Control of an Outbreak of Gamma-BHC-Resistant Sheep Body Lice in the North of England with the Phosphoric Ester Carbophenothion

BY
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SUMMARY.—Carbophenothion (s-(p chlorophenylthio) methyl 0,-0-diethyl phosphorodithioate, used at 0.021 per cent. is shown to eradicate the gamma-BHC-resistant sheep body louse *Dipylidium ovis*, and to protect from re-infestation for at least 20 weeks when used in late winter.

Introduction

THE emergence of gamma-BHC-resistant sheep body lice, *Dipylidium ovis*, is described elsewhere (Page, Brown & Flanagan, 1965; Treeby, 1966).

Farmers whose flocks were affected had already dipped them at least once in gamma-BHC dips, and in some cases four or five times, without effect, so that in the late winter of 1965 they were faced with the prospect of a drastic loss of income from wool, due to lice.

To cope with this problem, two sheep dips based on carbophenothion* were made available, one a paste and the other a liquid, both phenolic formulations, which when diluted gave 0.021 per cent. carbophenothion in the dipping bath. Both were purchased commercially and used without supervision to dip approximately 250,000 sheep, an estimate which was based on the bath gallons the concentrates would make up.

In earlier work, carbophenothion had been found to eradicate "normal" lice at 0.002 per cent., and to eradicate and protect from re-infestation for at least six months. In January, 1965, lice which were found to be resistant to 0.036 per cent. gamma-BHC were eradicated by low concentrations of carbophenothion.

This paper describes the length of protection to be expected from carbophenothion dips, used at 0.021 per cent., from re-infestation by the gamma-BHC-resistant louse as a result of laboratory tests

* Stauffer compound No. R.1303.

Anthelmintic Efficiency of Low Daily Doses of Hexachlorophene against *Fasciola hepatica* in Sheep.—*Concluded.*

in one of the sheep, infected with 2,000 metacercariae with access to the lick from four to 12 weeks. In all other groups this method of treatment was inefficient. Retardation of the growth rate of fluke was observed and consequently the egg production was much lower in the treated than in the untreated control groups.

Discussion

In both field experiments the calculated daily intake of hexachlorophene was approximately 6 mg. per kg. per sheep. The efficiency was satisfactory when the sheep grazed poor pasture, but this method of treatment when the sheep were on good pasture failed to reduce the fluke burden of most of the sheep. It is probable that on the poor pasture all sheep consumed some of the lick, and that the intake possibly approached the single dose therapeutic level from time to time. The intake on the good pasture might have been more variable and only a few sheep consumed sufficient of the preparation.

During the experiments on good pasture, it was observed that some sheep licked the blocks more readily than others, and that some sheep did not lick at all. It seems that success of this method of treatment of *F. hepatica* infection in sheep may depend on many factors, and that its use may be unreliable in controlling the disease.

It is known that at the beginning of a dry period the sheep may be exposed to heavy infections because they graze in the wet areas of the pasture contaminated with *F. hepatica* metacercariae. This method of treatment might result in reducing the degree of infection under such conditions.

The laboratory experiments showed that 7 mg. per kg. hexachlorophene can be given to sheep kept in pens and artificially fed for as long as 14 weeks without any clinical signs of toxic effects. Infections with *F. hepatica* of wild ruminants is of considerable economic importance in North America and some parts of Europe. Hexachlorophene in a more suitable formulation as a lick (possibly mixed with salt) might be an efficient measure in controlling these infections when individual treatment is not possible.

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and the monitoring of commercial dippings spread over a wide area.

Materials and Methods

Laboratory Tests

Insecticides were screened at this laboratory for all ecto-parasites of sheep. One method used for sheep body lice is known as contact challenge, whereby a severely infested sheep was penned in close contact with a sheep dipped in the insecticide under test for eight hours in each week, and re-infestation was judged to have taken place when lice in all stages had been established. When the validity of the method was assessed initially, infestations were established on undipped sheep in a differential way, dependent upon breed, and more specifically on wool type. Hill breeds and first crosses by Border or Hexham Leicester rams can be lightly infested within four weeks of initial contact, except in the period up to eight weeks after clipping.

