughout the plant, including: flowers, fruits, seeds. However, coniine is more concentrated in the leaves of the plant at the beginning of the vegetative stage, while the fruits incorporate the highest amount of coniine, in the autumn season (Cortinovis *et al.*, 2015).

Although, the effects of alkaloids on the nervous system are not fully elucidated it is believed that they act like nicotine, that is, initially stimulate and then block the autonomic ganglia (Gintaras, 2012). By the alkaloid content, *Conium* affects the cows (Binev *et al.*, 2007), the

poisoning being manifested by acute neurotoxic, cardiovascular effects and fetotoxic effects including teratogenesis (Mezzasalma *et al.*, 2016). Cows that have ingested *Conium* during 55-75 days of pregnancy (Panter *et al.*, 1992) will give birth of calves with malformations of the neck, spine: arthrogryposis, scoliosis, torticollis, kyphosis, and lordosis (Green *et al.*, 2012); limbs: over-or under-extension or curvature of joints, rigidity of joints and immobility, cleft palate (Panter *et al.*, 1992). The obvious symptoms of intoxication are translated by: foam on the mouth, restlessness, pain, dilated pupils, jaw clamping, teething, vomiting, weak pulse, diarrhea, bloating, seizures, respiratory failure (Binev *et al.*, 2007), gastrointestinal irritation, nervous irritation, neuromuscular blockade (Gintaras, 2012), cold extremities, and sometimes coma precede death of animals (Everest *et al.*, 2005). Sometimes, plant consumption can cause dermatitis, and cow poisoning occurs at ingestion of over 2 kg / 400 kg of live weight (www.envbop.govt.nz, 2003). Who has any doubt on the plant is quite easy to identify. By crushing the plant, it leaves a bad smell similar to the smell of the mice (<https://novascotia.ca>).

Although the name of the plant comes from the Italian word “belladonna”, which means beautiful woman, *Atropa belladonna*, is also known under other names as: belladonna, deadly nightshade, devil’s berries, naughty man’s cherries, death cherries, beautiful death, and devil’s herb, being one of the most toxic plants, common in all the wooded regions of the Carpathians, frequented on the floor of the beech forests (Zanoschi *et al.*, 1981).

Plant toxicity varies depending on the vegetation stage, but, the peak of toxicity is recorded during the fruiting stage (<http://www.provet.co.uk>). Contains alkaloids: atropine, scopolamine, hyoscyamine, last two causing delusions and hallucinations, plus other principles such as: beladonine and nicotine (El Mahdy, 2015).

Poisoning is rare but possible, by ingestion of berries or contamination of feed (Largo, 2014). Symptoms of cow intoxication occur rapidly causing paralysis and death within 5-6 hours (<http://www.belladonnakillz.com>), and as manifestations: animals refuse the feed, maximal pupil dilation and iris reduction, dry mouth and thirst, bloating, restlessness, accelerated and

weak pulse, heavy breathing, absent intestinal peristalsis, constipation, and the eye can not accommodate and the animals can prevent, acute tympanism (Zanoschi *et al.*, 1981). Milk obtained from poisoned cows is contaminated, alkaloids reaching in its composition (<http://www.provet.co.uk/>).

A plant which grow on pastures, meadows, grassland, especially at high altitudes of Romania, *Veratrum album* (Hellebore), comes from latin 'vere', 'true', 'real', 'truly' plus 'ater', 'black' because of the roots of very intense black color (<http://www.thepoisongarden.co.uk/>).

