What caused those Sheep in India to Die? A Plausible (Alternative) Hypothesis

Milind Kandlikar
University of British Columbia

Workshop on Biotech Contentions
Institute for Social Sciences
Cornell University
April 25-26, 2008.

The Sheep-death Controversy

- Claims of sheep deaths from grazing on Bt cotton detritus
- Claims of deaths numbered in the hundreds or more (disputed)
- Geographically localized in the Warangal regions of Andhra in 2005 and 2006, but spreading to the Adilabad
- Most reports pointing to “poisoning”

Sources of Evidence: 1

- News reports
- “Fact finding” missions of Center for Sustainable Agriculture (CSA) an AP based anti-GM NGO
- Autopsies conducted by the local animal husbandry officials
- Caveat: This work is not based on primary data. Info. that I use comes from anti-GM sites, and from Dr. Kameswara Rao’s blog.

Sources of Evidence: 2

- From GMWatch
  - http://www.gmwatch.org/archive2.asp?arcid=6494
    - Fact-finding April 06 (AP Shepherds Union and CSA)
    - Interviews with ***migrant*** farmers
    - Local Animal husbandry official – autopsies
- MK's Interview with CSA director Ramanjaneyulu
- Dr. K's blog

Body of Evidence

- Sheep did die and sources suggest “poisoning”
  - Farmers **(http://www.gmwatch.org/archive2.asp?arcid=6494)**
    - Sheep became dull/ depressed after 2-3 days post grazing; Cough with nasal discharge; Reddish and erosive lesions in the mouth; Bloat; Blackish diarrhea; Sometimes red colored urine;
    - Death over a few days
  - Animal Husbandry official **(http://www.gmwatch.org/archive2.asp?arcid=6494)**
    - Autopsy observed black patches in the small intestines, enlarged bile duct and liver with discoloration, and accumulation of pericardial fluid.
  - Dr. Kameswara Rao’s Blog

(http://www.fbaeblog.org/2007/07/plant_biotechnology_causes_of.html)

- Nitrate/Nitrite poisoning: “Lower quantities of insecticides on the Bt cotton crop, than on a non-Bt crop, nitrates and nitrites are more likely to be the toxicants than organophosphates”
- Chituku Rogam (bacterial disease)

Four Hypothesis

- Bt Cotton as the killer
- Biological/Bacterial agent – ‘Chituku Rogam’ (Pesticide dealers’ contention in K.Rao’s blog)
- Chemical Agent -Nitrates/Nitrites (K. Rao)
- This paper hypothesizes an agricultural toxin Ricin ingested from Castor bean and leaves

Testing the claims: Bt Cotton

- Certainly not an agent of acute toxicity
  - Extensive Testing of Bt varieties on sheep and goat in India prior to approval
  - A 90-day goat feeding study was conducted by Industrial Toxicology Research Center, Lucknow in 1998 (Caveat:Monsanto source)
- No recorded evidence (anywhere in the world) of acute Bt toxicity
  - Would surely have been revealed by now in other cases, both in India and abroad.

Testing the claims: Nitrate Poisoning

- Excess Nitrates detected in Bt cotton detritus
  - Expert study found presence of nitrates and nitrites, and residues of organophosphates in Bt cotton plants (Hindustan times, June 2007)
- Nitrate poisoning clinical symptoms
  - Loss in co-ordination, distress, labored breathing, excitability, cyanosis, muscular weakness, and collapse leading to death, in **a few hours to one day** after ingestion (K. Rao)
  - Pin-point hemorrhages may be present in the heart and trachea along with general congestion of the blood vessels (Halpin and Maffra, Victoria Dept of Primary Industries)
- Plausible but…
  - Sheep died much later than one day
  - Only some general symptoms overlap with observations (Breathing difficulties, distress)
  - Other autopsy evidence not consistent with Nitrate/ite poisoning (Liver and heart)

Castor Hypothesis

Castor bean (*Ricinus communis*) toxicosis in a sheep flock

M.R. Aslani[a,*], M. Maleki[b], M. Mohri[a], K. Sharifi[a], V. Najjar-Nezhad[a], E. Afshari[a]

[a]*Department of Clinical Sciences, School of Veterinary Medicine, Ferdowsi University of Mashhad, PO Box 91775-1793, Mashhad, Iran*
[b]*Department of Pathobiology, School of Veterinary Medicine, Ferdowsi University of Mashhad, PO Box 91775-1793, Mashhad, Iran*

Received 3 June 2006; received in revised form 25 October 2006; accepted 25 October 2006
Available online 3 November 2006

M.R. Aslani *et al.*, Castor bean (*Ricinus communis*) toxicosis in a sheep flock, *Toxicon* **49** (2007), pp. 400–406.

Abstract

This paper describes clinical, laboratory and pathological findings of sheep, which is intoxicated with castor bean. The source of intoxication was a miscellaneous garden waste. Forty-five animals showed clinical toxicosis and 17 died. The clinical signs included weakness, salivation, profuse watery diarrhoea, dehydration, mydriasis, teeth grinding, hypothermia and recumbency. The most significant haematological and biochemical findings were a high haematocrit, high concentration of serum BUN, creatinine and phosphorus and high activity of serum CK and AST. Pathology revealed severe gastroenteritis, cardiac haemorrhage and necrosis, hepatic necrosis and acute tubular necrosis in kidneys. Treatment included symptomatic and supportive care with fluid therapy and cathartic administration.

Castor bean as a toxin

- Contains Ricin a well known toxin and biological weapons agent (http://en.wikipedia.org/wiki/Ricin)
- Acute toxicity in small doses
- Symptoms
  - Liver necrosis (“black spots”); diarrhea; nasal discharge/salivation; cardiac hemorrhage
  - Much greater overlap with anecdotal evidence of post-mortem and clinical symptoms than Nitrates

When and where is Castor grown in India

- **When?**
  - Castor **planting season is during June/July** (rainfed-monsoon onset) or till August (irrigated).
  - Crop matures between 145-280 days after planting depending upon the variety, i.e., **harvesting between November and April**.
- **Where?**
  - Dryland crop; Semi-arid conditions
  - Soils
    - Andhra Pradesh (Nalgonda, Mahboobnagar, Rangareddy, **Warangal**, Karimnagar)
    - Karnataka and North Gujarat

Plausible Thesis?

- How does the evidence add up?
  - Sheep feeding on small amounts of Castor seed grown locally can die in large numbers by poisoning
  - Mortality rate is high as observed in Warangal
  - More overlap in autopsy and ‘clinical’ evidence than Nitrate/Nitrite
  - Castor is grown in the region, and timing seems plausible
  - Sheep farmers nomadic? So may not have prior experience with castor

More analysis…

- Need an animal scientist to look at the evidence (such as it is)
- Verify castor production in places where death occurred
- If hypothesis holds – information on castor should be disseminated.
- If not…Hey I am no expert on any of this!