

Clinico-Pathological Alterations and Therapeutic Management of Thiram Poisoning in Cattle

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Abstract

As there is very scarce literature on fungicide poisoning in livestock animals and in view of reporting fungicide poisoning in cattle in the study area, the present study was conducted to study the clinico-pathology of thiram poisoning in cattle and to standardize the therapeutic regime for the poisoning cases. Clinical cases suspected for Thiram poisoning on the basis of confirm evidence from animal owner were subjected to clinical examination, hematology and therapeutic management. Cases died of severe poisoning were subjected to post-mortem examination. A total of 17 cattle suspected for Thiram poisoning on the basis of history and clinical signs of sudden onset of anorexia, salivation, shivering, teeth grinding, restlessness, prolonged sitting, tympany, colic, dyspnea and constipation or diarrhea in few cases were taken for the study. Significant increase in heart rate and respiration rate was observed while hematological analysis showed non-significant changes compared to healthy counterparts. Post-mortem and histopathological examination of cattle died of thiram poisoning showed mild hepatocellular degeneration, tubular necrosis in kidneys with focal infiltrates while marked edema and congestion was evident in lung tissues. The ailing cattle were treated with fluid therapy, anti-inflammatory drugs, vitamin B complex, atropine sulphate, antihistaminics along with laxative and prebiotics-probiotics showed good response to treatment with complete clinical recovery in 4-5 days of treatment. Being there is no specific antidote, the cases of fungicide like Thiram poisoning could be managed with symptomatic treatment along with regular clinical assessment.

Keywords: Cattle, Clinico-pathology, Thiram poisoning, Treatment

Agrochemical poisoning is frequently reported in the livestock as agriculture and livestock farming in India is inter-related (Jadhav *et al.*, 2023). Fungicides are pesticides that specifically inhibit or kill fungi underlying diseases of agricultural crops. Thiram is a fungicide commonly used for seed treatment to prevent attack of fungi on seeds and to increase germination percentage (Gupta, 2010). The full chemical name is Tetramethylthiuram disulphide. It is used as a fungicide, seed protectant, animal repellent, rubber accelerator and bacteriostatic in soap. It is available as dust, flowable, wettable powder, water dispersible granules and water suspension formulations. It is most commonly used in mixtures with other fungicides. It is applied as post-harvest in a number of seed crops including small and large seeded vegetables, cereal grains, cotton seeds and soybeans. It is applied to protect the seeds from a possible fungal attack and thereby sustain germination potential of the seeds in agricultural practices (Kavita *et al.*, 2015). There are few studies on various types of fungicide poisoning in livestock animals limited only to case reports (Akkina and Estberg, 2018, Siddiqui *et al.*,

2019, Jadhav *et al.*, 2023). The present communication highlights the clinico-pathological alterations and therapeutic management of Thiram poisoning in cattle.

Clinical cases suspected for poisoning with evidence by animal owner that the packet of fungicide powder being chewed or ingested by the animal followed by onset of illness were included in the study. The clinical cases of poisoning reported to Veterinary Clinical Complex of the college with history of moderate salivation, restlessness and accidental ingestion of polythene bags containing Thiram powder (40-75% W.S) while grazing were included in the study. Confirmed cases were subjected to detailed clinical examination and haematological analysis. The cattle suffering from severe toxicity which succumbed to death in spite of treatment were subjected to post-mortem examination as per the standard bovine necropsy protocol. Various tissue samples were collected in 10% neutral buffered formalin for histopathological examination. After fixation, the tissue samples were embedded in paraffin wax. The blocks were cut to obtain 4-5 um thick sections which were further subjected to hematoxylin and eosin (H&E) staining technique as described by Bancroft and

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Gamble (2007). The cases of poisoning were subjected to detailed clinical examination and hematological analysis before start of treatment. As there is no specific antidote the treatment was done with supportive medications which included fluid therapy, anti-inflammatory drugs, vitamin B complex, atropine sulphate, antihistaminics, herbal laxative, pre and probiotics.

The data generated with respect to clinical and hematological parameters from ailing cattle was compared with data of healthy cattle using independent 't' test using SPSS software.