Veratrum acts as a modifier of muscle tonus and toxic bulbar, but, can cause dermatitis too, due to the principles that make it a violent vesicant (<https://www.coursehero.com>, 2015). The plant is toxic by its high alkaloid content, jervanine and veratranine type (veratridine, veratramine, veratrosine, jervine, pseudojervine, and isorubrijervine) and alkaloids with the cevanine skeleton (cevadine, cevine, zygadenine, veracerine, germine, protoverine, and their esters) (Gaillard *et al.*, 2001). Protoverine A and B reduce oxygen in the blood, manifested by respiratory problems where with the animals are confronted (Chaney, 2015). Veratridine, protoverin, jervine, is neurological and cardiac toxins comparable to *Digitalis* who acts through an increase in the intracellular concentration of sodium instead calcium (Gaillard *et al.*, 2001). It causes specific manifestations, namely: blurred vision, transitional blindness; dizziness; cardiovascular, respiratory disorders: slow and irregular pulse, slow and deep breathing, hallucinations; lack of muscle coordination, locomotor ataxia, seizures; gastrointestinal disorders: nausea, vomiting (Gaillard *et al.*, 2001), abdominal pain (Gilotta *et al.*, 2010), diarrhea, skin irritation (Wink., 2009).

According to Manceanu quoted by Zanoschi *et al.* (1981) the total amount of alkaloids in the plant is 0.6-0.7%, which is not lost by drying the plant. The dose of fresh lethal roots for cows is 2g/kg body weight. The cessation of bulbar nervous activities that control circulation and breathing lead to the death of animals. On the other hand, the consumption of this plant affects the pregnant cows which will give birth to some calves with defects (Chaney, 2015); jervine, cyclopamine causing malformations (cyclopean eye) which means, the presence of one eye at the center of the

forehead to the fetuses (www.thepoisongarden.co.uk).

The toxic potential is greatly reduced by frost (Kerr, <http://extension.wsu.edu/>).

Bittersweet, bittersweet nightshade, popular names of the plant *Solanum dulcamara*, is a plant with a wide spread: from the plain to the subalpine level (www.geomorphologyonline.com).

All parts of the plant are toxic, the tender peaks, seeds, but especially berries (Glen, 2008).

The intoxication is given by the solanidine and steroidal alkaloids solanine (<https://csuvth.colostate.edu/>), which interferes with digestion by inhibiting the vegetative nervous system and parasimpatic and direct irritation of the digestive tract (Schivera *et al.*, 2011).

It can cause serious poisoning through consumption, regardless of whether the plant is green or found in hay. The forms of intoxication have wide spread: from mild to chronic, where, after Bosworth (2006), small, but, daily amounts of the plant ingested by the animals induce chronic intoxication manifested by: general unthriftiness, depression, diarrhea or constipation. Neurodigestive symptoms occur in the subacute form of intoxication and, in severe, acute forms, signs are nervous caused by the damage to the nervous system by solanine (Glen, 2008).

On the whole, the clinical signs of cows poisoned with *Solanum dulcamara* translate through: loss of appetite, salivation, pupil dilation, abdominal pain, gastric lesions, inflammation of intestinal mucous membranes, diarrhea that may become bleeding (Forero *et al.* 2011).

Sometimes the symptoms are more extensive, affecting the kidneys with manifestation of nephritis. Hemoglobinuria may occur as a result of the action of solanine in the blood, causing hemolysis of erythrocytes and urine staining in red (Zanoschi *et al.*, 1981). In severe cases of intoxication cows manifest: vomiting, pupil dilatation, difficulty in breathing, diarrhea, paralysis, and death of animals (Chaney, 2015).

Chelidonium majus (Greater celandine) is a common plant throughout the country. It contains a bitter alkaloid stored especially in the root (chelidonine) which does not seem to be toxic, but at least another 20 alkaloids are found in the various organs of the plant dependent on the growth stage (Frohne *et al.*, 1983) of which

chelerythrine it is poisonous for cows (<http://poisonousplants.ansci.cornell.edu/>, 2015). Other principles present: protopine, sanguinarine, berberine, tetrahydrocoptisine (<https://research.vet.upenn.edu/>).

The plant does not have a high degree of palatability, therefore, because of the sour and spicy taste, but, also the fetid smell, repulsively, is avoided by cows (Pădeanu, 2017). The toxic part of the plant is the light yellow liquid, which in contact with the air becomes reddish (<http://www.cbif.gc.ca/>). Consequently, consumption of the whole plant has a toxic effect by ingestion (www.lancastercountypartnership.org/, 2010), the effects being: narcotic, emetic, purgative and manifestations of intoxication: drowsiness, salivation, staggering gait, staggering, convulsions, death. Calves consuming cow's milk with symptoms of intoxication are not affected, but necropsy reveals gastrointestinal irritation (<http://www.cbif.gc.ca/>, 2014). The plant has irritating effect on the eyes and the skin if the animals come into contact with it (Thomson, 2007).

