Oversummer and Overwinter Survival of the Cattle Lungworm

*Dictyocaulus viviparus* on Pasture in Louisiana (U.S.A.)

C. S. EDDI, J. C. WILLIAMS, AND R. A. SWALLEY

ABSTRACT: Two experiments were carried out during summer and winter conditions to determine if *Dictyocaulus viviparus* infective larvae could survive on pasture during these seasons in Louisiana. Pairs of tracer calves were grazed in August and September on a pasture that was heavily contaminated in May and then left free of cattle during June–July. These tracers were not infected with *D. viviparus*, indicating that the larvae did not survive summer conditions. However, a pair of tracer calves grazed in February on a pasture heavily contaminated into December and kept free of cattle until mid-February, was infected with lungworms, indicating that larvae could survive during this period. A second pair of tracers grazed on the overwintered pasture during March–April did not become infected with lungworm. Gastrointestinal nematodes, particularly intestinal species, did survive oversummer and overwinter conditions. *Ostertagia ostertagi*, however, did not survive the oversummer period. Temperature and rainfall patterns during the experiment differed only a little from those for 22-yr average conditions.

KEY WORDS: *Dictyocaulus viviparus*, trichostrongyles, oversummer, overwinter, pasture infectivity, survival of infective stages, transmission, *Ostertagia ostertagi*.

Little information is available on survival of *D. viviparus* on pasture in the U.S. (Lyons et al., 1981). Porter et al. (1941) and Porter (1942) in Florida and Alabama, respectively, did not observe infection in susceptible animals that were grazed on pastures held free of animals for 6 wk and 3 mo during winter. However, according to Lyons et al. (1981), lungworm larvae survived on a pasture in central Kentucky during the winter. Reports in other parts of the world are conflicting, because early investigations in the United Kingdom did not find evidence of larval survival during winter (Soliman, 1952; Michel and Shand, 1955). More recent observations in Canada, Ireland, and the United Kingdom have demonstrated that larvae can successfully overwinter (Gupta and Gibbs, 1970; Oakley, 1971; Downey, 1973).

The purpose of the present experiments was to determine the survival of *D. viviparus* infective larvae during summer and winter, under the subtropical climatic conditions of Louisiana.

**Materials and Methods**

The experiment was carried out on 2 pastures at the Department of Veterinary Science research farm in Baton Rouge, Louisiana. Climatological data were taken from the Ben Hur Experiment Station, roughly 4.8 km from the research site.

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1 Approved for publication by the Director of the Louisiana Agricultural Experiment Station as manuscript number 88-64-2108.

Oversummering experiment

A small pasture of 0.41 ha was contaminated by feces of 30 yearling cattle naturally infected with *D. viviparus* and GI nematodes for several weeks in spring (up to 19 May) 1986. From this time until 8 August (81 days), the pasture was maintained free of animals. Two groups of 2 Holstein tracer calves per group (4 mo old and reared free of parasites) were grazed on the pasture for 31 days during 8 August to 8 September and for 30 days during 16 September to 16 October, respectively.

In each case, at the end of the 2 tracer calf grazing periods, the animals were kept in a concrete-floored pen for 15 days and fed grass hay and a feed-protein supplement. At necropsy, the GI tract and lungs were examined for worm recovery, counting, and identification of parasites (Williams et al., 1988).

Overwintering experiment

A second small pasture of 0.41 ha was contaminated for several weeks in fall (up to 19 December) 1986 by 16 animals naturally infected with gastrointestinal nematodes and *D. viviparus*. This pasture was then maintained free of any animals until 2 February 1987 (45 days). Two groups of 2 Jersey tracer calves per group (4 mo old and reared free of parasites) were grazed on the pasture for 14 days during 2–16 February and during 24 March to 7 April, respectively. Tracer calf grazing periods during late winter-spring were of shorter duration than in late summer-fall because of expected greater levels of pasture contamination in the former period (Williams et al., 1983, 1987). In each case, at the end of the tracer calf grazing periods the animals were held in confinement for 15 days before slaughter as were the previous tracer calves.
Table 1. Dictyocaulus viviparus recovered from tracer calves used for testing oversummer and overwinter survival of L3.

<table>
<thead>
<tr>
<th>Pasture vacant period</th>
<th>Tracer grazing period</th>
<th>No. of animals</th>
<th>Mean no. of worms (SD)*</th>
<th>Range</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Adult</td>
</tr>
<tr>
<td>Summer, 5/19-8/8/86</td>
<td>8/8-9/8/86</td>
<td>2</td>
<td>0</td>
<td>—†</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>9/16-10/16/86</td>
<td>2</td>
<td>0</td>
<td>—</td>
<td>0</td>
</tr>
<tr>
<td>Winter, 12/19/86-1/30/87</td>
<td>2/2-2/16/87</td>
<td>2</td>
<td>68.5 (9.5)</td>
<td>59-78</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>3/24-4/7/87</td>
<td>2</td>
<td>0</td>
<td>—</td>
<td>0</td>
</tr>
</tbody>
</table>

* Standard deviation.
† No data.

