SCIENTIFIC SECTION

THALLIUM POISONING IN SHEEP.*

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Since its introduction into this country in proprietary rat poisons about 1920, the use of thallium as a lethal agent for the control of noxious rodents has greatly increased. The Bureau of Biological Survey, of the United States Department of Agriculture, has investigated the application of this substance to the control of such animals as prairie dogs, ground squirrels, rats, mice and other rodents of economic importance. James C. Munch, consulting pharmacologist of the Bureau, worked out the minimum lethal doses for thallium, as the sulphate, for rats and rabbits (1). In this author's review of the literature, it is noted that there is no reference to the toxicity of thallium to sheep.

This factor became of primary importance during the past year because of the fact that sheep losses were occurring on areas that had been treated with thallium-poisoned grain for the control of prairie dogs. Suspicion was immediately directed toward the thallium. Accordingly, an experiment was undertaken jointly by the Control Methods Research Laboratory of the Biological Survey and the Department of Veterinary Pathology of the Colorado Agricultural College to determine the minimum lethal dose (M. L. D.), the minimum toxic dose (M. T. D.), the ease of detection of thallium in sheep viscera and the degree of acceptance the sheep showed for thallium-poisoned prairie-dog bait. This experiment was conducted at the Veterinary Feed Lots of the Agricultural College, Fort Collins, Colo.

Definite information on the subject being lacking, it was assumed that the M. L. D. would be approximately 25 mg./Kg., and doses of 10, 20, 25, 30, 40 mg./Kg. were chosen for the first five sheep to be fed.

The sheep were penned on October 7th, and given no feed for 24 hours. At the end of that time, the animals were offered the poisoned grain, but they absolutely refused to touch it. Another twenty-four-hour starvation period followed, then the animals were again offered the doses of poisoned prairie-dog bait. Table I shows how reluctant the animals were to eat the poison. From these results it is readily seen that the acceptance of thallium-poisoned grain by sheep is indeed very poor. When an animal that has been starved forty-eight hours will consistently refuse a grain treated with thallium, while at the same time it takes the same kind of grain that has not been treated, one has reason to assume that the poisoned material would not be picked up under normal conditions.

Results of the feeding tests are tabulated in Table II. It is readily seen that the M. L. D. will fall very close to 25 mg./Kg., as the sheep dying with a dosage of 24.10 succumbed on the ninth day after being fed.

It is also seen that toxic symptoms, as expressed by alopecia, were observed from the dosages of the range from 8.00 to 10.00 mg./Kg.; while no effect

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was noticed in animals receiving doses in the range of 3 mg./Kg. downward.

It is unfortunate that gaps from 10 to 24 mg./Kg., and from 3 to 8 mg./Kg. were necessary, but lack of a sufficient number of animals for experimental purposes made that imperative. When occasion demands, an effort will be made to obtain tests of M. L. D. and M. T. D. for those ranges.

The symptoms of thallium poisoning in sheep follow very closely those described for other test animals, first appearing in about 36 to 48 hours. The symptoms consist of marked champing of the teeth, loss of appetite, general dejection and diarrhea, with the feces mixed with mucous. This mucous was of high viscosity and very stringy. A discharge from the nose was also observed in most cases. This was also of high viscosity, the strings hanging almost to the ground at times. Repeated stretching, as if muscular cramping was experienced in the hind legs, was also an early symptom. Loss of accommodation and ability to control posterior regions developed, and the sheep acquired a wabbly gait before going down. A period of coma preceded death—which was appparently due to respiratory failure.

Chemical examinations of the internal organs from the sheep No. 86, No Tag and No. 31 were made. (Table III.) The most marked test in each case came from the liver. It is noticed that in one case of early death (4 days) there was enough thallium left in the stomach lining to give a qualitative test; while in delayed death (9 days) all the poison had left the stomach and had become localized in the liver and kidneys.

No thallium could be demonstrated in viscera obtained from the sheep dying on the areas poisoned for prairie dogs.

