AN INSIGHT INTO THE TOXICOLOGICAL AND MEDICINAL PROPERTIES OF
LANTANA CAMARA PLANT

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- Plants are integral parts of nature and constitute the major portion of animals’ ration in the form of green and dry fodders.
- Some plants are very obnoxious and produce toxicity amongst livestock. Lantana is one of them.
- There are about 40 species of the genus Lantana. The important species include L. camara, L. indica, L. crenulata and L. trifolia.
- Amongst various species L. camara variety aculeata (red flower variety) has been responsible for livestock poisoning in Himachal Pradesh.
- This plant was brought to India in the early part of nineteenth century as an ornamental plant.
- The first report of lantana poisoning was from Townsville (Australia) in 1910.
- In India, field cases of lantana poisoning have been reported from Himachal Pradesh, Uttar Pradesh and Maharashtra.

Toxic chemical constituents: The toxic signs are mainly due to the presence of toxic triterpenoids, namely lantadenes (lantadene A, lantadene B, lantadene C, lantadene D and Icterogenin). Lantadene A, B and C constitute nearly 69% of the total triterpenoids.

Absorption of lantana toxins:
The triterpenoids can be absorbed from all regions of the digestive tract but most rapidly from the small intestine. The absorption appears to be slow from the rumen however it is continuous and hence exposure of the liver to the toxic lantadenes is maintained for several days.

Pathophysiology:
Features of the mechanism of lantana poisoning which are important in determining the onset and progression of the disease have been identified and are given in figure 1. These include:
- Only a small proportion of triterpenoids is absorbed from the digestive tract.
- Continuous absorption of the toxins is necessary for the disease to develop and be maintained.
- Ruminal stasis occurs and results in retention of toxins in the rumen for a long period.
- Absorption of the toxins from the rumen maintains the liver injury.
- Injury to the bile canalicular membranes is a prominent finding in affected liver injury.
Symptomatology:

- The course of illness and severity of symptoms depends on the quantity of lantana foliage ingested.
- After ingestion of lantana foliage the animal becomes partially off-feed within 2-6 hours and completely anorectic at 24 hours onwards.
- The ruminal motility decreases as early as 6 hours with complete ruminal atony from 48 hours onwards. Thus the animal suffers from acute constipation/impaction. The affected animal passes hard-palleted faeces with much straining. Sometimes the faecal balls are coated with mucous and blood. As the disease progresses the constipation/impaction becomes more pronounced and the animal is unable to defecate at all.
- The rumination is suspended or completely ceased.
- The poisoned animal soon becomes dull and depressed with dry muzzle.
- Signs of photosensitization are observed in animals which continue to take green fodder. These are in the form of swollen and oedematous ears and eye lids with cracks/fissures on the muzzle and other nonhairy parts. Later on the photosensitization is so severe that the skin starts peeling off at various parts, particularly at the head and face regions, leaving behind raw surfaces with wounds.
- Signs of jaundice include pale conjunctival, vaginal or vulvar mucous membrane and sclera of eye.
- Dehydration is pronounced as the disease advances.

Pathological findings:

- Liver is swollen with rounding of the edges and gall-bladder is 3-4 times distended.
- Kidneys are pale and swollen.
- Subcutaneous tissues and fat have yellow discolouration.

Diagnosis:

In spite of nearly more than 50 years of extensive work in the field of lantana toxicity meagre attempts have been made to develop the methods to diagnose the natural cases of lantana poisoning. Confirmatory diagnosis has remained a big limitation. However, a tentative diagnosis is made based on the following factors:

**History:** The farmers, in lantana infested localities, are very thoroughly aware of the symptoms of lantana poisoning and there are rarely cases of wrong reporting. A preliminary knowledge of the symptomatology of the condition with a little clinical experience is sufficient to extract the proper history. Most of the natural cases do occur when animals are left to graze specially after stall feeding for a long period. The incidence is more during the scarcity of the fodder or draught period.

**Circumstantial evidences:** The incidence of the poisoning is more in heavily lantana infested areas.
**Clinical findings:** The clinical symptoms of lantana poisoning are very characteristic. The signs develop in a proper fashion and are progressive. Usually the cases are reported after the lapse of a period of about 2 days when the poisoned animals become anorectic and are unable to defaecate even after strenuous efforts. These are the earliest signs which the farmers report at their own. Some of the affected animals are presented with some initial signs of photosensitization in the form of swollen and oedematous ears & eyelids.

