

AN EVALUATION OF THE ACARICIDAL PROPERTIES OF ALDRIN AND DIELDRIN FOR THE CONTROL OF SHEEP SCAB.

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Of the already very impressive list of new synthetic insecticides which possess marked insecticidal properties the gamma isomer of B.H.C. alone appears to be the acaricide of choice for the control of psoroptic scab in livestock. Not only does its pronounced acaricidal action influence this choice but, in addition, the fact that it possesses a low degree of toxicity to warm-blooded animals. B.H.C. has been accepted in England as being capable of effecting the cure of sheep scab (*Psoroptes communis ovis*, Railliet) by a single thorough dipping at a concentration of 125 p.p.m. of the gamma isomer (Downing 1947).

It has been shown that many of the chlorinated hydrocarbon insecticides, like D.D.T., Methoxychlor, Toxaphene, Chlordane and B.H.C. behave differently in the fleece of merino sheep (du Toit and Fiedler, 1953). D.D.T. and the compounds related to it tend to remain localised in the portion of the fleece originally treated and do not diffuse along the wool fibres into the new growth of wool. Toxaphene, Chlordane and especially B.H.C., on the other hand, readily diffuse along the growing wool fibres and so impregnate at skin level the ever-increasing untreated zone of new-growth wool rendering it parasite-proof for considerable periods.

Two of the more recently developed synthetic insecticides viz., Dieldrin and Aldrin, have been found to possess this property of diffusing along the wool fibres to a degree equal to or even greater than B.H.C. As B.H.C., Dieldrin and Aldrin of all the compounds tested show this property of diffusion to the greatest extent it was considered advisable to investigate their action upon sheep scab in order to determine the degree to which protective action could assist in the control of this disease by means of a single immersion of infected animals in suitable concentrations of the compounds.

Small groups of from three to four Merino sheep showing different degrees of severe infestations with scab were subjected to dipping tests with Aldrin and Dieldrin at Onderstepoort. For the sake of comparison one group of three sheep was dipped in B.H.C.

The test sheep were selected from a small flock at the institute in which psoroptic scab has been maintained for many years. All the animals selected were heavily infested. In some cases extensive areas of skin denuded of wool were present on which scab formation was very far advanced. In those animals which had retained the infection for a year or more the skin was thickened and thrown into folds with severe crust-formation apparent over the greater portion of the body. None of the animals had been shorn since their introduction into the isolation camp where they were kept with the result that in most cases the wool had a length of several inches, where it had not fallen out, and was felted to a degree where it formed a compact mass over most of the body.

Dipping was performed in a small metal tank of 40 gallons capacity in which the individual sheep were held under the fluid for two to four minutes, care being taken to plunge the heads under the fluid three or four times in each case during dipping. Each group was kept in a separate pen, the pens being isolated from each other, and observed over a period of several months. In that it was not always possible to demonstrate the presence of living mites in animals which retained the infection, observations were continued until the animals had either regained normal health and appearance or the infection showed signs of spreading and mites could again be demonstrated.

FIRST TEST.

Dieldrin wettable powder at a concentration of 0.05 per cent of the active ingredient. Group of three sheep (A, B, C).

Sheep A had been infested for a period of one year and seven months and had not been shorn throughout. The fleece was extremely irregular with wool fibres up to 6 inches in length. Extensive felting had occurred and the felted portions of the fleece contained a large amount of skin detritus. The other two sheep (B and C) showed an infection three months old with extensive crust formation over the greater portion of the body. The wool had a length of approximately $1\frac{1}{2}$ inches.

Observations.

Nothing but dead mites could be found on all three sheep one week after treatment. All signs of skin irritation, as evidenced by complete cessation of biting and scratching, had disappeared at this and the following weekly inspections. The crusts covering the lesions commenced lifting three weeks after dipping and the skin became soft and pliable again after an additional three weeks. At the end of twelve weeks the wool appeared to be growing normally again but the wool fibres showed a break over those parts which had been most severely affected. The condition of the animals improved rapidly after dipping and they remained in good health until they were discharged at the end of eleven months.

SECOND TEST.

Aldrin wettable powder at a concentration of 0.05 per cent of the active ingredient. Group of three sheep (D, E, F).