POISONING WITH PLANTS CONTAINING GLYCOSIDES

As a rule, animals do not consume these plants, most of them having flowers. However, if there is no selective consumption due to poor productive capacity of pastures, they will be consumed by animals (Popescu *et al.*, 1981). Among the plants that contain glycosides, *Digitalis purpurea* (Foxglove), protected species is very common among spontaneous flora species present in the meadows, forest edges or in glades, steppe grasslands (dry) which of ecological quality is medium-high, frequently burned in the spring, of the plain and hill areas (Akeroyd *et al.*, 2012).

Contains as principles, cardiotoxic glycosides: digitalin, digoxin and digitoxin, both, in green and dry plants (Kerr, <http://extension.wsu.edu>). In addition, it possesses a saponin-digitonin and digitanides A, B and C, accumulated in leaves, stem, seeds, flowers (Kormanik, 2016). So, all parts of the plant are toxic (<http://www.smallholdersseries.co.uk/>). The highest proportion of these toxic principles is found in the leaves and the action is cumulative. The lethal dose is 160-200 g for ruminants, signs of intoxication being of cardiovascular and gastrointestinal nature (<http://www.smallholdersseries.co.uk/>) manifested by:

abundant salivation, nausea, vomiting, colic, diarrhea (<http://www1.agric.gov.ab.ca>, 1995, 2010), polyuria, albuminuria, haematuria.

The cardiotoxic activity of glycosides is due to inhibition of ATPase transport and increased myocardial contractility (Dąbrowski *et al.*, 2005). Signs characteristic of cardiovascular poisoning: the alternation between bradycardia - tachycardia and periods of arrhythmia; high blood pressure. In serious cases of intoxication, the chance of survival animals is null, death occurring by asphyxiation. To avoid intoxication, the hay should not contain more than 0.5% *Digitalis*.

Digitalis lanatum, in our country grows spontaneously in meadows, stony places and glades (www.wikipedia.ro/). It contains as main cardiotonic glycosides: digitoxoside, lanatoside D, lanatoside A, lanatoside C, lanatoside E, lanatoside B, digoxigeninmonodigitoxoside, digoxigeninbisdigitoxoside, digoxin, glucosylfucoside, strospesid. Of the saponins, plant contains: digitonine, gitonine, tigonine (Zanoschi *et al.*, 1981), and other principles as well: antirrhizinic acid, digitalosmin, and digitoflavoneus (<http://poisonousplants.ansci.cornell.edu>, 2015). Leaves, roots and seeds are the most toxic parts of the plant causing heart disease. Poisoning is manifested by: nausea, vomiting, diarrhea, slowed/ abnormal heartbeat, hallucinations (Tikofsky, 2013).

Another plant that contains the same cardio toxic principles is *Adonis vernalis*, widespread in the pastures, grasslands, glades, scarp; having like spreading area: the plain area up to the region of the high hills, but, more widespread in the limestone areas of the plateau and hill areas of the Romanian Subcarpathians, in the counties: Cluj, Bistrița-Năsăud, Alba, Hunedoara, Sibiu, Mureș, Dobrogea (<https://dianthus2rt.wordpress.com>, 2011).

Contain cardenolides toxic especially in leaves and flowers (Forero *et al.*, 2010). The whole plant contains adonitoxin which causes cardio-vascular disorders by inhibit Na⁺,K⁺- ATPase (Wink, 2009), externalized by: weak pulse then accelerated, pronounced and progressive heart failure. Cardenolides causes gastrointestinal disorders such as: colic, haemorrhagic enteritis, diarrhea, decreased intestinal motility; nephritis and morphopathological changes: dilated cord (atrial dilatation), pulmonary with venous stasis (www.

scritub.com,). Sometimes the end is undesirable: the death of the animals (Puschner *et al.*, 2003). Symptoms would not be completely without long-lasting diarrhea, stubborn to treatment, polyuria (Zanoschi *et al.*, 1981). According to the same author, none of the glycosides disappear by boiling, and in the hay, the weight of this plant should not exceed 1%.