**Laboratory evaluations:** Following laboratory procedures may be adopted to support the diagnosis.

- **Liver function tests:** Increased plasma concentration of total and direct plasma bilirubin along with increased plasma enzymatic activity of gamma-glutamyl transferase and arginase have been reported as most sensitive indicators of lantana induced hepatitis. The BSPl/2 value increases rapidly.
- **Kidney function tests:** Increased plasma creatinine and blood urea nitrogen concentration indicate renal damage.
- **Rumen function tests:** Decreased rumen protozoal motility, concentration, iodophyllic activity, glucose fermentation (GFT) and total volatile fatty acids concentration (TVFA) along with increased rumen pH, ammonia nitrogen concentration, sedimentation activity time (SAT) and methylene blue reduction time (MBRT) are indicative of gross rumen microbial inactivity.
- **Chromatography and spectronic screening of body fluids:** Rumen liquor and blood samples from affected animals may be screened for the presence of toxins or their metabolites, if any. It can act as a very good diagnostic tool for confirmation of the toxicity. Unfortunately this aspect has remained neglected except a little efforts made by some workers.

**Differential diagnosis:** This is an important part in the process of making diagnosis. There are a large number of plants, growing in our country and causing hepato-toxicity and thus leading to the development of secondary photosensitization. The only method to make differential diagnosis is to correlate the history, circumstantial evidences, clinical findings and biochemical profile. The history of ingestion of lantana foliage and thereafter development of typical signs (ruminal stasis, complete anorexia and jaundice) may be correlated with raised plasma bilirubin level, particularly direct bilirubin. In addition, the locally growing lantana plant may be got screened for the presence of toxic constituents i.e. lantadenes.

**Therapeutic considerations:**

For better understanding of the therapeutic measures to be adopted, the course of diseases is divided into three parts:

1. **Gastro-intestinal (GIT) phase**
2. **Hepatic phase**
3. **Extra hepatic phase**
Figure: 1-Schematic representation of pathogenesis and treatment

Ingestion of lantana foliage  →  Purgatives
↓
Digestion in the rumen
&  →  Adsorbents

**GIT Phase**
Release of toxins in rumen  ↓
Effect on rumen microbes?  →  Rumen cud transplation & ruminotorics
↓
Absorption of toxins

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Portal circulation
↓
Liver
↓  Anorexia

**Hepatic Phase**
↓  Jaundice  →  Antidote(s)?
↓  →  Liver tonics
↓  Photosensitization  →  Housing in shade
↓  →  Soothening agents
↓  →  Anti-inflammatory

Toxins/metabolites in circulation?  →  Antidote(s)?

**Other effects**
Dehydration & Metabolic acidosis  →  Fluid & electrolytes therapy

**Extra Hepatic Phase**
↓
Secondary bacterial infections
Cutaneous  →  Antiseptics
Systemic  →  Antibiotics

✓ So far two adsorbents have been recommended viz. activated charcoal and bentonite. Recommended doses of activated charcoal are 2 kg suspended in 20 litres of electrolyte solution for an adult cattle and 500 g in 4 litres of electrolyte solution for an adult sheep.
✓ Another recommendation is to use activated charcoal @ 5 g/kg body wt. in 5 litres of multi-electrolyte solution (sodium chloride, potassium chloride, sodium citrate and dextrose) at an interval of 12 hrs, two doses, orally, along with extensive symptomatic and supportive therapy including liver tonics and fluids.
✓ Dose rate of bentonite is 5 g/kg body wt. in 4 litres of tap water as a single dose (addition of electrolyte may interfere with the adsorption process in the rumen). It has been suggested as an alternate and less costly adsorbent.