Post-mortem findings on the sheep of the experiment showed:

Signs of gastro-enteritis were present in fourth stomach and duodenum: the kidneys were congested and showed degeneration upon microscopic examination. The brain, lungs, heart, sex organs and large intestine showed no pathological conditions, although effects are usually reported on heart and sex organs.

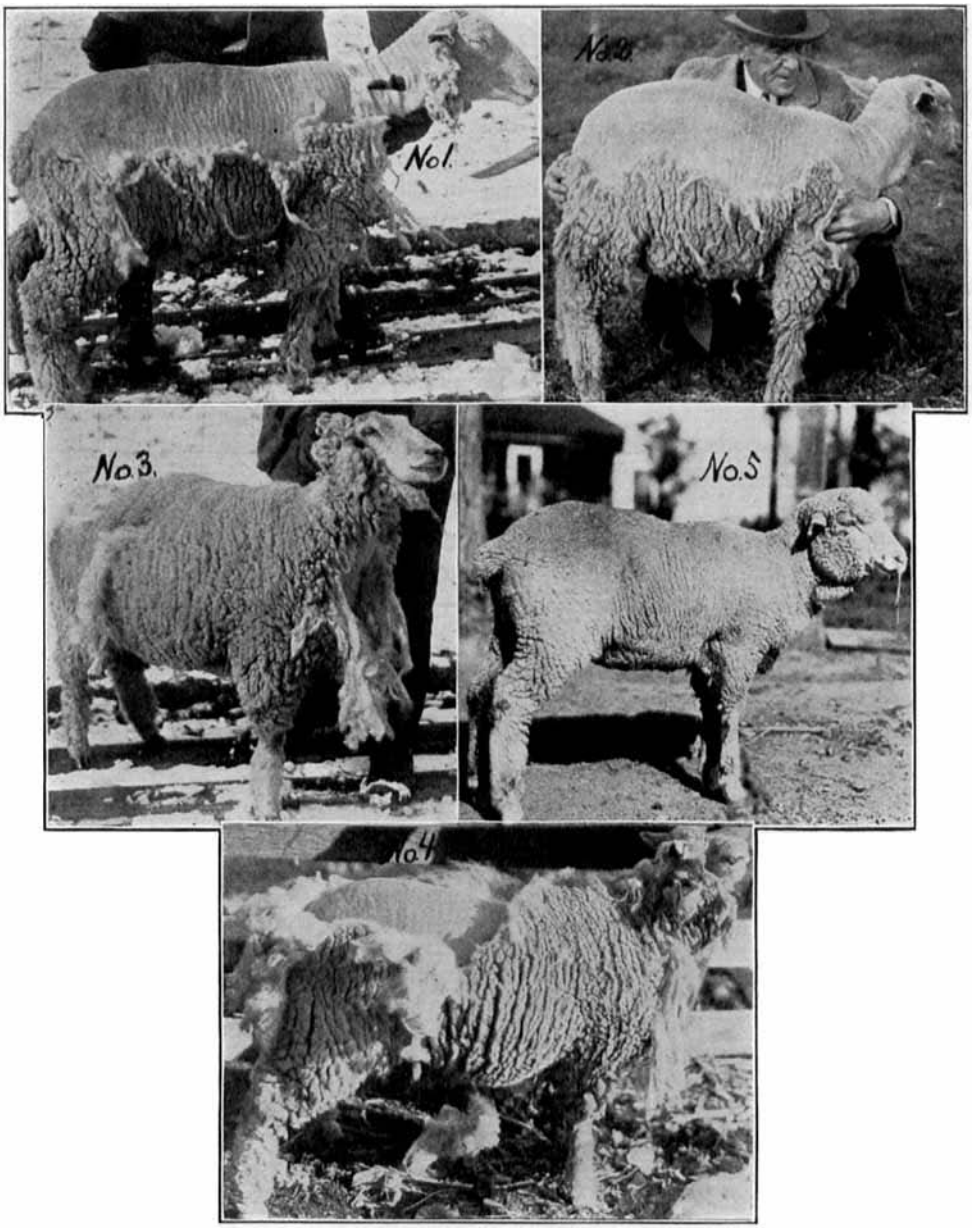
TABLE I.—ACCEPTANCE OF PRAIRIE-DOG POISON BY SHEEP.

