

PARASITES OF UNGULATES IN THE JACKSON HOLE AREA:  
SCARABAEOID BEETLES ACTING ON LUNGWORM,  
DICTYOCAULUS hadweni, LARVAE IN ELK FECES  
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The lungworm of elk, Dictyocaulus hadweni (syn: D. viviparus) has been noted in elk since the early 1900's.

It is interesting to note that a high percentage of the elk in Teton National Park are positive for lungworm in the spring. Fewer elk are infected as the summer and fall vegetation is usually sufficiently good to allow the elk an abundance of food and a resultant physiological condition that is excellent.

Perhaps elk serum proteins are somewhat low in the April-May period when the physiological "low" is reached by the elk. The lack of immunoglobulins may, in part, explain the high prevalence of lungworm infections in elk of the Tetons during early spring months.

### 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.) The search has been extended to elk in Yellowstone National Park during the past two years and will be continued.
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. other Scarabaeoid beetles against 1st stage larvae of Dictyocaulus sp.
4. Extend field observations to include the action of Aphodius spp. on Dectyocaulus 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.)

## 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 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

Per cent of elk positive for *Dictyocaulus* sp. (presumably *D. hadweni*) was higher (80%) during the spring (late May) but lower (35%) during the summer of 1979 as compared to data of 1978.

Percent of elk positive for lungworm larvae in feces is shown in Fig. 1 with the highest prevalence, as usual, in late May. As in previous years, the prevalence of positive elk decreased as the summer progressed. Fall data (Oct.-Nov.), where lungs from hunter-killed elk can be checked for the weather has not favored hunter success.

Laboratory trials with *Aphodius* spp. beetles versus *Dictyocaulus* sp. larvae were carried out as in 1977 & 1978.

The results, Table 1, show beetles, mostly *A. vittatus* individuals, were active in laboratory trials and apparently decreased the numbers of *Dictyocaulus* sp. larvae by 50-100% within a relatively short period of time (4.5 - 26 hours).

During August, only 4 trials were attempted. One trial, where no beetles were noted on the feces, during the period of interaction, was not included in the summary, Table 1.

Beetle species that were most active in August were *A. coloradensis* and *Canthon* sp. Those species (mostly *A. coloradensis*) were used in the lab. trials.

