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Physicochemical and microbial alterations in rumen liquor during *Lantana camara* toxicity in buffalo calves (*Bubalus bubalis*)*

R K MANDIAL[1] and S N S RANDHAWA[2]

Punjab Agricultural University, Ludhiana, Punjab 141 004

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ABSTRACT

Rumen liquor analysis of *Lantana camara* intoxicated buffalo calves revealed complete absence of protozoal motility, concentration and idophillic activity with significant ($P < 0.01$) increase in sedimentation activity test and methylene blue reduction time. However the glucose fermentation test value decreased significantly ($P < 0.01$). Significant ($P < 0.01$) increase in rumen pH (8.16±0.18) and ammonia nitrogen concentration (27.33±2.05 mg/dl) was also recorded during the toxicity. Total volatile fatty acid concentration decreased significantly ($P < 0.01$) to 9.06±0.88 m Eq/litre. It was concluded that *Lantana camara* var. *aculeata* caused gross rumen microbial inactivity in buffalo calves.

Key words: Buffalo calves, *Lantana amara* toxicity, Rumen function tests

Lantana camara is one of the most noxious weeds of the world. Field outbreaks of lantana toxicity have frequently been reported in India (Katiyar 1981). Toxic effects of lantana on liver and kidney are well documented, however, its effect on rumen microbes has attracted a little attention. Hence the present study was undertaken to investigate the effect of lantana toxins on rumen liquor in terms of physical, chemical and microbial alterations.

MATERIALS AND METHODS

The toxicity was induced in 6 male healthy buffalo calves (9-12 month old) by oral administration of shade dried *L. camara* var. *aculeata* leaf powder (@ 6 g/kg b. wt. once only). Another group of 6 calves was kept as a control.

About 100 milliliters (ml) of rumen liquor was collected with the help of paraffin lubricated stomach tube, from each calf at 0, 12, 24, 48, 72 and 96 hr and was immediately analyzed for its physical characteristics (Rosenberger 1979), protozoal motility (Mishra and Singh 1974), protozoal concentration and iodophillic activity (Mishra *et al.* 1972), pH (portable pH meter), total volatile fatty acids (Barnett and Reid 1957), ammonia nitrogen by micro-diffusion technique (Conway 1957), sedimentation activity test (SAT) and glucose fermentation test (GFT) (Nicholas and Penn 1958) and methylene blue reduction time (MBRT) (Rosenberger 1979). Statistical analysis (paired t-test) was done as per Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

The normal greenish brown colour of rumen liquor changed initially to brownish yellow between 24 and 48 hr and finally to deep brownish by 96 hr of toxicosis. The normal aromatic odour recorded at 0 hr turned to ammonical by 96 hr. These changes in colour and odour might be because of corresponding increase in rumen pH and NH^3-N concentration respectively. The viscous consistency changed initially to watery at 12 hr. However later on, rumen liquor became highly viscous probably due to rumenstasis and dehydration (Pass 1986, Kaushal 1994).

The protozoal motility, concentration and iodophillic activity decreased progressively from +++ to + by 48 hr with complete absence at 96 hr of intoxication. This might be due to significant ($P < 0.01$) increase in rumen pH (8.16±0.18) and non-availability of carbohydrate substrate due to anorexia. In addition, it is highly possible that lantana toxins (lantadenes) might have directly affected the protozoal population which needs substantiation by *in-vitro* studies.

Initial decline in microbial activity was followed by complete absence of rumen fermentation between 48 and 96 hr, post-induction of toxicity as reflected by SAT, MBRT and GFT (Table 1) values. This might be due to either direct effect of lantana toxins on microbial population as caused by other plant toxins like perloline, tannins and some essential oils

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Present address: [1] Associate Professor (Veterinary Medicine), College of Veterinary and Animal Sciences, Himachal Pradesh Krishi Vishavidyalaya, Palampur 176062.

[2]Professor, Department of Veterinary Clinic and Continuing Education.

Table 1. Microbial and biochemical changes during lantana toxicity (mean±SE)

