Parasites of Sheep and Deer

mutual parasites of domestic sheep and Columbian black-tailed deer studied for transference factors

William M. Longhurst, James R. Douglas, and Norman F. Baker

Similar foraging habits of sheep and deer provide ample opportunity for transference of mutual parasites.

Field and autopsy data obtained in a study of sheep and deer primarily at the Hopland Field Station, in southeastern Mendocino County, indicated that of the several kinds of parasites found, roundworms infecting the abomasum or fourth stomach, the small intestine, and the lungs had the most serious effects on the host animals.

From examinations of 98 sheep and 129 deer—in the study—45 kinds of parasites were identified, with 21 species common to both animals. The parasites included one protozoan, one fluke, five tapeworms, 22 roundworms, two lice, six flies, one flea, five ticks, and two mites.

Roundworms belonging to the genera *Ostertagia, Trichostrongylus*, and *Dictyocaulus* were considered to be the most important forms involved.

Living together as they do in close association on the range and with quite similar foraging habits, it is logical that sheep and deer should be exposed to many of the same parasites.

Generally, sheep foraged more on grass than did deer, but both animals fed almost exclusively on grass and herbs from November—when fall rains brought up the new growth—until mid-April. This was the period of maximum nematode transference and it was likewise during this time that deer particularly deteriorated in condition and suffered heaviest losses—amounting to nearly 40% of the herd during the winter of 1951–52.

Sheep losses were not abnormal for this section of the country even though the winter of 1951–52 was above average in severity. During this winter, for example, in one pasture of some 570 acres—with virtually no available browse—both sheep and deer subsisted almost entirely on grass and herbaceous forage, without supplementary feed. Nevertheless, a flock of 95 head of yearling replacement ewes came through the winter in relatively good condition and progressively increased their fat reserves. On the other hand, 12 deer carcasses were found, although this was not an area where carcasses were particularly concentrated.

Sheep were given supplements of cottonseed meal and ground barley during the dry summer period and into the fall until new green forage was available in quantity. Through the early part of the winter alfalfa hay was also fed.

Deer, on the other hand, obtained relatively little supplementary feed with the exception of those individuals that used grain and Sudan plantings prior to the time the sheep were turned in.

Autopsies of sheep and deer started in January 1952 and have continued through May 1954. Autopsy data—together with field observations—indicated that malnutrition coupled with multiple roundworm infections probably accounted for most of the losses among fawns. Older deer usually carried few worms and their deaths appeared more directly traceable to uncomplicated malnutrition.

To determine why sheep were better able to survive competition on a grass and herbaceous diet, measurements were made of the digestive tracts of several sheep and deer. Lengths of various sections of the intestinal tract were taken as well as the volume content of the four stomach compartments and the intestines. The small intestines—for example—of the sheep were approximately twice as long as those of the deer.

From these and other data, it is apparent that sheep can handle a larger volume of forage for their size and can possibly digest it more efficiently in their longer intestinal tracts. The net result is that deer appear to be less adapted than sheep to exist on a winter diet of grass and herbs and may therefore be more prone to suffer from the effects of parasitism.

The life cycle of most of the roundworms found to be of importance in this study is that of direct infection with no intermediate host involved. Eggs laid by adult worms in the digestive tract and lungs pass out with the feces. The larval worms hatch out and after a series of developmental stages with suitable conditions of moisture and temperature, crawl up on blades of grass and are ingested by a grazing sheep or deer.

Because rain is seasonal in this area—usually occurring from October to June—moisture conditions are most favorable for roundworm larvae during these months, and it is at this time that infections increase. Drying out of ranges through the summer virtually precludes the survival of larvae except around spring seepages where there is green grass.

Since field and laboratory data indicated that nematodes were transferred between deer and sheep, an experimental roundworm transference test was set up to rule out the possibility of host-specific biological strains of worms.

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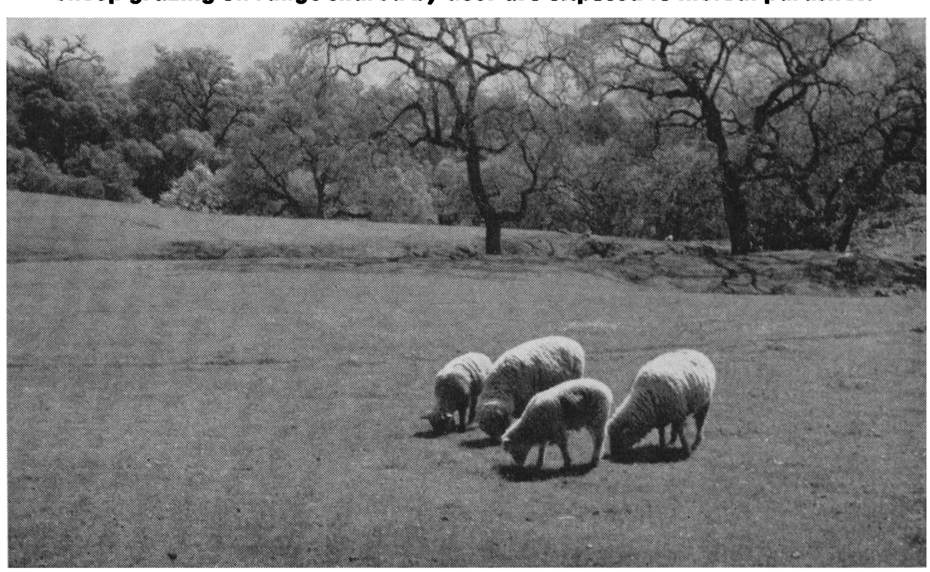
Sheep grazing on range shared by deer are exposed to mutual parasites.