Ear Tag.	Weight in lbs.	Poisoned oats fed, ounces.	Time fed, A.M.	Food eaten, P.M.
86	91.5	5.82	11.00	5.00[1]
37	108.0	4.35	11.00	5.00
No Tag	86.0	3.65	11.00	5.00[1]
31	83.0	2.92	11.00	5.00
100	103.0	1.45	11.00	11.30

[1] These animals refused to clean up the poisoned grain until it was mixed with clean grain and salt.

TABLE II.—M. L. D. AND M. T. D. OF THALLIUM TO SHEEP.

Ear Tag.	Mg./Kg.	Results.
86	43.70	Died in four days
37	27.80	Died in seven days
No Tag	26.20	Died in four days
31	24.10	Died in nine days
100	9.72	Survived—wool started slipping on twentieth day
		Series two.
142	8.15	Survived—wool started slipping on fourteenth day
248	3.18	Survived—no symptoms



No. 1.—Sheep No. 100, six weeks after being fed.

No. 2.—Sheep No. 100, ten weeks after being fed.

Nos. 3. and 4.—Sheep No. 142, three weeks after being fed.

No. 5.—Sheep No Tag, one day before death.

TABLE III.—DISTRIBUTION OF THALLIUM IN VISCERA.

Ear Tag.	Stomach.	Liver.	Kidney.
86, 4 days	+	++	+
No Tag, 4 days	+?	++	+
31, 9 days	–	+	+

CONCLUSIONS.

1. The M. L. D. of thallium for sheep is about 25 mg./Kg.
2. Sheep will not readily accept thallium-poisoned rolled oats.
3. Thallium poisoning causes alopecia in sublethal doses down to 8 mg./Kg.
4. History of poisoning follows that of other test animals.
5. Thallium can be readily isolated from liver and kidneys of sheep killed by this poison.
6. Post-mortem findings show areas of irritation in fourth stomach and duodenum together with kidney degeneration.
7. Death in most cases is apparently due to respiratory failure.

ABSTRACT OF DISCUSSION.

Dr. M. I. Smith asked if pulmonary hemorrhages developed. William T. McClosky pointed out that thallium was dangerous to handle, because of the chronic toxicity and the lack of a definite antidote.

In reply, James C. Munch stated that this work had been undertaken in connection with the use of thallium on a large scale by the Bureau of Biological Survey for the control of certain rodents and predatory animals. When properly used by experienced men, toxic symptoms had not been produced. However, where sufficient care is not taken the drug is very dangerous and should not be used by persons who are not experienced in the method of handling it. Post-mortem examinations had shown hemorrhage in the lungs. Ward had demonstrated the distribution of thallium throughout the entire body when sufficiently large doses were given. He commented on the fact that the lethal dose of 25 mg./Kg. was essentially the same for sheep, rats and rabbits. Furthermore, the dose of 8 mg./Kg. which caused loss of hair in sheep was essentially identical with the dose used for depilation in humans.

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(1) James C. Munch, JOUR. A. PH. A., 17 (1928), No. 11.

LIGHT AND MEDICINES.

In the *Scientific Monthly* for June, H. V. Arny writes on the above subject. He refers to the reports of the Committee on Glass Standardization and Relation of Glass to the Preservation of Pharmaceutical Preparations (JOUR. A. PH. A., 17 (1928), 1056). The article is concluded with the hope, "where light is clearly proved to be the destructive factor, to discover in each case the appropriate 'stabilizer,' that appropriate chemical, a trace of which may aid the medicament in resisting the untoward action of light rays."