Sheep D showed a very old scab infestation of three years and three months and had not been shorn throughout this period. In many parts the wool had disappeared initially and had grown again but some areas showed wool of eleven inches in length with considerable felting and matting. Sheep E and F had a three months old infection with well developed and extensive scab formation. The wool length was about $1\frac{1}{2}$ inches.

Observations.

Living mites were found on all three animals two days after dipping and it was possible to demonstrate living mites at every inspection on sheep D and E. It is doubtful whether sheep F was ever free of living mites although it was not possible to find them. A second dipping became necessary twelve weeks later.

In the case of sheep D with the old infection, slight improvement only occurred after three weeks. At the end of six weeks the skin was still hard and thickened over the greater part of the body and copious secretion of lymph was

still occurring. Twelve weeks after treatment a few small areas of the skin appeared to have returned to normal but the greater portion of the body remained unchanged. Disturbance of the wool due to biting was present on both sides indicating that the infection was still present. Sheep E showed a general improvement after six weeks and the skin became soft and pliable except for a few small areas on the rump and brisket which failed to clear up and on which living mites could be found. These foci remained localised but irritation persisted as could be noted by the biting and rubbing on the part of the animal which did not cease. The skin of sheep F commenced to clear after six weeks and skin irritation subsided nor was it possible to find living mites. Although the mesh wire fence surrounding the pen was cleaned, locks of wool rubbed off by animals and adhering between the wire strands were always present indicating the attempts made by the animals to allay the irritation caused by the scab mites which had persisted.

THIRD TEST.

Aldrin emulsifiable concentrate at a strength of 0.05 per cent of the active ingredient. Group of four sheep (D, E, F, G).

This test comprised the three sheep from the previous test which the treatment with Aldrin wettable powder had failed to cure, together with an additional sheep G. Sheep G. had been infected with scab four years previously. Prior to its inclusion in this test its wool was shorn off as far as its felted condition and the wrinkled skin permitted. With the exception of sheep D which had patches of very long wool the fleece length of the group varied between $\frac{3}{4}$ and $2\frac{1}{4}$ inches.

Dipping was conducted twelve weeks after the previous dipping in the Aldrin wettable powder.

Observations.

A general improvement was apparent in all four animals three weeks after treatment. The skins became pliable again and signs of biting and scratching were no longer evident. The hard crusts commenced to lift and this improvement was maintained during several subsequent inspections when it was observed that the wool seemed to be growing normally again. Nine weeks after dipping, however, a clearly defined scab focus 2" x 1" in size was found on the right side of sheep D. The skin over this lesion was hard and crusty and living mites could be demonstrated in scrapings of the skin. The lesion increased rapidly and after twenty-one weeks a large area on the right side showed active infection whereas the remainder of the group (E, F and G) showed no sign of irritation at this stage.

To note whether the improvement shown by sheep E would be maintained this sheep was placed amongst a group of scab free sheep. No further signs of any irritation became apparent during the ensuing three months indicating that Aldrin in emulsion form had cured the infection, and it was then discharged from the experiment.

An uninfested new sheep (H) was introduced into the group D, F, G twenty-three weeks after they had been dipped in order to give a better indication of any dispersion of the infection from the potential carrier D.

Nine weeks later all four animals now comprising the group (D, F, G, H) showed fairly extensive lesions with living mites situated at the shoulders, thoracic wall and rump region. The infection had obviously originated from sheep D which had retained living mites throughout and which, at this stage, showed scab lesions dispersed over the entire body including the neck, cheeks and base of ears where the skin was again hard and crusty.

It was decided to dip this group for a third time.

FOURTH TEST.

Dieldrin wettable powder at a concentration of 0.03 per cent of the active ingredient. Group of four sheep (D, F, G, H).

At the time of dipping the length of wool of the group varied from 2 to 4 inches.

Observations.

Skin irritation subsided immediately after dipping. All biting and scratching ceased and no mites could be found at all subsequent inspections. The skin of the badly infested sheep D became soft and pliable and the wool commenced growing normally again after four weeks. All four sheep showed a similar improvement, the hard crusts disappeared and the skin and wool growth appeared normal after a short time. No further signs of irritation were observed during the following weeks and the entire group could be regarded as cured when they were discharged in very good condition five months after treatment in 0.03 per cent Dieldrin.

