PARASITES OF UNGULATES IN THE JACKSON HOLE AREA: SCARABAEOID BEETLES ACTING ON LUNGWORM, *Dictyocaulus hadweni*, LARVAE IN ELK FECES 1978

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The lungworm of elk, *Dictyocaulus hadweni*, is morphologically quite like the species in cattle but the parasite affects the two species of host animals in very different ways.

In cattle, *D. viviparus* is usually found only in young animals. After a calf is exposed and makes antibody or cell mediated immunological responses to the parasite, the calf usually can not be reinfected. In the case of the parasite's invasion of elk tissue, some immunological response is apparently made during the late spring, summer and fall months so that very few elk are positive for lungworm from September-January. However, most elk (65-80%) are susceptible to infection or reinfection annually (April-May). It appears that the reinfection time coincides with the span of time in which the elk are at their physiological low. The April-May period may be the time when the physiological condition of the elk is at a seasonal low.

Any biological factors which would decrease the numbers of infective Dictyocaulus larvae would benefit the elk.

Objectives

The objectives of the present study are:

1. Continue research of the prevalence of *Dictyocaulus hadweni* in Teton elk during four seasons of the year. (This must be done to find worm-positive elk for the biological predation research.)

2. Check, via fecal analyses, for larvae spring-summer and winter and by lung dissections (adult worms) and/or by fecal analyses during the fall for relative numbers of the parasite/elk.

3. Experiment in the laboratory for the effect of *Aphodius* spp. *Canthon* sp. and other Scarabaeoid beetles against 1st stage larvae of *Dictyocaulus* sp.

4. Extend field observations to include the action of Aphodius spp. on Dictyocaulus larvae in or on elk feces. (This portion is very time consuming due to the fact that the investigator does not, beforehand, know which elk are positive for the worm.)

5. Extend research from the Teton herd to the Gibbon River and northern (Yellowstone National Park) herd if the time permits.

Procedures

Fecal analyses were conducted by the use of a jet of water played over 6-100 g of elk fecal pellets in a plastic petri dish. After the water had wetted the pellets, the larvae were allowed 10-20 minutes to move off the pellets. The pellets were again rinsed by a jet of water after which the pellets were removed from the dish by sterile forceps. Dictyocaulus larvae were counted in the sectioned petri dishes via dissecting scope at 45X. Prevalence (% of elk positive for lungworm larvae) and number of larvae were noted.

During the fall hunting season, elk lungs were gathered by the Wyoming Game and Fish personnel, by the researcher, but primarily by Teton Park rangers. Elk lungs were checked for the presence of adult Dictyocaulus worms by use of bandage scissors as pneumotomes in order to lay open all major bronchioles. With light infections, worms were found in the smaller bronchioles near the periphery of the lobes of the lungs while with larger numbers of worms, larger bronchioles were partially or completely filled with worms up to and including the area of the main bifurcation of the trachea.

Worms were collected, sexed, counted, and in some cases, fixed for preservation.

Results

Percent of elk positive for Dictyocaulus hadweni lungworm was higher during the spring and summer months of 1978 than during the same periods of time, 1977.

Percent of elk positive for lungworm is shown in Fig. 1, appended, with the highest prevalence, as in previous years, in late May (67%), dropping slightly in "wet" cows to 54% by early August. A strikingly low prevalence of infection was noted in mature (2-6 years of age and 4-7 points) bulls in August south of Signal Mountain in Teton National Park. Few "dry" cows were positive for lungworm in August but that fact is not shown in Fig. 1 because the numbers of true, known "drys" sampled was small (10-12). The highest prevalence of Dictyocaulus-positive elk in "high COUNTRY" (47%) noted during the past 10 years, was found in elk from Big Game Ridge in early August.

Eleven laboratory trials with Aphodius spp. beetles versus Dictyocaulus sp. larvae were conducted during May and again during August. The decimation of Dictyocaulus numbers in elk feces is shown in Table 1, appended. Decimatory action by the beetles was excellent, varying from near zero to nearly 100%.

Trials 1 and 7 were not representative of beetle action since the laboratory conditions were far different than field conditions at the same hours of those days.

Only 14% of the Gibbon River elk in Yellowstone National Park were found positive for lungworm larvae in 22 elk fecal samples, August 16, 1978.

Discussion

Since we have been conservative in estimating prevalence of lungworm infections via fecal analyses, it appeared that from 75-83% of the elk in Teton National Park were positive for lungworm during the spring of 1978. The harsh winter of 1977-78 may have been an important factor in the condition of the elk and may account for the difference during May 1977 (following a relatively mild winter) when 57% of the elk were positive during May 1977 as compared to the 67% positive in May of 1978. The difference could also be due to sampling error.

Aphodius spp. beetles were found to be very active decimators of lungworm larvae. Percent decimation of lungworm larval populations was not significantly different than decimation percentages shown in our data of 1977.

Field work with Dr. David Worley, Montana State University, Bozeman, on August 16, showed that the Gibbon River elk were relatively low in prevalence of infection with *Dictyocaulus* sp. (14% positive).

Conclusions

1. *Aphodius* spp. beetles have a very important decimatory effect on lungworm larval populations.

2. Lungworm infections appear to rise, at least slightly, in elk wintering on the National Elk Refuge during a long or harsh winter.