Various fungicides are encountered in field during agricultural operations. Understanding mechanisms of fungicide action and toxicity is important because humans and domestic animals get exposed to these pesticides accidentally or intentionally (Oruc, 2010). Full chemical name for Thiram is tetramethylthiuram disulphide. It is used as a fungicide, seed protectant, animal repellent, rubber accelerator, and bacteriostat in soap (Osweiler *et al.*, 1985). At high doses it acts as a repellent to birds, rabbits, rodents and deer in fields and orchards. Thiram is available as dust, wettable powder, water suspension formulations and in mixtures with other fungicides. It has been used in the treatment of human scabies, as a sunscreen and as a bacteriostat in medicated soaps and certain antiseptic sprays. Another important source of thiram for environmental contamination is the degradation of the two widely used ethylene bisdithiocarbamate fungicides, ferbam and ziram (Dalvi, 1988).

There is very scarce literature about Thiram poisoning in cattle (Akkinu and Estberg, 2018, Siddiqui *et al.*, 2019, Jadhav *et al.*, 2023). Thiram is moderately toxic by ingestion, but it is highly toxic if inhaled. A total of 17 cases were found suffering from thiram poisoning in cattle. All the cases were admitted to the clinic have brought the packets of thiram or instruction details written overleaf recovered while accidental ingestion by animals as evidence of poisoning. History and circumstantial evidence revealed greater number of cases of fungicide poisoning occurred during cultivation of soybean crop during Kharif season by animals grazing near the recently sown soybean field. Unscientific handling and improper disposal of fungicide instead of its scientific use for seed treatment might be responsible for toxicity in livestock. Among affected cattle only 3 were female while 14 were male used for drought work.

Clinical examination of the ailing cattle showed signs of salivation, anorexia, shivering, teeth grinding, restlessness, tympany and dullness in mild to moderate

cases while symptoms like incoordination, convulsions and prolonged sitting were observed in moderate to severe form of thiram poisoning. Defecation status in affected cattle varied from constipation to diarrhea. Straining with mild rectal prolapse was observed in one cattle while abdominal colic was reported in two cases. Similarly, conjunctival mucous membrane colour varied from pink to congested. Clinical examination of ailing cattle showed non-significant changes in body temperature while significant ($P > 0.05$) increase in heart rate and respiration rate in thiram poisoning affected cattle compared to healthy counterparts. Hematological analysis showed non-significant changes when compared to healthy cattle. Siddiqui *et al.* (2019) reported hypersalivation, congested mucous membranes, sub-normal body temperature, head shaking and mydriasis in Thiram poisoning affected bull. The non-specific signs might be attributed to dose of Thiram ingested by the ailing animals. Clinical signs in thiram poisoning in cattle were anorexia, listless behavior, dyspnea, convulsions and death due to cardiac arrest (Kaya and Bilgili, 1998). Thiram is metabolized in the body to toxic metabolites as dimethyldithiocarbamate and carbon disulfide. These compounds have been shown to inhibit hepatic microsomal enzymes (Dalvi and Deoras, 1986). Inhibition of egg laying was reported in layer hens when thiram levels in ration were in the range of 100-500 ppm (Lorgue *et al.*, 1996). An outbreak of thiram poisoning on Spanish poultry farms showed softening of egg shells, depressed growth rate and limb abnormalities in around 1 million birds due to contamination of corn with thiram (Guitart *et al.*, 1996).

Since there is no specific antidote for thiram poisoning in animals, the treatment of all cases was done symptomatically with objective of evacuation of the toxin from gut and supportive therapy. Treatment comprising of Atropine sulphate, fluids, steroidal / non-steroidal anti-inflammatory drugs, pre and probiotics, vitamin B complex and laxative. Cattle showed neurological signs were treated with Diazepam for at least 2 days or till resolution of nervous signs. The treatment comprising of fluid therapy (Dextrose 5% + Ringer Lactate) @ 2-4 liter IV twice daily for 3-5 days, atropine sulphate @ 0.02 mg/kg IV twice daily for 1 day, vitamin B complex @ 10 ml IM for 3-5 days, steroidal (Dexamethasone @ 0.1 mg/kg) / non-steroidal anti-inflammatory drugs (Meloxicam @ 0.5 mg/kg) IV once daily for 3-5 days, prebiotics and probiotics @ 2 boli twice daily for 3-5 days along with laxatives (Magnesium Sulphate @ 0.5-1 gm/kg) twice daily for 1-2 days was instituted for the thiram poisoning affected cattle. As indicated above the