✓ Symptomatic and supportive therapy is must to get favorable results.
✓ It is worthwhile to use the rumen-cud transplantation and ruminotorics in case of rumen dysfunctions. The related therapeutical trials needs to be undertaken in a proper and systematic manner.
✓ The use of liver tonics is justified provided damage to the liver is reversible.
✓ To counteract the effect of circulating toxins/metabolites? the specific antidote(s) may play a decisive role, however, so far no antidote(s) could be developed perhaps because of inadequate information on the chemistry and geometry of the various lantana toxins.
✓ Housing of the animal in shade along with the use of smoothening, anti-inflammatory and antiseptics is useful in animals exhibiting the signs of photosensitization.
✓ In case of secondary bacterial infections local and/or systemic antibiotics are helpful.

Medicinal properties:

Medicinal use of *Lantana camara* has been mentioned. Sharaf and Nuguib (1959) extracted resins and alkaloids from *L. camara* leaves with alcohol. The alkaloid fraction is believed to lower the blood pressure, accelerate the respiration, stimulate the intestinal movements and inhibit the uterine motility in rats. In view of their low toxicity, the alkaloids may have application in the treatment of asthma, bronchiectasis, arterial hypertension and fever. On steam-distillation, the leaves yield (0.2%) yellow or greenish yellow oil with a pleasing and lasting odour. On standing the oil becomes viscid and insoluble in alcohol. The leaf oil is not of any direct value in perfumery. It is used in the treatment of itches of skin and may also be useful as an antiseptic for wounds. The leaves contain a steroid, lancamarone (C\(_{28}\)H\(_{40}\)O\(_{4}\)) which is a fish poison (upto 1 : 1,000,000 dilution) and is a cardioactive. Bark of stems and roots of lantana contain a quinine-like alkaloid lantanine which has strong antipyretic and antispasmodic properties. Similarly, extracts of shoot showed antibacterial activity against *Escherchia coli* and *Micrococcus pyogenes var. aureus*. The plant is also considered to have vulnerary, diaphoretic and carminative properties. It is useful for fistulae, pustules and tumours. A decoction of the plant is given in tetanus, rheumatism, malaria and atox of abdominal vesceae. A decoction of fresh leaves is used as gargle for toothache. Pounded leaves are applied to cuts, ulcers and swelling. A decoction of leaves and fruits is used as a lotion for wounds (Wealth of India, 1962).

Akhter (1971) studied the pharmacological action of the alcoholic extract of the lantana leaves on the blood pressure of the anaesthetized dogs and rats, isolated guinea pig ileum, rabbit intestine and rat uterus. However, no noticeable action of the alcoholic extract, on its own, was recorded.

Kurian (2003) has recently described the therapeutic use of *L. camara* in humans and mentioned that various parts of the plant have different medicinal value as given below:
Decoction of the leaves and stems, when used externally, acts as an excellent wash for eczema and a chronic inflammation of skin.

Pounded fresh leaves are used for sprain.

The flowering tops in decoction are used for cough, cold, fever, jaundice and chest diseases. It is a good acid in baths for rheumatism.

Decoction of root is recommended for use against infection of respiratory tract, mumps; in gargles and is a good mouth wash for mouth ulcers.

Decoction is prepared by taking the required parts of the plant which are simmered for about 30 minutes in water so as to get their medicinal components released. The preparation is strained before its use (Kurian, 2003).

While using the plant for the purpose of medicinal use, some guidelines have been given which apply to all the medicinal plants (Kurian 2003).

Leaves should be collected when fully developed. In case of biennial plants the leaves should be collected in the second season / year of growth, when they are strongest. Collect in clear, dry weather, in the morning, after the dew, if any, has disappeared.

Collect the stems either during the time of flowering or when the fruit is ripened. Dead and decaying portions should be discarded.

Flowering tops are collected before and after the flowers open completely. Collect them in clear, dry weather, in the morning after the dew, if any, has disappeared.

In view of above account about the toxicity and medicinal value of *L. camara* a common question may arise “whether lantana is a bane or boon to the society?“. It appears that there is a potential for utilizing lantana for various therapeutic uses, however, most of the above mentioned uses are more of academic interest than practical uses. As regards as toxicity is concerned, the plant is highly toxic to livestock causing mortality. The mortality rate is high because of non-availability of specific antidote(s) The plant has spread very fast and has occupied a sizable land presently in spite of many control measures. Thus, lantana is definitely a bane to the society in general and to the farmers in particular.

Reference:


