

GENERAL DISCUSSION

H.J. Over (*The Netherlands*)

I would like to consider the involvement of earthworms in the spread of larvae and/or eggs of *trichostrongyles* into soil. It is unlikely that earthworms are the only invertebrates concerned. In fact it is probable that many invertebrates assist and this will depend on the nature and structure of the soil.

J.F. Michel (*UK*)

Would someone like to speculate about what form investigations on this topic might take?

H.J. Over

A study of this role of particle size of the soil and the penetration and retention of larvae related to this would be most useful.

J. Eckert (*Switzerland*)

I would like to ask Dr. Raynaud whether fewer tracer animals may be of significance when put on a large area. What we are measuring is the infection risk. As long as we assume that the food intake is similar in the tracer animals, this measurement of the infection risk is independent of the size of the area in which the animals are grazing. I would like to know what risk exists for some of the calves grazing on a large area compared to when the animals are put on a small area and highly overstocked. We have information on the infection risk which indicates that it does not depend on the area on which the animals are grazing. It is comparable with the grazing area which the other animals have.

J.-P. Raynaud (*France*)

In your work the initial contamination is in the pasture around the home? Animals start with a few weeks in the home pasture, and it is there that the initial contamination of the

calves starts. Then the animals are moved to the alpage. With the Limousin calf, for example, when you have ten calves in ten hectares, can you really put out tracers? We know, we have tried and it is impossible, because the tracer is so different from the normal animal, they are killed by the normal. What could be the system to control either the pasture or the availability of the larvae, in such a cow/calf system where you have ten animals per ten hectares? It is an extensive area. This compares to your system in alpage which is also a very extensive system.

J.F. Michel

There are two elements here. One is the question of area; I suppose the thought there was that there would be gross inequalities in the distribution of worms, so that if you had a large area some calves, especially if they had a different grazing pattern, would not be grazing where the calves which you are trying to monitor were grazing. The other point was the practical difficulty of using a tracer calf as a measure of what is happening to the single suckled calf. I suppose the only answer is to use a single suckled calf as a tracer.

J.-P. Raynaud

Yes, the principals.

J.F. Michel

No, not the principals. To have tracer calves, not as hand reared calves, but to have a cow and calf.

R.J. Jørgensen (Denmark)

I have a question for Professor Eckert on the overwintering of lungworm larvae in Switzerland. You believe that overwintering of larvae in the lungs of animals is the most important. Can you be sure that larvae do not overwinter, or do you think that overwintering in the animal is the most important thing? It is my experience that lungworm larvae

survive freezing very well, and the drop in larvae on the pasture which takes place in spring occurs before animals are turned out (here in Denmark) and during the first weeks there on pasture.

J. Eckert

Our statements are based on the following studies. Several years ago we distributed faecal samples with lungworm larvae in the midlands and hilly areas, and we could not recover any larvae after the winter months. I cannot recall the exact data but we could not find living larvae after some months - the samples were distributed in autumn.

The second experiment was done on a pasture which in the previous year was heavily contaminated with clinical cases of Dictyocaulosis. The following spring we turned out some tracer animals and they did not pick up any lungworm infections. These results may now be interpreted differently in view of the paper, which we heard this morning, concerning the probability that lungworm larvae may survive in the soil. This could be the explanation why tracer animals, which had been grazed for about 14 days in spring, were not infected. However, our impression was that overwinter survival of larvae is not important, and similar results were obtained in Austria. On the other hand, we could isolate inhibited larvae from the lungs of cattle during winter time.

R.J. Jørgensen

I do not think you should give up this idea, because overwintering lungworm infection means sufficient larvae are picked up perhaps by a single animal, these then produce a patent infection.

J.F. Michel

I think there is great individual variation, with respect to *Dictyocaulus* infection.

H.-J. Bürger (FRG)

I would like to quote results obtained by Mr. Bunke. He placed a dozen tracer calves, in spring, on pastures which had been contaminated with *Dictyoacaulus* larvae the previous autumn. The animals were put out in May, and by the first few days of June, we could not find a single lungworm in any of these calves. We purposely restricted the animals to those areas of the pastures where most of the larvae would probably have been - and the animals had to graze this part of the pasture closely. No *Dictyoacaulus* was found in any of these tracer animals in spring.

J. Eckert

We distributed faecal samples and examined them until the end of April. We could not find larvae at this time. We used tracer animals and, one group was grazed from the 3rd of May until the 24th May and these animals had trichostrongylids but not lungworms. Other animals of the group remained on the same pasture until the end of September and still there was no lungworm infection at all. However, these animals picked up fairly high numbers of trichostrongylids. On this evidence we concluded that overwintering of *Dictyoacaulus* larvae may be negligible under our conditions in Switzerland.

