A STUDY OF THE IMPORTANCE, OVERWINTER SURVIVAL, AND GEOGRAPHICAL DISTRIBUTION OF INTERNAL PARASITES OF SHEEP IN MANITOBA

UNIVERSITY OF
ZOOLOGY DEPT.
MANITOBA

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A number of natural factors favor the production of sheep in Manitoba. Large tracts of cheap land, unsuited for more intensive types of agricultural endeavor, appear ideal for sheep-raising. These areas provide sufficient forage for large flocks of sheep that can be kept over winter at low cost. The usual practice is to provide low-cost, open-type sheds for shelter, as sheep do very well in such quarters. This type of shelter also requires little in the way of labor that would be necessary in a more elaborate system of housing.

The prices of sheep and sheep products in recent years have been consistently higher than previously, and in view of the smaller amount of labor required for sheep raising than for other types of agriculture, one might reasonably have anticipated a substantial increase in the sheep population during the war. Also favoring an expansion of sheep population is the low provincial incidence or relative absence of bacterial, virus and protozoan diseases such as anthrax, foot-and-mouth disease, looping ill, scrapie and braxie(59).

Despite all these natural advantages, the sheep

industry in Manitoba has not flourished. The Dominion Government's request for a 25 percent increase in sheep production during the war was not met, although in Manitoba there was some increase in the number of sheep kept during this period. This increase in Manitoba constituted a shift of sheep population rather than a real increase for the whole Dominion; the sheep population of Canada in 1937 was about the same as in 1871(59). The trend has been for the sheep population to increase in an area for a time, and then to shift to some other part of the country, mostly from the east to the west. The evidence that the increase in Manitoba was due, in part at least, to such a shift in population rests on the figures of the Provincial Department of Agriculture, which show that the sheep population in Manitoba reached the peak figure of 327,000 in 1943, but dropped to 319,000 in 1944(38).

It has been demonstrated that in Eastern Canada, parasitic diseases of sheep were taking a tremendous toll (59). Till recently it had been assumed that the climate in Manitoba was too dry and the winters too long and severe for sheep to acquire heavy infestations of internal parasites. This proved to be a fallacy, when, during the last number of years, many sheep raisers were unable to market their lambs in the fall because of stunted growth.

Invariably when such stunted and emaciated animals were examined, they were found to harbour a great number of intestinal and stomach parasites. These preliminary examinations suggested that internal parasites are the limiting factor in sheep production in Manitoba.

When the fact that internal parasites constituted the limiting factor in sheep production was demonstrated, it was decided that a general survey should be conducted to determine the species of parasites that occur here. There are a variety of phases of parasitism that could have been studied, such as the host-parasite relationship, pathogenicity, modes of infection and life cycles, but it was the intention of the writer to gather information on those phases that would be of immediate economic benefit to the sheep industry in Manitoba. With this view in mind, special attention was paid to the factors that would assist the adoption of adequate control measures. The incidence and geographical distribution of sheep parasites was determined in order to prove to the practical man that a parasitic problem exists.

When it was once determined that parasitism was the limiting factor in sheep production, a study of the modes of spreading parasitic infections became a necessity. It was deemed essential that a study of the ages and conditions of sheep that are most favorable to parasitic

infestations be studied also. In order to give practical value to the study of this important problem, a study of the symptoms, diagnosis and pathogenicity of parasitic infections was included in the present survey.

It is the writer's contention that when information regarding all the salient points of parasitism in sheep is placed in the hands of extension workers, an intelligent campaign against the biggest hazard to the sheep industry can be launched and brought to a favorable conclusion. With this view in mind, the different phases of the parasite problem of sheep in Manitoba were studied by the writer from May 1944 to September 1945. The results of this study are presented in the following report.

MATERIALS AND METHODS

In the summer of 1944 some information on sheep parasites was gathered, mainly from tests conducted on the flock at the University of Manitoba but also from some of the flocks adjacent to the Winnipeg area. The following winter was spent in testing the overwinter survival of the free-living stages of Haemonchus contortus, the large stomach worm of sheep. This species proved to be the most common and widely distributed parasite of sheep in Manitoba.

During the summer of 1945 a survey was conducted to determine the types and relative degree of infestation of the helminth parasites of sheep in Manitoba. This included a study of the incidence and geographical distribution of the different species.

In all a total of 96 farms in 15 different areas in the province were surveyed. The number of farms to be visited in each district was calculated roughly according to the total sheep population in that district, relative to the total sheep population in the province.

An effort was made to take uncontaminated faecal samples from 10 different sheep on each of the farms visited. This number could not be rigidly adhered to in the field, but a total of 868 individual faecal samples were examined from the 96 farms, or the equivalent of just over 9 sheep examined on each of the farms visited.