diazepam was used in the present study to control the convulsions in affected cattle. Siddiqui *et al.* (2019) treated successfully one case of thiram poisoning in non-descript bull using atropine sulphate, chlorpheniramine maleate, diuretic furosemide, flunixin meglumine and fluid therapy. As there is no specific antidote for thiram poisoning, symptomatic treatment using gastrointestinal demulcents, adsorbents, cardiorespiratory stimulants

and treatments to control convulsions has been indicated (Oruc, 2010). The treated cattle showed progressive recovery depending on the severity of poisoning with average recovery period of 3.93 days (2-6 days). Out of 17 cases suffering from thiram poisoning two severe cases succumbed to death in spite of initiation of treatment while 15 cases recovered successfully with instituted treatment indicating 88.23% recovery rate.

Table 1: Mean ($\pm$ S.E.) values of vital and hematological parameters in thiram poisoning affected and healthy cattle.

Sr. No.	Parameter	Affected (n=15)	Healthy (n=10)	T value
1.	Body temp. ($^{\circ}$ F)	101.54 $\pm$ 0.32	101.21 $\pm$ 0.16	0.761 ^{NS}
2.	Heart rate (/min)	73.90 $\pm$ 3.91	52.10 $\pm$ 0.48	5.605**
3.	Resp. rate (/min)	26.60 $\pm$ 1.02	22.00 $\pm$ 0.51	4.080**
4.	TEC ($\times 10^6/\mu$ l)	6.32 $\pm$ 0.30	5.97 $\pm$ 0.34	3.025 ^{NS}
5.	Hb (gm/dl)	10.40 $\pm$ 0.46	10.49 $\pm$ 0.48	-0.202 ^{NS}
6.	PCV (%)	26.54 $\pm$ 1.50	30.57 $\pm$ 1.84	-1.70 ^{NS}
7.	TLC ($\times 10^3/\mu$ l)	11.60 $\pm$ 1.71	10.45 $\pm$ 0.75	1.619 ^{NS}
8.	Granulocyte (%)	43.96 $\pm$ 7.57	47.47 $\pm$ 3.39	-0.399 ^{NS}
9.	Lymphocyte (%)	53.49 $\pm$ 7.14	47.27 $\pm$ 2.56	0.791 ^{NS}
10.	Monocyte (%)	2.55 $\pm$ 0.75	5.27 $\pm$ 0.94	-2.001 ^{NS}
11.	Platelets ($\times 10^3/\mu$ l)	165.80 $\pm$ 22.67	170.40 $\pm$ 11.37	-0.184 ^{NS}

NS: Non-significant, **: Highly significant ($P < 0.01$)

Two severe cases of thiram poisoning which died in spite of treatment were subjected to post-mortem examination. Histopathological examination of liver, kidneys and lungs mild to moderate hepatocellular degeneration, marked renal tubular epithelial necrosis and sloughing and pulmonary edema along with congestion respectively (Fig. 1-3). Hepatotoxicity has been found to be one of many toxic effects of thiram in

exposed workers and test animals. Typical pathology of thiram poisoning has been reported as liver enlargement and dysfunction, hepatitis, degenerative changes and focal necrosis (Hasegawa *et al.*, 1988; Maita *et al.*, 1991). The findings of mild to moderate hepatocellular degeneration in the present study are in accordance with the findings of experimental thiram poisoning in F344 rats by Hasegawa *et al.* (1988).

