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Survival of *Taenia saginata* Eggs on Stored Hay

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The suspicion that hay contaminated with eggs of the beef tapeworm, *Taenia saginata*, might have been a source of infection in certain outbreaks of *Cysticercus bovis* infection recently investigated by disease-eradication personnel was brought to our attention several months ago. Accordingly, we carried out an experiment in an effort to determine how long hay known to have been so contaminated need be stored to destroy the viability of the eggs.

Available chains of proglottids and free eggs of this tapeworm* were divided into aliquots. The control aliquot in saline solution was immediately placed in a refrigerator. On the same day, each of the remaining aliquots was placed on alfalfa hay in a separate glass tube about 6 inches in length and 1¼ inches in diameter. In the middle 2 inches of the tube were placed a layer of crumbled alfalfa leaves, an aliquot, and another leafy layer; from here to each end, the tube was lightly plugged with a layer of stemmy hay and a leafy layer; each end of the tube was covered with two-ply cheesecloth. Each aliquot consisted of (1) six proglottids which appeared to be definitely gravid, (2) six whose ripeness was doubtful, and (3) about 180,000 free brown-shelled eggs contained in about 5 ml. of saline solution. The tubes were kept in a horizontal position at room temperature until the next day. Then the control aliquot was removed from the refrigerator and transferred to a gelatin capsule which was administered to a calf and the tubes were inserted horizontally into a bale of alfalfa in a hay loft. They were inserted along the axis of the bale.

When a tube was removed from the bale, its contents and a small volume of water in which the emptied tube had been thoroughly washed to remove any adherent eggs were admixed with calf meal. Each of the hungry calves to which this mixture was offered quickly and completely consumed it, as well as additional calf meal moistened with washings from the tray in which the mixture had been placed. The calves used in the experiment were reared and kept at the Agricultural Research Center, Beltsville, Maryland. Extraneous infection with *C. bovis* has not been detected in any of a large number of cattle that had been kept on the same premises under the same conditions.

*Obtained through the cooperation of Rex W. Allen, ADP, ARS, State College, New Mexico.

Calf 1, which received the control aliquot and was slaughtered 63 days later, was found to be heavily infected with cysts of *C. bovis*. When the tissue was finely sliced with a knife, the following numbers of cysts of various sizes were found in weighed amounts of the musculature from various sites: Heart—251 in 110 grams; masseter—90 in 85 grams; diaphragm—20 in 45 grams; hind legs—28 in 270 grams; shoulders—7 in 75 grams; neck—18 in 110 grams; intercostal—2 in 45 grams; abdomen—15 in 75 grams. Five cysts were found in the tongue, which was completely examined; 12, in the nearby buccal tissues; and 7, in the muscular layer of the esophagus.

Only 1 cyst, located in the cheek, was found in calf 2, which received an aliquot stored in the hay for 22 days (range in outdoor temp., 34 to 87° F.) and was slaughtered 77 days later. None was found in calf 3, which received an aliquot stored in the hay for 71 days (range in outdoor temp., 11 to 87° F.) and was slaughtered 70 days later. The heart, including its external and internal surfaces, diaphragm, tongue, masseter muscles, and the muscular layer of the esophagus of each of these calves were completely, or nearly completely, examined; the sample examined from each of the other aforementioned sites was considerably larger than the corresponding sample taken from calf 1, and numerous other incisions were made in the carcass for inspection of the cut surfaces. In each case the examination was much more extensive than the initial procedures of inspection proscribed by Federal meat-inspection regulations for determining whether carcasses of cattle are free from or infected with *C. bovis*.

From these findings, we conclude that a small percentage of *T. saginata* eggs deposited on hay kept under the conditions here described remained viable for about 3 weeks; however, none remained viable for as long as 10 weeks. Dessication was probably the factor mainly responsible for their loss of viability. Silverman (1956. *Trans. Roy. Soc. Med. and Hyg.*, 50:8) found that eggs of this tapeworm did not survive longer than 14 days in the absence of surface moisture, irrespective of relative humidity.

The carcass of calf 1 contained a large number of small and very small "cysts," which were especially conspicuous in the heart, as well as many cysts approximately normal in size for their age (9 weeks). Each of the larger cysts dissected contained a well-developed *C. bovis* larva; larvae examined on the day the calf was slaughtered were alive. Recognizable cestode tissue was not obtained from the small cysts.

However, on histologic examination it was observed by Dr. W. T. Shalkop (ADP) that many of the small cysts had been replaced by lymphoid cells along with a few neutrophils and an occasional eosinophile. These small reactive foci, some of which were centered around an unidentifiable foreign body, resembled the host-tissue reaction that had developed around recognizable *C. bovis*. Therefore, it seems reasonable to assume that they were provoked by *T. saginata* larvae that had died in early stages of development.