

PARASITES OF UNGULATES IN THE JACKSON HOLE AREA:
SCARABAEOID BEETLES ACTING ON LUNGWORM,
DICTYOCAULUS hadweni, LARVAE IN ELK FECES
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Lungworm of elk, Dictyocaulus hadweni (syn: D. viviparus) was first designated as Strongylus filaria in elk and red deer, (Blair, 1903) and lungworm was then and in 1905 reported to cause bronchopneumonia in elk. (Blair 1905). Records of lungworm in elk in Yellowstone and the Tetons were rather incomplete until Rush (1932), Mills (1936), Alderson (1951), Murie (1951) and others listed internal parasites found in elk. It is surprising that Mills did not find D. hadweni in 100 elk taken from the Yellowstone herd.

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 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.)

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 the 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

Percent of elk positive for Dictyocaulus sp. (presumably D. hadweni) was quite high (68%) during the spring (late May) but lower (35%) during the summer (August) as would be expected.

Percent of elk positive for lungworm is shown in Fig. 1 with the highest point of infection, as usual, in May.

Laboratory trials with Aphodius spp. versus Dictyocaulus sp. were carried out as in 1977-1979. Results shown in Table 1. indicate efficient decimation of Dictyocaulus larval numbers within a relatively short time (6.5-24 hrs). Larval Dictyocaulus numbers were decreased from 44-100%, mean about 80%.

Beetle species involved in the lab. trials were principally A. coloradensis, A. vittatus with a few A. fimetarius and A. homatus.