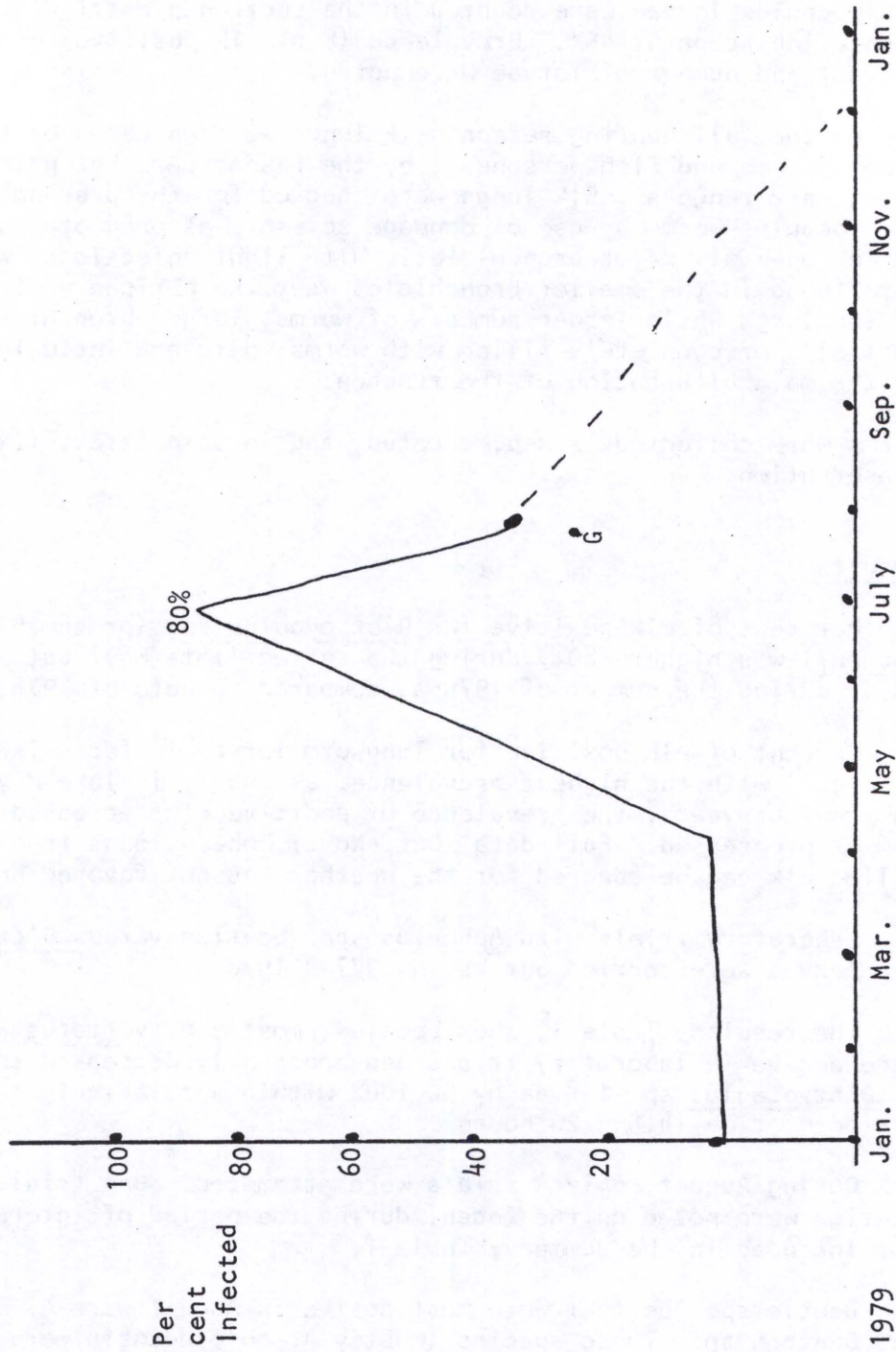


Fig. 1. Prevalence of Dictyocaulus-infected elk. through the spring and summer, Teton National Park and adjacent areas.

G. Gibbon River elk, Yellowstone National Park.

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

Trial No.	Grams of Feces Control & Principle	Hrs. Interaction	No. of Surviving Control No Beetles	Dictyoc. Larvae Principles W/1-2 Beetles/g	% Decrease in Dictyocaulus Larval Numbers Due to Beetles
May 1979					
1	7	12	198 of 210	22/210	89
2	6	11	6 of 9	0/9	-100
3	7	26	84/98	42/98	50
4	5	9	12/25	2/25	83
5	6.5	14	36/39	8/39	78
6	6	12	32/42	8/42	75
7	9	18	234/270	24/270	90
*8	6.5	5	468/520	24/520	95
9	13	4.5	216/260	108/260	50
* new beetles added					
					$\bar{x} = 78.9$
August					
1	2.3	17	6/29	1/29	83
2	4.8	25.5	7/9	0/9	100
3	8.5	24	160/170	0/170	-100
					$\bar{x} = 94$

## Discussion

More elk moved onto the National Elk Refuge, Jackson, Wyo. during the winter of 1978-79 than during the previous two winters. That increase in numbers of elk during a winter of relatively heavy snow fall may, in part, account for the relatively large percentage of lungworm - infected elk during the spring of 1979.

Since the estimate of prevalence of lungworm in elk via fecal analysis is conservative by 8-16% (Bergstrom, 1968, unpublished), from 88-96% of the elk of both sexes were positive for lungworm during late May of 1979. This relatively high percentage of prevalence is a high, according to our results, for the last 11 years.

It is also possible that our technique for recovering larvae in "sprayed" fecal samples is improving to the point that we are not as conservative in our estimates, via fecal analyses, as we were in 1968. At any rate, most elk in Teton National Park and the National Elk Refuge are carrying lungworms during May and early June.

Physiological condition of the elk improved rapidly and markedly from June 1 to August 7 according to visual appraisal of the elk south of Signal Mt. Such field observations were made by the writer after crawling to within 30-50 yards of bedded and standing elk.

Gibbon River elk are very easy to observe at 20-60 feet because that elk herd is sufficiently accustomed to human intrusion along the highway through their meadows. Warm fecal samples are easy to collect but are frequently dropped in moist grass and/or water on the soil so that fecal analyses may show a somewhat over conservative (low) estimate of lungworm-positive elk.

Beetle action was effective, as in previous years, in removing lungworm larvae from elk feces. Laboratory trials apparently never duplicate the true efficiency of the beetles in the field where beetle activity, depending on ambient air and soil temperatures, is almost always several times greater than that noted in a laboratory trial. Fecal material is macerated by beetles even when only 1 beetle is active per gram of fecal material. In the field a given quantity of elk fecal material is always macerated and spread over a much greater area and with resultant increased exposure to desiccation and solar exposure than one finds in the laboratory trials. Hence, it is assumed that all of our lab-trial results are conservative when assessing the efficiency of beetles as population decimating agents against D. hadweni larvae.

Field work with the Gibbon River elk was conducted in cooperation with Dr. David Worley, Montana St. Univ., Bozeman. Dr. Worley noted a high prevalence of Dictyocaulus-positive elk, Gibbon Meadows during June-July, 1979.

### Conclusions

1. Most elk are positive for lungworms during May in the Teton National Park.
2. Numbers of elk wintering on the National Elk Refuge may affect the percentage of elk positive for lungworm during spring months.
3. Beetles are more active against Dictyocaulus sp. larvae in the field than in the laboratory.

### Work Planned: 1980

Attempt a survey of elk for Dictyocaulis-infection along the Lamar River, in Northeastern Yellowstone National Park.

Work in the field with Dr. Worley and/or with Yellowstone biologists in regard to possible internal parasites that could be identified and numbers estimated from elk fecal analyses.

### Acknowledgments

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