FIFTH TEST.

B.H.C. wettable powder at a concentration of 0.02 per cent of the gamma isomer. Group of three sheep (I, J, K).

The scab infection on sheep I was two years and seven months old and the fleece which had a length of two to three inches was extremely irregular and matted over extensive areas of the body. Sheep J and K were infected eleven months previously and the wool was about one inch long due to mechanical removal in patches by biting, scratching and rubbing. The skins of all three animals were thickened and covered with crusted areas over most of the body surface including the faces and ears.

Observations.

A marked improvement in the general condition of the animals was noted shortly after dipping in spite of the fact that they were exposed to 3.03 inches of rain during the first six days following treatment. All signs of irritation ceased and no living mites were demonstrable at subsequent inspections. After four weeks the scabs commenced lifting together with patches of old wool in many places leaving the skin soft and pliable beneath which new wool commenced growing. General improvement continued and sixteen weeks after treatment the sheep could be regarded as cured and perfectly normal again.

DISCUSSION.

The three insecticides under test were employed in the following formulations and at the following strengths:—

- Aldrin—Wettable powder at 0·05 per cent active ingredient,
- Aldrin—Emulsifiable concentrate at 0·05 per cent active ingredient,
- Dieldrin—Wettable powder at 0·05 per cent active ingredient,
- Dieldrin—Wettable powder at 0·03 per cent active ingredient,
- B.H.C.—Wettable powder at 0·02 per cent gamma.

The suspensions obtained with the three insecticides varied considerably in quality. The B.H.C. wettable powder readily formed a good uniform suspension whereas vigorous stirring was required to disperse the Dieldrin in water although fairly good suspensibility resulted ultimately. The suspension obtained with the Aldrin wettable powder was poor, the particles being coarse and tending to settle out rapidly so that constant agitation was necessary throughout the process of dipping. In the case of the emulsifiable concentrate of Aldrin premixing in a small quantity of water was resorted to and the resultant creamy emulsion further diluted with the appropriate volume of water to give a uniform emulsion which remained stable throughout the dipping process.

A fresh bath of insecticide was prepared for each test and cold tap water as diluent was used throughout.

Each experimental group contained one sheep with a very old scab infection showing very advanced affection of the skin. The remaining animals had been infected three to eleven months previously and showed well-advanced lesions. The old cases were included with the object of placing as heavy a burden of curing the infection as possible upon the particular insecticide.

Aldrin in the wettable powder form at a strength of 0·05 per cent of the active ingredient was unable to effect a complete cure in heavily infested cases. The infection was considerably reduced however, but patches of active infection remained in all cases giving the impression that the acaricide, by virtue of its physical state, had not penetrated the places in which the mites were concealed to make proper contact in all cases. In the form of a uniform emulsion a greater degree of effectiveness was displayed but here again Aldrin failed to effect complete cure of grossly infected animals.

Although possessing excellent powers of diffusion along wool fibres as demonstrated in experimental work on blowflies (du Toit and Fiedler 1953) and remaining active in wool for long periods Aldrin appears to be a less effective acaricide for psoroptic mites than either Dieldrin or B.H.C.

Dieldrin in wettable powder form at 0·05 per cent or 0·03 per cent of the active ingredient was successful in effecting a cure of scab in all cases with a single dipping. This compound possesses an extremely rapid toxic action upon psoroptic mites and its powers of penetrating situations in which the mites might be partially protected appear to be excellent. All traces of irritation subside immediately after treatment.

The B.H.C. wettable powder at 0·02 per cent of the gamma isomer behaved in the same way as Dieldrin and effected complete and instant eradication of all mites present in a single dipping.

CONCLUSIONS.

It may be concluded from the experiments conducted which, though on a small scale, nevertheless represent a severe test of the insecticides used, that Dieldrin is an extremely potent and quick-acting acaricide. Against *Psoroptes communis ovis* it is able to control sheep scab with a single dipping at a concentration of 0·03 per cent of the active ingredient. Its acaricidal action at this strength is comparable to that of gamma B.H.C. at 0·02 per cent. Aldrin in wettable powder or emulsion form, at a concentration of 0·05 per cent of the active ingredient must be regarded as not being sufficiently effective to eradicate scab with a single treatment.

LITERATURE.

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