Estimation of the rate of depletion of insecticides in the fleece was done by bio-assay, and the quantitative method for organophosphorus compounds depended upon the preparation of a mortality curve for *Lucilia sericata* as follows.

L. sericata were reared in isolation at 25° C. and 50 per cent. humidity. After emergence, flies were fed liver for three days under the stimulus of artificial light. After this time, and up to 14 days later, eggs laid on liver were used for bio-assay. The liver was introduced at 9 a.m. and removed after adequate oviposition for transfer to a hatching tin under muslin, and the eggs were kept thus until 9 a.m. the following day, by which time fairly uniform development to second instar larvae had taken place. Meantime, 3 inch × 15 mm. wasserman tubes had been loaded with approximately 200 mg. of wool, soaked previously and dried in wettable powder suspensions of insecticide, at dilutions ranging from 0.075 to 800 p.p.m., as a geometrical progression, three tubes to each dilution. A measure of 2 ml. of a solution of Difco beef blood serum prepared at 50° C. with distilled water was added to each tube. The hatched larvae were floated in a watchglassful of 6 ml. serum, numbers equal to half a level teaspoonful. A 2 inch × 5 mm. glass tube with a rubber bulb was filled with serum and larvae and two drops were loaded into each tube, careful note of the time being made. Tubes were corked with cotton wool and the racks incubated under strip lights at 30° C. Time kill observations were made, and a mean of three results was plotted to give a mortality curve.

Bio-assay procedure for unknown wools was similar, and results were plotted against the prepared curve. Assays were made of the tip, middle and lower wool segments.

Sheep dipped in 0.021 per cent. carbophenothion were penned weekly with sheep severely infested with lice of the resistant type. The challenge sheep were drawn from a flock dipped four weeks previously in 0.36 per cent. gamma-BHC without effect.

Wool samples were taken at intervals after dipping in carbophenothion at 0.021 per cent. from five random sheep in each of five flocks dipped under commercial conditions.

Field Trials

Five infected flocks of sheep on widely separated farms in the north of England where the lice had been proved resistant to BHC were dipped in carbophenothion at 0.021 per cent. Two flocks were dipped in a paste phenolic formulation, and three in a liquid phenolic. Undipped lousy sheep continued to run with the treated sheep in a ratio of two lousy to 100 dipped. Wool samples removed from dipped sheep at intervals were assayed for carbophenothion.

Results

Laboratory Tests

Sheep dipped in carbophenothion at 0.021 per cent. early in February, 1965, and contact challenged each week for 20 weeks, or up to clipping time when the test was abandoned, remained free from resistant lice.

Bio-assay results for wool samples taken from sheep dipped in field trials are shown in Table I.

TABLE I

	Wool Segment	Concentration (range 5 results of carbophenothion in wool at indicated intervals after dipping at 0·021% (as p.p.m.) 10 weeks	20 weeks
Paste test No. I W. Riding Yorks.	Tip	7-70	1-30
	Mid	10-70	2-8
	Lower	10-70	1-8
Paste test No. II W. Westmoreland	Tip	4-10	1-6
	Mid	5	6-8
	Lower	5-10	2-8
Liquid test No. I N. Riding Yorks.	Tip	7-40	5-7
	Mid	40	5-10
	Lower	7-40	6-7
Liquid test No. II E. Westmoreland	Tip	19-60	7
	Mid	6-60	5-40
	Lower	10-60	5-40
Liquid test No. III Cumberland	Tip	10	1-5
	Mid	10	6-10
	Lower	10	1-5

Field Trials

The flocks were followed through up to clipping time and no case of re-infestation took place during the period of 20 weeks after dipping.