3. Many micropredators such as beetles are active against internal parasites of elk and domestic livestock but the action of many important biological control factors (beetles, fly larvae, fungi, etc.) are not yet known.

4. Free-ranging elk, even those on limited areas of range in the winter, may not carry as many internal parasites as elk utilizing refuges during the winter. Much needs to be done in this area of research.

Work Planned: 1979

Extend present field studies to elk herds in north and northeastern Yellowstone National Park. Cooperation will be sought from biologists in Yellowstone Park. Cooperation therefrom has always been of high order during the past 20 years.

Table 1. Decimation of Dictyocaulus sp. larval populations due to the action of Aphodius sp. beetles in lab. trials

Trial no.	No. of Larvae	Hrs. Inter Action	No. of Dictyocaulus Larvae Control No Beetles	Principle w/5 Beetles/g.	% Decrease in Larval Numbers due to Beetles
1	Brightsun 25	6	23	21	insign.
2	Dark 55	6	49	18	63
3	Dark 46	24	22	0	~100
4	Dark 50	7	23	13	43
5	Dark 50	7	23	8	65
6	Lab. Lite 50	12	24	8	70
7	Bright Sun 20	12	6	5	17
8	Lab. 60	7	57	17	70
9	Lab. 24	4	19	5	60
10	Lab. 30	6	26	4	85
11	Lab. 15	18	7	0	~100 (693)
				$\bar{x}$ of 11	61%

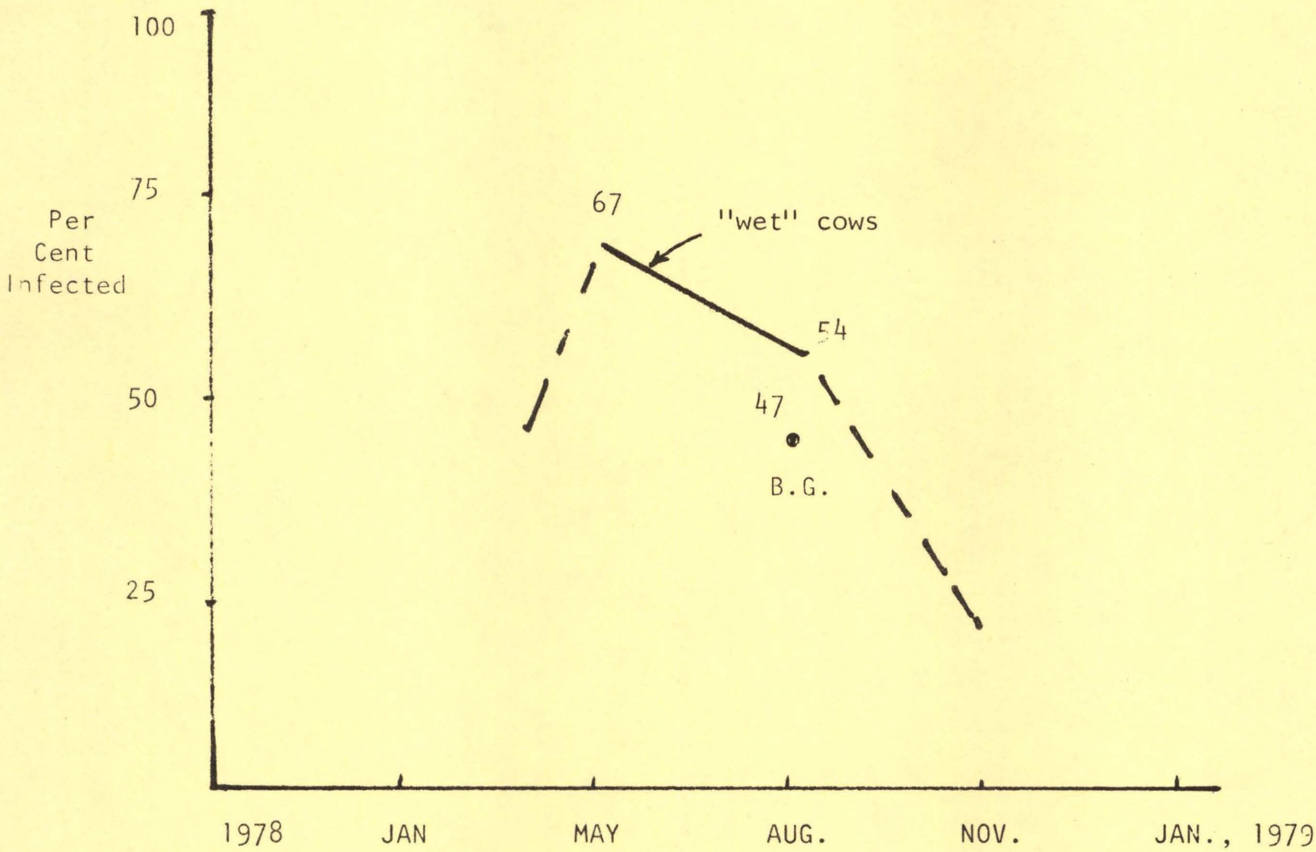

Fig. 1 Prevalence of Dictyocaulus-infected elk, 1978, from fecal analyses during May and August, Teton National Park and adjacent areas.
B.G. = Big Game Ridge

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