Although this number is a small percentage of the total sheep population in Manitoba, the random selection of the farms and animals should tend to give a moderately accurate picture of sheep parasitism in this province.

DIVISION OF DISTRICTS

The data gathered during the survey has been divided into 15 separate districts. These divisions follow from the fact that the Manitoba Department of Agriculture has grouped together certain adjoining municipalities to comprise Agricultural Representative districts. It was by the assistance of the Agricultural Representatives that the writer was enabled to traverse the survey area, and the data have been kept segregated into these districts to facilitate their interpretation.

The data are based mainly on the helminth ova found and identified in the faecal samples. Post mortem examinations were conducted whenever the opportunity afforded, so that the actual specimens could be taken and specifically identified. The ova were identified according to Kates and Shorb(33). Adult nematodes were cleared in the laboratory and their identity established according to the keys set out by Yorke and Maplestone(68). The cestodes required staining as well as clearing before they could be specifically differentiated. This was accomplished with the aid of Monnig's text on that topic(41).

Over the two years of the survey, 16 post mortem examinations were conducted in the field. The viscera of 5 sheep from local packing plants were also examined, as well as the viscera of 6 sheep sent in to the Provincial Animal Pathology Laboratory for post mortem.

The faecal samples were taken either directly from the rectum of the animal, or from uncontaminated, freshly dropped excretions. The faecal samples were then placed in small consecutively numbered bottles and preserved in 10 percent formalin or by means of cotton wadding soaked in ortho-dichloro-benzine(67). The preservative prevented the ova from developing enroute to the laboratory but left their ability to rise to the surface of a concentrated salt solution unchanged.

Pertinent information on the flock management was collected from each farm by filling in a routine questionnaire. The questions asked dealt with the type and size of farm, size and management of the flock, mortality losses, anthelmintic medication, and general practice.

EGG-COUNTING TECHNIQUE

A modified dilution-flotation technique was employed in the laboratory to determine the number of helminth eggs the faeces contained per gram(66). Ten grams of faeces were weighed from each sample and placed in a half-pint bottle.

Water was added to a filed mark at the 150 cc. level. The solid faecal particles were broken up by means of a glass rod, and mixed with an electric mixer for one and a half minutes so as to get an even suspension(36).

A portion of the suspension was then poured through a strainer into a glass beaker. A 0.5 cc. sample of this suspension was drawn up into a 1.0 cc. syringe, and 0.5 cc. of a saturated sodium chloride solution was also drawn into the syringe. The two solutions were then mixed by means of an air bubble drawn into the barrel of the syringe(66). Three 0.15 cc. samples were then placed in a special counting slide for examination under the microscope. These slides were left undisturbed for several minutes. During this time the helminth ova floated to the upper surface of the counting chamber, while the faecal debris sank to the bottom. In this way the ova were gathered in a relatively small area, free from debris, and could be identified quickly and easily. The number of each parasitic species for the triplicate count from each sheep was averaged and recorded on separate, numbered cards corresponding to the number designated for the sheep and farm at the time the sample was taken. The total number of eggs per gram of all the parasitic species present in particular sheep was also entered on the card.

No attempt was made to eliminate the variation in

egg-count due to differences in the moisture content of the faecal sample because it has been found that the day to day and sample to sample variation can not be eliminated even by dry-basis counts, and the extra work of drying the faecal samples was avoided(44). The writer is also aware that there are seasonal variations in the egg-counts of nematodes(39). As the present data are not being used to draw conclusions and comparisons from the actual numbers of ova present, the seasonal factor was also disregarded. The present egg-count data were used mainly to determine the species of parasite present by differentiation of their ova.

During the course of the survey, 13 different genera of nematodes and 2 genera of cestodes were found to be present in Manitoba sheep. These were specifically identified and their classification is listed below.

ZOOLOGICAL CLASSIFICATION

OF THE HELMINTH PARASITES OF SHEEP IN MANITOBA

CLASS: NEMATODA ORDER: EUNEMATODA

I. SUPERFAMILY: STRONGYLOIDEA

A. Family:Trichostrongylidae Subfamily:Trichostrongylinae

Genera:
1. Haemonchus
2. Ostertagia
3. Cooperia
4. Trichostrongylus
5. Nematodirus
6. Mecistocirrus

B. Family:Strongylidae Subfamily:Oesophagostominae

Genera:
1. Oesophagostomum
2. Chabertia

C. Family:Ancylostomidae Subfamily:Necatorinae

Genus: 1. Bunostomum

D. Family:Metastrongylidae Subfamily:Metastrongylinae

Genus: 1. Dictyocaulus

II. SUPERFAMILY: TRICHUROIDEA

A. Family:Trichuridae

Subfamily: Trichurinae

Genus: 1. Trichuris

Subfamily: Capillarinae

Genus: 1. Capillaria

III. SUPERFAMILY: RHABDIASOIDEA

A. Family:Rhabdiasidae

Genus: 1. Strongyloides

CLASS: CESTODA

SUPERFAMILY: TAENIOIDEA

Family:Anoplociphalidae Subfamily:Anoplocephalinae

Genus: Moniezia

M. expansa

M. benedeni

Family:Taeniidae

Genus: Taenia

T. hydatigena (*Cysticercous tenuicollis*)

INCIDENCE OF PARASITISM

Table I shows the proportions of Manitoba sheep and flocks that are parasitized. The table is arranged so that a comparison can be made between the various districts concerned.