G. Urquhart (UK)

I would like to refer to the question of whether overwintered lungworm larvae mature gradually in the spring. Some twenty years ago in an abattoir survey of animals which had died in the first and second year of life, we found the incidence of infection was roughly 30%; about 10, 20 or 30 lungworms per animal. There was a gradual increase in the number of lungs with adult lungworms of the order of 10, 14, 18 and 25 worms per set of lungs. One got the impression that each month there was a larger number of adult lungworms than previously. This would suggest that lungworm larvae do mature and adults commence excreting larvae.

J.F. Michel

Would anyone like to take up Dr. Bürger's suggestion that the mid-season increase in the pasture contamination with trichostrongyle larvae should be predictable? I was wondering whether he also thinks that the rate of decline in the pasture infestation in the spring is predictable? I would like to ask if these things are, in fact, capable of being forecast and whether there would be any practical value in doing so?

H.-J. Bürger

My data do not indicate that the decline in spring is predictable. We have shown previously that the number of larvae present on pastures in autumn is correlated to the number on the pastures in the spring. We compared the data of September/early October with those in March and early April. However, I cannot say that the decline in spring is predictable. The first increase during mid-summer might be predictable, since the rise of the larval counts occurred at the same time on a variety of pastures.

There is a practical use of prediction insofar as we want an answer to the question which is often put to us by farmers, as well as veterinary practitioners, namely, can we delay the movement of the calves to other pastures - and of the heifers and bulls during the second year as well - to late July or early August? I think we can now say yes! But still we are not certain about this.

J.F. Michel

Does anyone else have strong feelings about the usefulness of forecasting?

H.J. Over

Looking at Dr. Bürger's data, to forecast for fall and spring is very reliable. But when spring comes you see these larval counts come back anyhow, so it makes no sense to say it

is forecasting - it is like forecasting spring, it will come with grass growth!

J.F. Michel

Yes, with grass growth. So grass growth is predictable, and it is variable from year to year.

H.J. Over

I would like to ask Dr. Bürger whether the fields he described were in one locality?

H.-J. Bürger

Yes, the pastures which I showed you were in one locality - one, two, three beside the other, in all $1\frac{1}{2}$ km from one end of the farm to the other.

However, in the other study, showing the increase during September, those were different fields, and were about 15 km away from the first group.

H.J. Over

That bears on the point of the summer prediction. You mentioned the occurrence of a thunderstorm in August; it fell on all three pastures; one obviously reacted and the others did not. I don't think you can use this in relation to forecasts.

J. Armour (UK)

I wish to explain a situation that we have in two different parts of Scotland. In the Edinburgh area (East Scotland) Ostertagiasis often is not observed. However in the West it occurs annually. In 1977/78, the rainfall increased markedly in the East of Scotland; it showed quite a different pattern. Normally this area has a rainfall not dissimilar to the southeast of England (perhaps marginally more). However, for two years there were 10 - 15 inches of rain more than usual

and Ostertagiasis was common in East Scotland. Were there to be a good prediction formula it would be very useful because, in many years, in many parts of Scotland there is very little need to take any control measure.

R.M. Connan (UK)

Are you talking about Type 1 or Type 2 Ostertagiasis?

J. Armour

Type 1.

R.M. Connan

We see Ostertagiasis in our area (Cambridgeshire).

J. Armour

However, in Linlithgow and Fife (and so on) the disease is reputed not to occur.

R.J. Thomas (UK)

With regard to the overwintering of larvae and their decline in spring, I think the number of larvae that overwinter is more important than the rate of decline. I think the rate of decline is steady and depending when spring arrives, there is a proportion of larvae surviving. The important factor is the number of overwintering larvae which constitute the starting point. Olleranshaw has suggested that one can predict this from the weather conditions of the previous autumn. This may be useful.

J.F. Michel

If the decline in larval populations in the spring depends on grass growth then is there any need for sophisticated forecasting techniques?

H.-J. Bürger

At this point I would like to mention the work of the Copenhagen people who demonstrated some of the consequences of larval survival. They put the animals out to pasture at different times of the year, which would include periods when larval populations had declined.

N. Downey (Ireland)

I would like to ask Dr. Bürger if he noticed, in years where he got a late season increase in pasture infection, if this was followed by more overwintering infection.

H.J. Bürger

The results were equivocal. I do not think the number of larvae which overwinter depends on the number in the mid-summer increase. The mid-summer increase can end up with even lower numbers, for example in situations with two or three dry years; in these the larval counts decreased after an early peak in July or August, while it increased in other years which were particularly wet during late September and October. I cannot see from my data any correlation between the mid-summer increase and the overwintering of larvae.

N. Downey (Ireland)

Even if the increase is late? Recently we have had very warm late summers and one would have expected more development and survival over winter.

R.J. Jørgensen

The Danish experiments indicate clearly that the climatic conditions in spring are most important in relation to the number of overwintered larvae. This is assessed by the number of larvae acquired by grazing calves. The Danish farmer will turn his animals out when there is a period of warm weather and provided there is sufficient herbage, therefore it is a question of the air temperature.