Discussion

Carbophenothion dips at 0.021 per cent. will eradicate the gamma-BHC-resistant sheep body lice, and when used in late winter will provide protection against re-infestation for at least 20 weeks. However, the dippings reported here are abnormal in that sheep are usually dipped in the autumn and not in the later winter months, and confirmation of the

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The Effect of Slow and Quick-release Preparations of Penicillin against *Streptococcus agalactiae* Infection

BY

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SUMMARY.—A trial comparing the therapeutic effect of a quick-release and a slow-release penicillin preparation against *Streptococcus agalactiae* infections of the bovine udder is reported. Four hundred and sixty-six infected quarters were included in the trial. The cure rate of the quick-release preparation was 74 per cent. with 50,000 U., 83 per cent. with 100,000 U. and 85 per cent. with 300,000 U. The cure rate using the slow-release preparation was 86 per cent. with 25,000 U., 88 per cent. with 50,000 U. and 95.5 per cent. with 100,000 U.

The problem of penicillin residues after treatment with slow-release preparations of penicillin is discussed. It is suggested that when maximum therapeutic effect is required multiple doses of a quick-release preparation have no advantage over a single dose of a slow-release preparation, provided the time of excretion of the slow-release preparation is approximately six days.

A strain of *Str. agalactiae* negative to the CAMP test and infecting 45 quarters in a herd of 60 cows is recorded.

Introduction

THE eradication of *Streptococcus agalactiae* by bacteriological examination and treatment of infected quarters is an important part of mastitis control in many countries (Anon, 1954; Roberts *et al.*, 1963; Klastrup, 1963). After years of misunderstanding, the validity of eradication of this organism from dairy herds has been established in Australia (Frost & Sanderson, 1965). Following bacteriological diagnosis, it is desirable to have a method of treatment which will give a cure rate as close to 100 per cent. as possible (Wilson, 1952), and the number of visits to a farm is minimised by using a preparation highly effective as a single dose. It has been suggested that a single dose of a quick-release preparation gives a similar rate of cure to a slow-release preparation against *Str. agalactiae* infections (Anon, 1965).

This paper describes a trial comparing the therapeutic effect of a slow-release and a quick-release preparation of penicillin. The trial was carried out on commercial dairy herds in the Brisbane and Laidley districts of S.E. Queensland.

Materials and Methods

Penicillin Preparations

The quick-release preparation consisted of procaine penicillin G in a vegetable oil base.* Dosages of 50,000 U., 100,000 U. and 300,000 U. were used. The slow-release preparation consisted of procaine penicillin G in a mineral oil base containing 3 per cent. aluminium monostearate.† Dosages of 25,000 U., 50,000 U. and 100,000 U. were used. All preparations were dispensed in single-dose tubes for intramammary infusion.

Bacteriology

Separate quarter samples were collected at the afternoon milking and each sample was seeded onto a quadrant of a 5 per cent. sheep blood agar plate. Samples were plated out either within a few hours of sampling, or were held overnight at 4° C. *Str. agalactiae* was identified by the CAMP reaction (Christie, Atkins & Munch-Peterson, 1944), on ferric citrate-aesculin blood agar plates (Murphy, Stuart & Reed, 1952), CAMP-positive, aesculin-negative colonies were regarded as *Str. agalactiae*. CAMP-negative, aesculin-negative colonies were submitted to the HAA test (Slavin, 1948) and other biochemical tests. Quarters showing more than 1,000 *Str. agalactiae* colonies per ml. were regarded as infected for the purposes of the trial.

Treatment

Infected quarters were treated on the second afternoon after sampling. Each consecutive cow was treated with a different penicillin preparation. Where more than one quarter in a cow was infected the same preparation was used in each infected quarter.

Post-treatment Sampling

A final sample was taken 19 to 24 days after treatment. Samples were incubated overnight at 37° C. and seeded onto a modified Edwards medium (Wilson & Slavin, 1950). Plates were read at 24 to 48 hours. The isolation of a single *Str. agalactiae* colony from a treated quarter was

* Mylipen Q.R. Cerate: Glaxo-Allenburys Pty. Ltd.
† Vetspen Cerate: Glaxo-Allenburys Pty. Ltd.

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protection period when used in the autumn will be the subject of future work.

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