Results and Discussion

No clinical evidence of infection was observed or lungworms recovered from either of the groups of tracer calves that grazed the oversummered pasture in August or September (Table 1). However, as is shown in Table 2, gastrointestinal nematode L3, particularly those of the intestinal species, survived summer conditions and infected the 4 animals. Ostertagia ostertagi was the exception, because L3 of that species apparently did not survive the observed oversummer period, and the tracer calves were found free of this parasite. Even though rainfall was well above to near normal from June through August, normal high summer temperatures were apparently responsible for failure of L3 of D. viviparus and O. ostertagia to survive on pasture (Fig. 1).

A mean of 68.5 lungworms, with a standard deviation of 9.5 was found in the 2 tracer calves that grazed the overwintered pasture from 2 February to 16 February (Table 1). However, no clinical signs of infection or lungworms were observed in the 2 calves that grazed the overwintered pasture from 24 March to 7 April 1987 (Table 1).

Results obtained in the oversummer experiment indicated that lungworm infectivity on pasture did not persist through the summer pasture rest period. Apparently either the L3 or earlier larval stages did not survive conditions of summer.

In regard to overwintering of L3 of D. viviparus on pasture, results are not only controversial in Europe (Michel and Shand, 1955; Oakley, 1971), but also in North America. Porter et al. (1941) and Porter (1942) did not observe overwinter survival in Florida and in Alabama, respectively, but Lyons et al. (1981) found that lungworm larvae were capable of surviving overwinter in Kentucky. Results obtained in the present work indicated that susceptible calves were infected by L3 of D. viviparus that survived through the coldest portion of winter in Louisiana (to mid-February). Near continuous wet weather from October 1986 through March 1987 and only slightly lower than normal temperatures in December and January were apparently favorable to survival of lungworm L3 during winter (Fig. 1). Overwinter survival of gastrointestinal nematode larvae through this period was (Table 2) in accord with previous epidemiological

Table 2. Mean gastrointestinal nematode counts recovered from tracer calves used for testing oversummer and overwinter survival.

<table>
<thead>
<tr>
<th>Pasture vacant period</th>
<th>Tracer grazing period</th>
<th>No. of animals</th>
<th>Ostertagia ostertagi Adults</th>
<th>Trichostrongylus axei</th>
<th>Haemonchus sp.</th>
<th>Small intestine</th>
<th>Large intestine</th>
<th>Total worm count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer, 5/19-8/8/86</td>
<td>8/8-9/8/86</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>818</td>
<td>1,800</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>9/16-10/16/86</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8,344</td>
<td>100</td>
</tr>
<tr>
<td>Winter, 12/19/86-1/30/87</td>
<td>2/2-2/16/87</td>
<td>2</td>
<td>6,381</td>
<td>141</td>
<td>674</td>
<td>770</td>
<td>806</td>
<td>5,947</td>
</tr>
<tr>
<td></td>
<td>3/24-4/7/87</td>
<td>2</td>
<td>43</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>2,007</td>
<td>0</td>
</tr>
</tbody>
</table>

* DL = developing fourth stage.
† EL₄ = early fourth stage.
‡ Primarily Cooperia spp. in small intestine; primarily Oesophagostomum radiatum in large intestine.
§ Abomasal worm count data on 1 animal only.
Figure 1. Line graph of monthly average maximum and minimum temperature (°C) and histogram of monthly rainfall from March 1986 to April 1987 compared to 22-yr averages.

Observations in Louisiana (Williams et al., 1983, 1987). Ostertagia ostertagi was predominant in February, whereas intestinal species were more common in calves grazed during March–April.

Jørgensen (1980, 1981) in Denmark, found that few lungworm larvae survived overwinter and the number that did were not sufficient to produce clinical signs in calves. In our study, even though lungworm burdens were low in both tracers grazed on the overwinter pasture in February, clinical signs of coughing, anorexia, and weakness were obvious. However, neither of the 2 calves grazed during March–April acquired lungworm infection. Even though rainfall was minimal in April 1987, generally prevailing weather conditions of the spring would appear to have favored survival of lungworm L3 through the March–April tracer calf grazing period (Fig. 1). It may be that inherent limitation for lungworm L3 survival (depletion of stored energy reserve) was more important than weather factors in this case. When the second set of tracers grazed the overwinter pasture in March–April, the length of the overwinter period observed was similar to that reported by Porter et al. (1941), confirming their results, and suggesting that even under conditions when the larvae can overwinter until February, they may not survive until March–April.

According to Oakley (1981), different results on overwinter survival of lungworm larvae on pasture may be due to climatic differences between regions and techniques used to detect the presence of the larvae. Although failure to detect larvae by tracer grazing experiments does not mean that they are absent, the use of young susceptible tracer calves grazed for 2–3 wk on a small paddock is obviously the most sensitive and quantitative means of testing availability.

Literature Cited