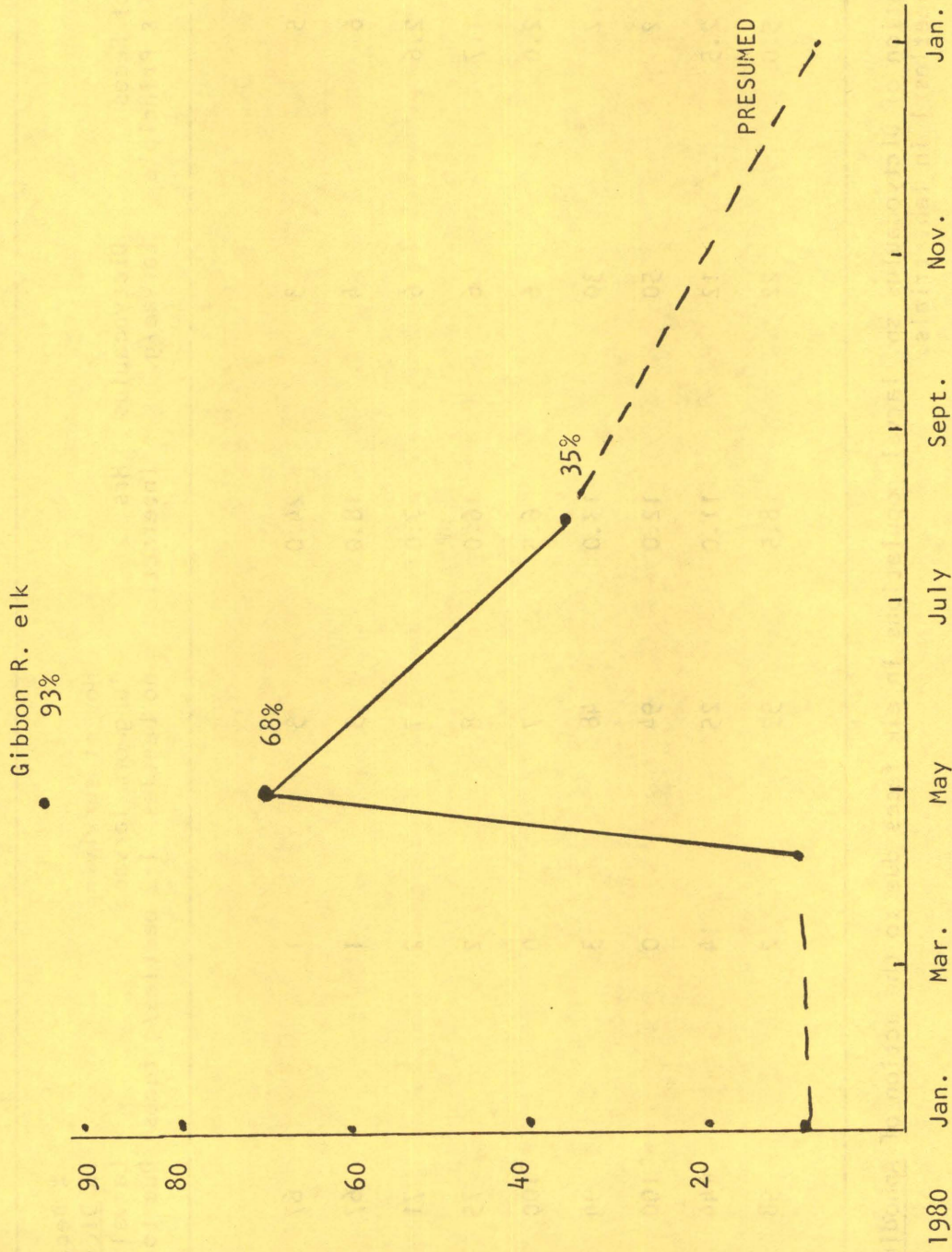


Fig. 1. Prevalence of Dictyocaulus-infected elk throughout the spring and summer, Teton National Park as compared to May and August sampling for lungworm positive elk, Gibbon R. Meadows, Yellowstone Nat. Park.

Trial no.	Grams of Feces Control & Principle	Dictyocaulus Larvae/g.	Hrs Interaction	No. of surviving lungworm larvae	No. of surviving 1-2 beetles/g feces	% Decrease in Dictyocaulus Larval Numbers Due to Beetles
May 1980						
1	5	3	24.0	3	1	67
2	6	4	18.0	3	1	67
3	2.6	6	7.0	7	2	71
4	1.7	6	16.0	8	2	75
5	2.0	6	6.5	7	0	*~100
6	2	30	13.0	48	3	94
7	2	50	12.0	94	0	*~100
8	2.5	12	11.0	25	14	*44
9	5.0	22	8.5	99	2	98

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

1. Mean 80

Parasitic larval stages of *Dictyocaulus* lungworm were found for the first time during August of 1980. Vegetation clipped near 3-4 week old elk feces, yielded 1 live and several dead larvae during Baerman-ization of grass samples.

Discussion

Teton elk left the National Elk refuge early in May, 1980. Since the numbers of elk on the National refuge, Jackson, was lower than in 1978-79, that fact and the fact that elk left the refuge earlier due to a mild April, may account for a slightly lower prevalence of lungworm-positive elk during May, 1980. As previously noted, a 68 percent positive figure indicates that the actual numbers of infected elk is from 8-16 percent higher than shown in Fig. 1, due to the over conservative estimates made in fecal analyses where immature worms, senile female worms and other factors lead to conservative estimates.

Gibbon River elk were almost all positive for lungworm in May, 1980. When fecal analyses show 93 percent positive, one can assume that nearly 100 percent of the elk are actually infected. Since the vegetation samples from Gibbon Meadows were the first carrying visible, infective third-stage *Dictyocaulus* larvae which we have been able to recover during the past several years (Gibbon area or National Elk Refuge), one might hypothesize that the Gibbon River elk show a higher, or at least as high, prevalence of positives as do the National Refuge elk. Since both Dr. David Worley, Montana State parasitologist, and the writer were involved in the fecal collections and analyses of numbers of larvae, means of separate efforts supply credibility to this data.

Beetle action was effective, as in previous years, in the dissemination and/or destruction of *Dictyocaulus* larvae. Decreases in larval numbers ranged from 44- ~ 100 percent, mean 80%. Such biological control mechanisms have always been present but were not defined. Of course the beetle action against lungworm larvae is restricted to the spring, summer and warmer portions of the fall months.

Gibbon River elk showed low prevalence (13-16%) of infection during August and October 1980. These data show that immune responses of elk are effective during periods of good physiological conditions. We know that mature bulls lose their lungworm burden more quickly throughout the summer than do "wet" cows. These data also indicate that immune mechanisms are closely related to physiological condition of elk.

Conclusions

1. As in past years, a high prevalence of elk were positive for lungworm in May 1980. A mild winter and early spring allowed elk to move off the National refuge early.
2. Aphodius beetles, even the larval stages, decrease Dictyocaulus larval numbers by a mean of 80% in laboratory experiments. Beetles activity in the field indicates more efficient removal of Dictyocaulus larvae there than in the lab.
3. Gibbon River elk (Y.N.P.) show as high or higher prevalence of Dictyocaulosis than do the elk at Jackson, Wyoming.

Work Planned: 1981

Again attempt recovery of Dictyocaulus larvae from vegetation, National Elk Refuge

Work with Dr. Worley, Montana State University as during 1980

Literature Cited:

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