Parameters	Time of sampling (hr)					
	0	12	24	48	72	96 or before death
SAT (Min)	12.17±1.06	23.67**±1.92	51.00**±3.36	Nil	Nil	Nil
	(11.15±1.13)	(13.17±1.08)	(12.33±1.16)	(9.83±0.98)	(11.83±1.24)	(10.5±1.02)
MBRT (Min)	3.17±0.47	15.33**±2.17	32.67**±4.58	Nil	Nil	Nil
	(3.67±0.33)	(2.50±0.22)	(3.17±0.31)	(4.5±0.34)	(3.5±0.22)	(2.83±0.17)
GFT (ml/hr)	1.62±0.12	0.73**±0.08	0.48**±0.03	0.18**±0.06	Nil	Nil
	(1.54±0.09)	(1.46±0.09)	(1.48±0.16)	(1.67±0.14)	(1.52±0.12)	(1.60±0.11)
pH	6.61±0.1	37.08±0.11	7.12*±0.13	7.21*±0.16	7.64**±0.09	8.16**±0.18
	(6.56±0.13)	(6.62±0.18)	(6.48±0.12)	(6.64±0.16)	(6.7±0.14)	(6.51±0.09)
NH3-N (mg/dl)	6.72±0.53	8.02±0.66	10.67*±0.75	18.83**±1.16	21.1**±1.45	27.33±2.05
	(7.05±0.62)	(6.78±0.51)	(6.64±0.16)	(7.19±0.62)	(7.09±0.53)	(6.96±0.51)
TVFA (mEq/litre)	74.05±5.26	50.50*±4.17	24.7**±3.46	19.58**±3.03	11.37**±1.39	9.06**±0.88
	(72.83±3.48)	(68.44±3.52)	(62.57±4.15)	(74.53±4.37)	(69.71±3.58)	(76.33±4.26)

Figures in parentheses, control group; * significant at 5% level ($P < 0.05$); ** significant at 1% level ($P < 0.01$).

(Allison 1977, Keeler *et al.* 1978) or due to indirect effect on account of unfavourable intra-ruminal atmosphere (Hungate 1966, Czerkawski 1986).

Progressive and significant ($P < 0.01$) increase in rumen pH (Table 1) appears to be because of corresponding increase in NH_3-N concentration and decrease in TVFA concentration (Tsuda *et al.* 1991).

In rumen liquor NH_3-N concentration the gradual increase might be due to microbial digestion of dead bacteria retained in the static rumen combined with decreased utilization of ammonia by rumen bacteria under scarcity of soluble carbohydrate (Warner 1956 a, b, Hungate 1966).

It is concluded that *L. camara* var. *aculeata* - red flower containing lantadene A, lantadene B and reduced lantadene A caused gross rumen microbial inactivity in buffalo calves.

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REFERENCES

Allison M J. 1977. The role of ruminal microbes in metabolism of toxic constituents from plants. In proceedings of a joint United State-Australian Symposium on poisonous plants at Utah State University, Logan, Utah, June 19-24.

Barnett A J G and Reid R L. 1957. Studies on the production of VFA's from grasses in artificial rumen. 1. The VFA's production from fresh grasses. *Journal of Agriculture Science* **48**: 315-21.

Conway E J. 1957. *Microdiffusion Analysis and Volumetric Error*. 4th edn. Crossby, Khood and Sons, London.

Czerkawski J W. 1986. *An Introduction to Rumen Studies*. Ist edn. Pergamon Press, New York.

Hungate R E. 1966. *The Rumen and its Microbes*. Ist edn. Academic Press Inc., New York.

Katiyar R D. 1981. A report on plant poisoning in sheep and goat. *Livestock Advisor* **6**: 57.

Kaushal A K. 1994. 'Clinico-biochemical and therapeutic studies on induced lantana toxicity in bovine.' M.V.Sc. Thesis submitted to HPKV, Palampur.

Keeler R F, Kampen K R V and James L F. 1978. *Effects of Poisonous Plants on Livestock*. Ist edn. Academic Press Inc., New York.

Mishra S K, Dash P K and Mohanty G P. 1972. The protozoan fauna of the rumen and reticulum of Indian cattle. *Indian Veterinary Journal* **49**: 463-70.

Mishra S K and Singh U. 1974. Studies on the clinico-pathological and therapeutic aspects of indigestion in cattle. *Indian Veterinary Journal* **51**: 698-704.

Nicholas R E and Penn K E. 1958. Simple methods for determination of unfavourable changes in ruminal ingesta. *Journal of American Veterinary Medical Association* **133**: 275-77.

Pass M A. 1986. Current ideas on the pathophysiology and treatment of lantana poisoning. *Journal of Comparative Pathology* **87**: 301-05.

Rosenberger G. 1979. *Clinical Examination of Cattle*. Ist edn. Verlog Paul Perey. Berlin and Hamberg.

Snedecor G W and Cochran W G. 1967. *Statistical Methods*. 6th edn. Iowa State Universitty Press, USA.

Tsuda T, Sasaki Y and Kawashima R. 1991. *Physiological Aspects of Digestion and Metabolism in Ruminants*. Ist edn. Academic Press Inc., London.

Warner A C I. 1956a. Criteria for establishing the validity of *in vitro* studies with rumen microorganism in so called artificial rumen systems. *Journal of General Microbiology* **14**: 733-48.

Warner A C I. 1956b. Proteolysis of rumen micro-organism. *Journal of General Microbiology* **14**: 749-62.