The whole plant of *Convallaria majalis* is toxic because it has over 20 cardiac glycosides and saponins (Wink, 2009). The poisoning is severe by affecting the cardiovascular system. The plant contains convallarin (<http://poisonousplants.ansci.cornell.edu>, 2015); cardiac glycosides (<https://www.coursehero.com>, 2015), which causes painful burns in the mouth and throat, salivation, nausea, vomiting, abdominal pain, pupils dilation, slow and irregular heartbeats, hypertension, sometimes coma and death (Wink, 2009; Chaney, 2015).

Helleborus purpurascens, has as a spreading area: the beech and spruce forests, from the altitude of 300 meters inside the Carpathian arch and from 500 to 600 meters in the rest. Because it is a calcite plant, it does not grow on acidic lands, but it appears around limestone rocks (<https://ro.wikipedia.org>,). Contains 3 active principles: heleborine, alkaloid - drastically purgative; heleborein, saponin acting on the nervous system causing narcosis and anesthesia and a steroidal glycoside with cardiotonic action, hebrin, to which is added ecdysteroids and γ -lactones (protoanemonin) (Maier *et al.*, 2013). Because of these principles, the signs of intoxication manifested by cows are: digestive, nervous, cardiac. Cows exhibit inappetence, vomiting, gastroenteritis (Paul, 2007). At the cardiac level manifestations include: slow heart rate, with periods of arrhythmia, difficulty breathing. Muscle tremors are usually preceded by coma and death by asphyxia. It is not recommended to consume milk from poisoned cows because it causes diarrhea and vomiting (Zanoschi *et al.*, 1981).

Poisoning with plants containing cyanogenic glycosides

Plants of the genus *Sorghum*. *S. halepense* (Johnson grass), a naturalized and invasive plant present in Romania's spontaneous flora (Sîrbu, 2012), under certain soil and climate conditions, ie frost or drought, contain a cyanogen nitrile

glycoside (durrhin) whose toxicity level is low, after Knight (2007). Durrhin, by hydrolysis at an alkaline pH or by crushing the plant, decomposes into glucose, oxybenzoic acid and hydrogen cyanide which inactivate cell ferments and produce respiratory center paralysis (Popescu *et al.*, 1981) and cardiac arrest (D'Mello, 2002).

Poisoning is manifested by hind limb paralysis, paresis, death through anoxia (Man, 1986). The parts of the plant with a high concentration of cyanide are: strain and leaves, but, the young shoots are the most toxic (Fishel F., 2001).

The animals will not be allowed to grazing the sorghum before the dew rises because it exacerbates the toxicity of the plant. Other cases in which toxicity is manifested are: the consumption of green sorghum during or after rain or bumpy days, or when animals are hungry and consume a great quantity of plant in a short time (<http://www.dpi.nsw.gov.au>, 2007). Poisoning usually occurs after a period of drought followed by rainy weather when the amount of hydrogen cyanide reaches 1 mg / kg of live weight (El Mahdy, 2015).

Prevention measures consist of avoiding grazing or sorghum consumption in rainy weather. In hay or silo the toxicity of durrhin is lost (Luginbuhl, 2015). Whatever the variety, *Sorghum* contains between 400-900 ppm cyanide by dry weight, which is why it is difficult to set a limit due to many factors, but 600 ppm is considered a dangerous threshold and sometimes 200 ppm for starving animals. (<https://www.daf.qld.gov.au/>, 2013).

Sambucus nigra (Elderberry), common species from the plain to the lower floor of forests, meadows, shrubs, (Zanoschi *et al.*, 1981), is particularly present on soils rich in nitrogen, phosphate and potassium (Atkinson *et al.*, 2002), but, poisonings are rare (DiTomaso, <http://wric.ucdavis.edu>,).

Palatability is differentiated over seasons, less in the spring and with greater expansion in late summer and autumn (Stevens *et al.*, 2003). All parts of the plant: bark, leaves, mature fruit, unripe berries, roots, stems (Cooper *et al.*, 1984), by ingestion produce poisoning in mild or moderate forms (Gough, 2010).

Cyanogenic glycoside, sambunigrine is present in the leaves (Long, <http://books.google.ro/>), fresh fruits contain hydrogen cyanide (Zanoschi

et al., 1981), and those unripe, samburigrine (EMA/HMPC/44208/2012). Another cyanogenic glycoside is vicianine (Tewe *et al.*, 1989), to which, it is added purgative substances (www.weeds.mangrovemountain.net, 2008); sambucine-alkaloid, plus triterpenoides, resins, lecithins (Knight, 2007). Cyanogenic glycosides, by enzymatic or acidic hydrolysis, release cyanogenic acid, which inhibits enzymes that play a role in tissue respiration, producing histotoxic hypoxia. In small quantities it causes purging, and large ingested quantities induce animal depression. It is a violent emetic, animals displaying cathartic effect with diarrhea, abundant diuresis, accelerated pulse (Long, <http://books.google.ro>). The nausea is caused by raw fruits (Chaney, 2015).

POISONING WITH PLANTS CONTAINING OTHER TOXIC PRINCIPLES

Euphorbia spp. (spurge) is part of the category of toxic plants for cows and not only (DiTomaso, <http://wric.ucdavis.edu>), but it is rarely consumed due to low palatability (Bosworth, 2006). Spread: All the country! Grows in pastures, cultivated places, vacant lands (Zanoschi *et al.*, 1981).

In contact with the sap that has a high content of euphorbon (Beardsley *et al.*, 1983) it is noted severe irritation of the skin, with the emergence of blisters (Glen., 2008).

Manifestations in case of consumption occur 1-2 hours after ingestion and are translated by: salivation, vomiting, burning irritation in mouth, throat and eyes, abdominal pain, diarrhea often haemorrhagic, muscle trembling, sweating, due to euphorbia, which in addition causes nervous and, cardiac disorders (Zanoschi *et al.*, 1981), manifested by: arrhythmia, tinnitus, kidney and liver disorders, coma and in addition is co-carcinogenic (Wink, 2009).

The dominant clinical sign in fatal cases is blood-borne diarrhea due to haemorrhagic enteritis. Also, it can be noticed: the depreciation of organoleptic quality of milk, which has reddish color, bitter taste and more, is toxic, that is why it is avoided to be consumed (Robinson, 2011).

The hay should not contain more than 1% of *Euphorbia spp.* and *Mercurialis annua* of the composition of the plant mixture, because because, by drying they lose out of toxicity but, do not completely disappear (Gligor *et al.*, 1971). As a spreading area *Eupatorium spp.*, is found in

the meadows of the plains and mountain areas, terraces, virgin land (Enache, 2012).

Eupatorium rugosum (white snakeroot), *E. ageratoides*, *E. urticaefolium* and the newest invasive plant *Eupatorium cannabinum* - boneset (<http://issg.org/>) are plants of high toxicity especially at the end of the summer or when, by overproduction, the feed is insufficient (Bosworth, 2006).

From the parts of the plant, stems and the leaves are the most toxic, because of tremetol that causes the disease called "trembles", and the symptoms are manifested by: muscle tremors especially in the nose and legs, especially of the flank and hind legs (<http://poisonousplants.ansci.cornell.edu>, 2015), deficiency to stay in standing position (Beardsley *et al.*, 1983), stiff gait, depression, periods of sweating, normal or subnormal body temperature, labored or shallow respiration, partial throat paralysis, jaundice, passage of hard feces, prostration, death. The effect of consumption is cumulative, poisoning may occur at the consumption of 1-20% of the body weight and occurrence of poisoning manifestations within 2 days to 3 weeks (<http://poisonousplants.ansci.cornell.edu>, 2015). Because the toxin is eliminated through milk, cows will show signs of poisoning later (Spaink, 2003).

The toxic effect of *Eupatorium* consumption does not only occur directly on animals but, the toxin absorbed in milk or meat, products derived from poisoned animals also affects consumers to which it provokes "milk disease", butter or meat (Robinson, 2011, <https://zidbits.com/>, 2011/).

Pteridium aquilinum (Bracken fern). All parts of the plant are toxic (Knight, 2007), having several principles: ptaquiloside - unstable glycoside (German, 2017) that, under alkaline conditions is transformed into conjugated diene-one which is readily added to various nucleophilic compounds, the exerted action being positively carcinogenic (<http://ethnobotanical.info>); at least two carcinogenic potential principles: quercetin și kaempferol (<http://ethnobotanical.info>); prunasin which are glycoside; thiaminase, an enzyme that reduces the thiamine reserve of the body, present in the leaves and root (Stegelmeier, <http://www.msdevetmanual.com>; <http://www.pfaf.org>). In cattle, the effect is cumulative, the plant having direct or indirect anticoagulant properties,

signs of intoxication occurring after 1-2 months from feed consumption containing more than 30% bracken fern (<https://documents.tips>). Animals are listless, weight loss, bleeding on the mucous and internal membranes, anemia (Schivera *et al.*, 2011), high fever, (Bosworth, 2006), abundant salivation, petechial hemorrhages, haematochezia, bright blindness (<http://vetbook.org>). Nasal and rectal haemorrhages, difficulty in breathing, blood in urine and faeces, haemorrhagic syndrome, induces immunotoxic effects (Latorre *et al.*, 2011), aplastic bone marrow, (<https://www.ars.usda.gov>) leading to severe leucopenia, trombocytopenia (Bradley, www.chm.bris.ac.uk), bladder and intestinal carcinomas, urinary bladder neoplasm of various tissue types and epithelial tumors of the upper gastrointestinal tracts of ruminants (Panter *et al.*, 2011). Symptoms are dependent on the severity of poisoning.

Thus, in mild cases, acute dermatitis is noted on the nasal bridge which are a tell-tale, and in severe cases two different syndromes are distinguished: first, acute hemorrhagic syndrome translated by bone marrow depression and urinary tumors that is considered the second syndrome (<http://vetbook.org>).

Young animals can develop swelling in the larynx and may have respiratory problems due to laryngeal and perilaryngeal edema (Mc Kinnon, <http://www.ava.com.au>) called hematidosis, blood sweat, or Keridilis's disease (<https://documents.tips>).

The second form of intoxication mentioned by the same authors is enteric, which precedes laryngeal form and which is manifested by bloody feces, hematuria, the blood coagulates hard, since there is a deficiency of platelets. After German (2017), thiaminase does not obviously affect ruminants because ruminal bacteria degrade the enzyme, but, most likely ptaquiloside affect bone marrow. The same principle is incriminated in soil pollution and can reach in drinking water (<http://ethnobotanical.info>). Health damage is reversible if thiamine is administered in a timely manner. The immunodepressive effect of ptaquiloside can be prevented by selenium supplementation (Latorre *et al.*, 2011). The possibility of consumer poisoning through the milk obtained from cows that have ingested this plant is possible (Chaney, 2015).

THE REVERSE OF THE COIN: THE POSITIVE EFFECT OF TOXIC PLANTS

Although intoxications are imminent in the case when the proportion of toxic plants is high in floral composition, should not be undermine the beneficial, healing effect of these, which may come to the aid of medicine, and considered "the gift of God to mankind" in Hindu mythology (Lans *et al.*, 2007), that, can be harvested at the end of August, early September. Ethnoveterinary research is defined as "the systematic investigation and application of folk veterinary knowledge, theory and practice" (Schmid *et al.*, 2012).

Veratrum album. Has been used since the Middle Ages in Europe as an emetic for cows (Lans *et al.*, 2007). In folk medicine *Veratrum* is used as well against irritation in neurologia, tonic cardiac due to its content in alkaloids with antihypertensive action (Schmid *et al.*, 2012).

Roots of *Veratrum album* are used as tea in the treatment of diarrhea in calves (Bartha *et al.*, 2015). Root dried and smeared onto the hair or boiled in combination with *Brassica oleracea* leaf sap are used in the fight against lice to large and small ruminants (Gub, 2005).

Applying the leaves in the form of a blanket or in the form of a powder obtained from the drying of the plant *Chelidonium majus*, is used in veterinary treatment to combat scabies in animals. The aerial parts of the plant mixed with forage are used to treat intestinal infections in cows and the decoction of *Chelidonium majus* can be given to cows for the elimination of placenta (Vlková *et al.*, 2015). Among the plants with anti-parasitic effect, white lupine (*Lupinus albus*) is beneficial. In fact, it is the only plant that can be applied directly to the skin of the animals (Tikofsky, 2013), or by boiling lupine seeds which, due to their high alkaloid content, give a bitter taste. These, after boiling, are applied to the skin of animals having a repellent and aficid effect (Bischoff *et al.*, 2016).

Nicotiana tabacum, is used in the treatment against ectoparasites (Bischoff *et al.*, 2016). Nicotine sulphate extracted from *Nicotiana tabacum*, is used to eliminate gastrointestinal nematodes: *Monezia*, *Ascaridia* and other parasites (Laudo *et al.*, 2013).

According to the same author *Belladonna* is used in: high fever systemically and locally and the tissue is bright red or red streaked and painful such as acute mastitis (McCrory, 2012). The parts

used in the plant *Eupatorium perfoliatum*: Leaves, flowers, have an effect immune stimulant, reduce bone pain, fever (Tikofsky, 2013)

In the heart diseases the parts of the plant *Digitalis lanata*: leaves, roots, seed have homeopathic effect (Tikofsky, 2013). Convallatoxin and convaloside from *Convallaria major* can be used as an alternative to *Digitalis* cardiac failure treatment (Laudo *et al.*, 2013). Convallatoxin, from the blossoms, is used as a cardiotonic. The dried rhizome, known as *Convallaria* root, has also been used as a cardiotonic and diuretic. In veterinary science it has been used as a diuretic and cardiac stimulant (<http://poisonousplants.ansci.cornell.edu>, 2015).

In Romania, but also countries such as Italy, Turkey, Serbia, the roots and branches of *Helleborus spp.* are inserted under the skin of sick animals to treat respiratory problems (Maior *et al.*, 2013). At cattle, *Helleborus purpurascens* roots are inserted in the outer ear to treat inflammation (Vlková M., *et al.*, 2015), the petiol of *Helleborus bocconeii* are inserted into the ear or the neck for bronchitis the leaves of *Helleborus foetidus* are inserted into the ears for bronchitis and pneumonia (Bartha *et al.*, 2015),

Equisetum arvense is used to maintain the mineral balance during the period of calving (<http://www.bionaturesanteanimale.fr>).

For prevention and therapy of false gestation it is indicated *Senecio vulgaris*, which promotes estrogen secretion and inhibits the secretion of progesterone (Laudo *et al.*, 2013)

Sambucus nigra - elderberry may be effective for the treatment of gastrointestinal disorders, such as colic, impaired digestion, tympany, and meteorism (Mayer *et al.*, 2014). *Sambucus nigra* flower as a decoction has diuretic effect; the flower in fumigation used for inflamed udder, mastitis (Bartha *et al.*, 2015). "Elderberry flowers contain flavonoids and rutin, which are known to improve immune function, particularly in combination with vitamin "C." The flowers also contain tannins, which account for its traditional use to reduce bleeding, diarrhea, and congestion" (Stevens, 2003).

CONCLUSION

Not all animal species react in the same way to the action of a substance present in plants, but the strategy of good management of pasture and

grazing is the main desideratum for maintaining the integrity of health and productive performance in cows.

Although plants with toxic potential may also have beneficial effects being used in Ethnoveterinary.

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