Root Fumigation

carrot and beet roots used in tests for nematode control

J. F. Harrington and H. K. Pratt

Seedsmen should never use carrot and beet roots infested with root knot nematode for transplanting into uninfested soil.

In tests to find a means to sterilize the roots at the time of transplanting—without injury to the roots—both heat treatments and three fumigants were tried.

In a preliminary test, different lots of ten roots each of two varieties of carrot were immersed in water at 120° F for 15 minutes and 110° F for three hours. Additional lots were stored at 0° F for two hours. None of the roots survived these treatments. The treated roots rotted when placed in the soil, while the untreated roots all grew. Therefore, none of these treatments could be used for nematode control.

In a more extensive experiment, the tolerance of carrot and beet roots to fumigation and vapor heat treatments was tried with the view that later tests could be made on infected stock if any tolerance level appeared promising. Three fumigants—methyl bromide, ethylene dibromide, and ethylene chlorobromide—were each tested at five different combinations of rate and time. The roots were treated in a fumigation chamber at 68° F. The rates given in the larger table on this page are in pounds of fumigant per 1,000 cubic feet of chamber volume. The five vapor heat treatments were done with steam in modified mattress sterilizers.

For each treatment, two matched lots of 20 carrot roots per lot and two matched lots of 25 beet roots per lot were used. After treatment one lot was planted in a Yolo heavy clay loam, and the second in a Yolo fine sandy loam. The table lists the treatments and contains the data obtained on survival in the field. The data from the two field lots for each treatment were combined since there was almost no difference in results between the two fields. The relatively poor survival of the carrot check plots was due to root decay which started in the period between digging and the experimental treatments and which affected all treatments equally. The survival results indicate that the following treatments would be the maximum that might be safe:

	Carrots	Beets
Vapor heat ...	none	none
Ethylene dibromide	1 lb. for 2 hrs.	2 lbs. for 2 hrs.
Methyl bromide	2 lbs. for 2 hrs.	4 lbs. for 2 hrs.
Ethylene chlorobromide .	2 lbs. for 2 hrs.	1 lb. for 2 hrs.

Of the beet roots that survived any of the treatments, only 74.7% produced seed stalks compared to 90% of the beets in the check plots. Thus the treatments converted some beet roots back to a vegetative state. All carrot roots produced seed stalks.

It is not known whether these maximum safe fumigation treatments would control nematode in the roots of carrots and beets. So far, no treatment can be recommended that will control nematodes in beet or carrot roots without seriously injuring or killing the roots.

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The test roots were obtained through the cooperation of B. H. LaZansky, Ferry-Morse Seed Company.

The Effect of Treatment on Survival of Roots Planted in Test Plots

Treatment	Rate	Plants Which Survived: Carrots	Plants Which Survived: Beets
Vapor heat	110°F, 0 hr.*	0%	52.5
	110°F, 2 hr.	0	35.0
	110°F, 4 hr.	0	20.0
	120°F, 0 hr.*	0	0
	130°F, 0 hr.*	0	0
Ethylene dibromide	1 lb., 2 hr.	40.0	95.0
	2 lbs., 2 hr.	7.5	72.5
	2 lbs., 4 hr.	0	0
	4 lbs., 2 hr.	0	0
	4 lbs., 4 hr.	0	0
Methyl bromide	2 lbs., 2 hr.	35.0	92.5
	4 lbs., 2 hr.	22.5	75.0
	4 lbs., 4 hr.	0	0
	8 lbs., 2 hr.	20.0	2.5
	8 lbs., 4 hr.	0	0
Ethylene chlorobromide	1 lb., 2 hr.	42.5	82.5
	2 lbs., 2 hr.	42.5	57.5
	2 lbs., 4 hr.	17.5	35.0
	4 lbs., 2 hr.	17.5	32.5
	4 lbs., 6 hr.	0	0
Average of four check plots		40.6	92.5

* Roots were brought to this temperature and immediately cooled.

PARASITES

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Lambs raised under worm-free conditions were successfully infected with six species of stomach and intestinal worms cultured from deer feces.

To some extent, parasites appear to exhibit a correlation both in their numbers and in their effects with the physical condition of the host. This effect is most likely to be influenced by nutrition of the host. Nutritional status in turn is largely determined by the availability of food and bodily demands for maintenance, growth, and reproduction. Young animals—because of the demand on their nutritive intake for growth—are in a relatively poor position to withstand attacks by parasites. Both sheep and deer were found to build up resistance to worms after exposure so that animals past their first year generally carried only a small worm burden.

Parasitism under these range conditions can probably be best attacked by improving range management practices, with stocking rates being one of foremost importance.

Chemical control of nematodes in sheep can be effective, however. Successful control with phenothiazine—the most effective agent—includes therapeutic doses given as a drench or pellet according to body weight, as well as prophylactic doses in a salt mixture. Obviously such a program is not practical for deer. On the other hand, it is probable that a reduction of nematodes in the sheep flock would be of indirect benefit to deer in that the rate of infection would be lowered. By the same token, reducing the incidence of roundworms in deer would benefit the sheep.

Nematode transference between sheep and deer is primarily a problem of the north coastal section of the State. There large numbers of both of these animals share common range, and conditions of moisture, temperature, and vegetation make it possible for the worms to complete their life cycle.

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