From the table it can be seen that parasitism is particularly severe in those districts that are located in the Interlake area and east of the Red River. The Interlake area refers to that portion of Manitoba situated between Lake Winnipeg and Lake Manitoba. For this whole area, comprised of the first five districts listed in the table, at least 40 percent of all sheep examined showed evidence of parasitism. This is considerably higher than the 28 percent for the province as a whole, or the less than 18 percent for the part of the province outside of the Interlake area and the portion east of the Red River.

The table also shows a high percentage of parasitised sheep for districts such as Russell, Carman, and Elkhorn, which are outside of the parasitological area. In fairness to these areas it must be said that the figures in the table indicate a higher incidence of parasitism than the actual for these districts. This results from the fact that only two farms were selected because parasitism was suspected, so that the species occurring in the particular area could be determined.

The Shoal Lake area shows a relatively high incidence of parasitism, but the results from this area are weighted by a particularly large flock in the Birtle district. The owner of this flock buys a large number of ewes from packing plants outside of Manitoba, and a high percentage of these animals are parasitized as shown by faecal egg counts and visible symptoms. This parasitism decreases in severity as the season progresses, because the animals have access to an abundance of brome grass pasture over a large area of hilly land with a good water supply. This flock was checked twice during the summer of 1945, and the degree of parasitism was much less at the time of the second visit.

The area east of the Red River and the Interlake country can be called the parasitological centre of Manitoba as far as sheep are concerned. This area contains more than one third of the total sheep population of Manitoba and practically every farm has some parasitised animals.

Table I also shows a low incidence of parasitism for the area around St. Pierre. This area is actually more heavily parasitized than the table would indicate. While faecal samples were taken from only three flocks in this area, a number of other farms in the district were visited and several flock owners had just gone out of sheep

TABLE I

INCIDENCE OF PARASITISM IN MANITOBA SHEEP

District	No. of Farms Visited	No. of Farms Parasitized	No. of Sheep Examined	No. of Sheep Parasitized	% of Sheep	% of Farms
Eriksdale	11	11	90	54	60.0%	100.0%
Seven Sisters	4	4	34	15	44.1	100.0
Selkirk	4	4	21	12	57.1	100.0
Teulon	16	15	160	58	36.2	93.8
Vita	10	8	96	22	22.9	80.0
Minnedosa	10	6	100	22	22.0	60.0
Russell	2	2	13	6	46.2	100.0
Carman	2	2	20	5	25.0	100.0
St. Pierre	3	2	30	3	10.0	60.0
Pilot Mound	5	3	50	7	14.0	40.0
Boissevain	4	1	40	1	2.5	25.0
Dauphin	11	4	90	6	6.7	36.4
Swan River	8	6	61	9	14.8	75.0
Shoal Lake	4	4	40	13	32.5	100.0
Elkhorn	2	1	23	11	47.8	50.0
Total	96	73	868	244	28.1%	76.0%

production. While some of these owners claimed that marauding dogs had forced them out of business, others described symptoms of parasitic diseases as the cause.

PREVALENCE OF CERTAIN GENERA

Besides determining the different parasites that occur in Manitoba sheep, and the incidence of these parasites, knowledge of what genera are most widespread and occur most frequently is important in planning control measures. Table II shows the regularity with which certain parasites occur on different farms.

Haemonchus is the most common parasite of sheep in Manitoba. It occurs in more sheep than any other parasite, and can be found in more flocks.

Ostertagia, Chabertia, Trichostrongylus, and Bunostomum are all found in a large percentage of the flocks. The difference in their incidence may be entirely seasonal, but in any case they are sufficiently widely distributed to cause trouble over a wide area.

The data with regard to Moniezia are not very accurate because this parasite can sometimes be found in animals at post mortem when no eggs appeared in the faeces. In the life cycle of this genus the gravid segments pass out in the faeces, rather than the eggs being shed in the host and mixed with the faeces. The fact that eggs of this tapeworm were found in faecal samples of 20 percent of the flocks tested, indicates that Moniezia is very common in Manitoba sheep.

The other genera occur less frequently. Nematodirus