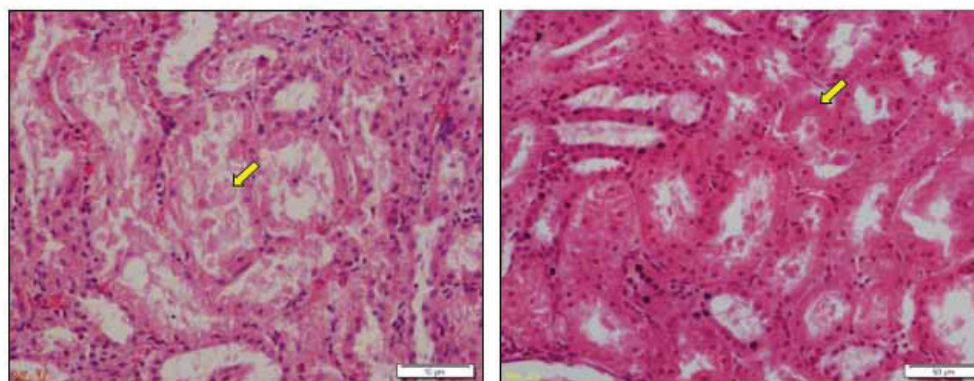


Fig.1: Histopathological Lesions. Kidneys: Marked renal tubular epithelial cells necrosis and sloughing (arrow) (H & E Stain, Bar=50 μ m)

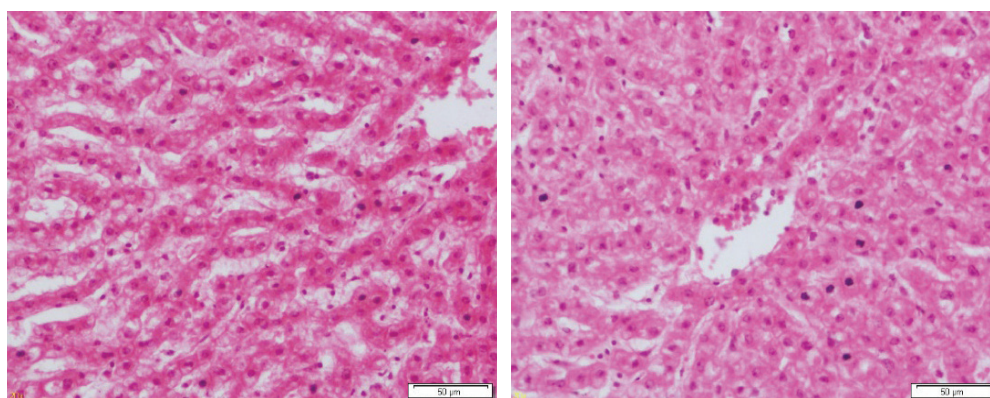


Fig.2: Histopathological Lesions. Liver: Mild to moderate vacuolar hepatocellular degeneration and necrosis (H & E Stain, Bar=50 μm).

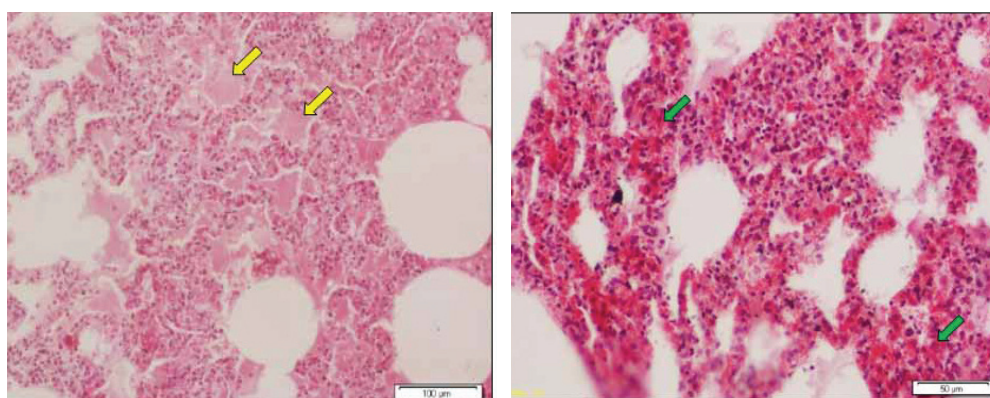


Fig.3: Histopathological Lesions. Lung: Note the presence of marked oedema (yellow arrow) and congestion (green arrow) (H & E Stain, Bar=50 μm).

Fungicide were the most commonly observed agrochemical poisonings in cattle during Kharif season due to accidental ingestion of carelessly disposed fungicide packets in agriculture field. Clinical syndrome comprising of anorexia, salivation, tympany, abdominal colic and occasionally nervous signs was observed in ailing cattle. Symptomatic treatment with regular assessment of the cases found effective in successful recovery in mild to moderate cases of thiram poisoning. Awareness about careful and scientific use of any agrochemicals in agriculture operations among farmers is required to prevent the accidents of poisoning in livestock animals.

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