

PARASITES OF UNGULATES IN THE JACKSON HOLE AREA:
SCARABAEOID BEETLES ACTING ON LUNGWORM,
Dictyocaulus viviparus, LARVAE IN ELK FECES
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The lungworm of elk, Dictyocaulus viviparus, elk strain, 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 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 serum proteins such as albumin, gamma globulin and, perhaps, other immunologically oriented serum proteins are 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 viviparus 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.
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 herd (Yellowstone National Park) if time permits.

Procedures

Fecal analyses were conducted by the use of a jet of water played over 60-100 g 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 sp. lungworm, was lower during the spring, summer and fall months of 1977 as compared to per cent of infected elk during the same time of year for the past 5 years.

Percent of elk positive for lungworm (larvae or adults) is shown in Fig 1. with the highest prevalence, as usual, in late May. During the spring and summer, the prevalence of positive elk decreased to 34 percent in August and 12 percent in early November.

Laboratory work with Aphodius spp. beetles versus Dictyocaulus sp. larvae was conducted during late May - early June during the season with the results of experimentation shown in six trials, Table 1.

In other trials during May, and later (August) it was determined that the Aphodius spp beetles are only poorly attracted to elk feces that have remained in a refrigerator for 2-6 days at 4 C degrees.

Observations made in the field indicated that beetles are much more active, and thus more efficient predators, in the natural environment than they are in the artificial environment of the laboratory.

During August, elk of Big Game Ridge, along the south boundary of Yellowstone National Park, were checked via fecal analyses for the presence of Dictyocaulus sp larvae in elk feces. Two elk, of 12 sampled, were positive for a prevalence of about 17%. This per cent of prevalence is much like that of previous years.

Discussion

Since the per cent of elk, positive for Dictyocaulus viviparus, was the lowest (57% positive, May 1977) as compared to a similar time of year for ten years in Teton Park elk, one is tempted to conclude that the reason for the relatively low prevalence of lungworms in the spring was the mild winter of 1976-77. Since we cannot prove the relationship of low numbers of elk on the refuge (2500-4500 during 1976-77) and/or better physiological condition of the elk during May 1977, the conclusion must await more evidence in succeeding years. If numbers of elk are high during the winter of 1977-78, one would predict a return to high prevalence percentages in May 1978.

Aphodius spp. beetles are excellent decimators of lungworm larvae, but the laboratory data presented herewith does not show the true per cent of decimation of Dictyocaulus larval populations by beetles. A. vittatus beetles "hit" elk feces within 10 seconds after the fecal material reached the ground when air temperatures were near 80F degree during early June 1977. Ten beetles were active on the fecal pellets before the observer could sprint 30 yards from observation point to the fecal material. Such rapid activity was never seen in laboratory trials. Laboratory data therefore, never shows the extremes of decimation activity by beetles against lungworm larvae as achieved in the field.

More field work will be conducted during the warmer months of 1978.

Conclusions

1. Beetles have a very important decimatory affect on lungworm larval populations.
2. Lungworm populations in elk are apparently affected by weather patterns. The severity of a winter may force greater numbers of elk to smaller wintering areas and thus affect Dictyocaulus lungworm prevalence.
3. Many micropredators are active against lung parasites of elk, but many, perhaps most, effects of the micropredators are not yet known.

Acknowledgments

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Table 1. Decimation of Dictyocaulus viviparus larval populations due to the action of Aphodiu spp. beetles in laboratory trials.

Trial No.	No. of larv.	Hrs. of Interaction	No. of Dictyocaulus larvae Control; No beetles	Principle w/10 beetles	% decrease in larval numbers due to beetles
1	30	12	6	0	100
2	36	17	32	4	81
3	42	22	21	8	56
4	72	15	60	6	90
5	120	20	36	9	75
6	55	16	32	16	50

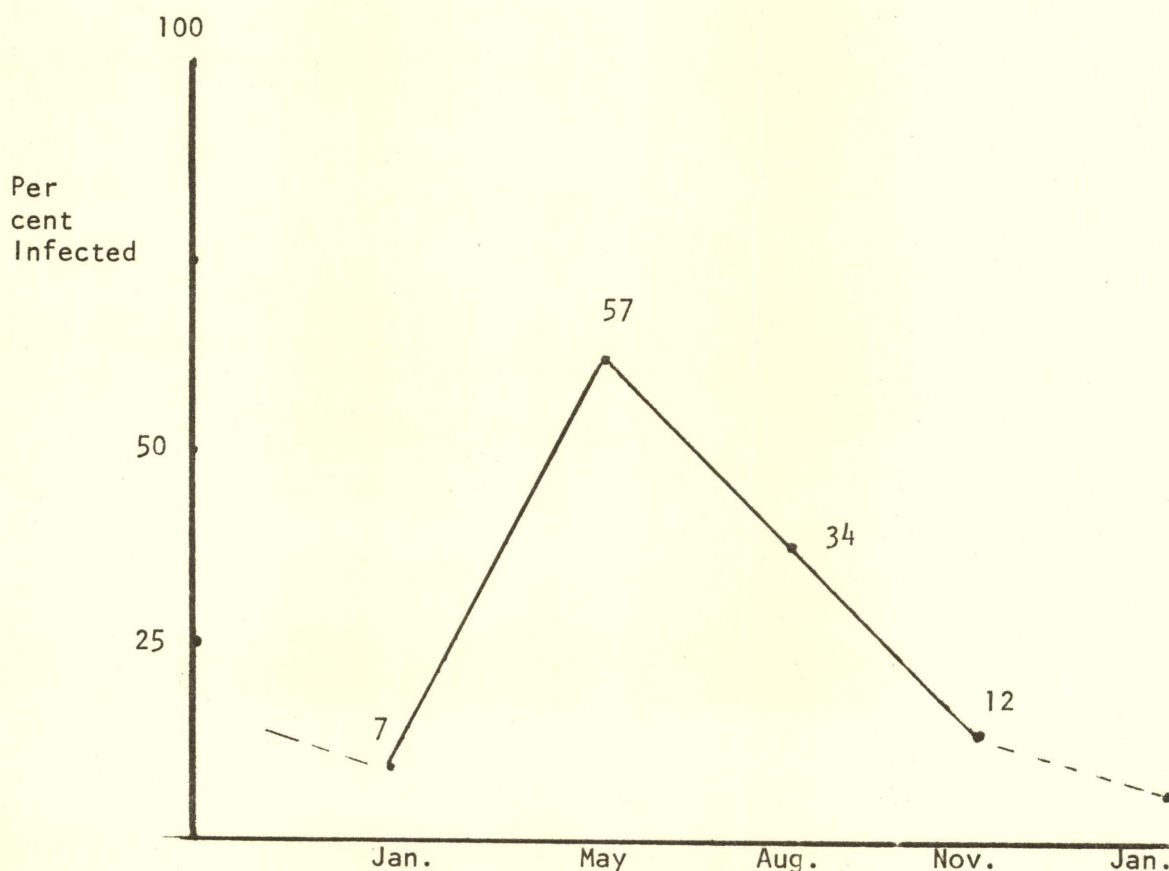


Fig. 1 Prevalence of Dictyocaulus-infected elk, 1977, from fecal analyses (Jan., May and Aug.) and lung dissection (Nov.). Teton National Park.