

STUDIES ON SPECIFIC OCULO-VASCULAR MYIASIS (UITPEULOOG) OF DOMESTIC ANIMALS: IV. CHEMOTHERAPY

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INTRODUCTION

The promising results obtained with certain organic phosphorus compounds such as Dow-ET-14 and Dow-ET-57 against *Hypoderma* sp. (McGregor, Radeleff & Bushland, 1954; McGregor & Bushland, 1957; Adkins, 1957; Roth & Gaines, 1957), indicated the possible use of these systemic insecticides for the treatment of specific oculo-vascular myiasis (Basson, 1962). The heavy losses sustained by the farmers in the Kalahari area of South West Africa further prompted and necessitated these studies.

MATERIALS AND METHODS

As an adequate number of cases could not be produced artificially, the trials had to be conducted during natural outbreaks. The unpredictable occurrence and nature of the disease necessitated the use of animals on more than one farm. Some of these farms were up to 100 miles apart and the bad roads, as well as other duties, made personal daily supervision impossible. Experimental treatment, therefore, had to be undertaken in co-operation with the farmers.

Sheep were used as the highest incidence and mortality occurs in this species. Affected animals were marked for identification and separated from the rest of the flock after treatment.

The following series of studies was undertaken.

Systemic treatment with insecticides

(a) Initial pilot experiments were conducted on two farms, where a total of 195 cases in various stages of the disease was dosed with Dow-ET-57* or Dow-ET-14* (0, 0-dimethyl 0-2, 4, 5-trichlorophenyl phosphorothioate). These are the names given to different technical grades of the same chemical and henceforth will be used synonymously. A 5 per cent aqueous suspension was prepared and 80 to 200 mg/Kg of the active ingredient dosed after predosing with 4 ml of 10 per cent copper sulphate solution. All sheep that died after treatment were autopsied and carefully examined for *Gedoelestia* larvae.

* Dow Chemical Co., Michigan

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(b) Studies were undertaken on several farms where treatment was mainly, but not exclusively, confined to cases in the early stages of the disease. The flocks on each farm were closely inspected once or twice daily for the initial symptoms of the disease such as ocular swelling, exophthalmia and ocular haemorrhages. Affected animals were divided at random into several groups and subjected to treatment with the insecticides listed hereunder. Usually one group was left as controls. However, some of these control groups were treated later by the farmers with Neguvon-A and consequently had to be disregarded as controls. As a result other farms then had to be selected for control studies only. The absence of either controls or treated groups on certain farms was therefore inevitable.

The following insecticides were selected for study:—

- (i) Dow-ET-57* (Nankor 25W, Korlan 25W, Nankor 44E, Nankor 8 and Trolene bolusses) at 80–250 mg/Kg.
- (ii) Ruelene 25W* (4-tert-butyl-2-chlorophenyl methyl methylphosphoramidate) at 45 mg/Kg.
- (iii) Neguvon 95 per cent† (dimethyl-hydroxy-trichloroethylphosphonate) at 50–62 mg/Kg.
- (iv) Dazfli‡, 40 per cent diazinon wettable powder [0, 0-diethyl 0-(2-isopropyl-4-methyl-6-pyrimidinyl) phosphorothiate] at 55 mg/Kg.

All these insecticides were prepared in aqueous suspensions or emulsions and administered as a drench at the indicated levels, after predosing with 4 to 8 ml of a 5 to 10 per cent copper sulphate solution. Adult sheep received 60 ml and younger sheep a volume in direct proportion to their weight. Nankor 8 was given either intramuscularly or subcutaneously (8 ml per 100 lb).

Some of the farmers applied local treatment to the eyes. Aureomycin and Neomycin were used on Corridor-12, silver nitrate solutions on Swerweling and various remedies intermittently on the other farms. Nankor ointments (1, 3 and 5 per cent)§ were applied experimentally on some sheep on Corridor-12 and Corridor-20. The early encephalitic cases on Corridor-12 were in addition dosed with Aureomycin soluble (Cyanimid) (6 mg/Kg) for two successive days after predosing with 5 per cent copper sulphate solution.

All animals that became blind or died were recorded. Whenever possible, autopsies were made on the latter and the carcasses carefully checked for dipterous larvae. Those that survived were subjected to a final examination after three months.

Systemic prophylactic trials

These were undertaken during outbreaks on six different farms. Dow-ET-57 and Neguvon were selected and methods and levels of dosing similar to those used previously were employed. A total of 434 unaffected sheep was dosed with Dow-ET-57, 250 with Neguvon and 1,857 kept as controls. These animals were inspected daily for three weeks and the numbers that contracted the disease were recorded. All the affected sheep were re-examined after five weeks.

* Dow Chemical Co., Michigan

† Agro-Chem. (Pty.), Ltd., Johannesburg

‡ Klipfontein Organic Products Cooperation, Johannesburg

§ Nicholas Products (Pty.), Ltd.

RESULTS

Systemic treatment

The evaluation of the therapeutic trials was mainly based on the mortality, the number of encephalitic cases developing from the ophthalmic cases after treatment and the number of sheep that eventually became blind. The mortality rate in the encephalitic cases which were treated was also taken into consideration. All these findings are summarized in Tables 1 to 4. In these tables no distinction is made between the various forms of Dow-ET-57 that were used.

The mortality rate was reduced substantially by Dow-ET-57, Ruelene and Neguvon, in this order of efficacy, but with no real significant difference between Dow-ET-57 and Ruelene. It should, however, be taken into account that a comparatively small number of animals was used for treatment with Ruelene. There was no appreciable variation in the efficacy of the dosing range with Dow-ET-57 which seemed equally effective at both 80 mg and 250 mg/Kg.

The most practical form of Dow-ET-57 proved to be the wettable powder (Nankor 25W and Korlan 25W). It was easy to handle and prepare as a drench. Trolene bolusses on the other hand were safe even at 250 mg/Kg, but, having been prepared for cattle, were too large for sheep and had to be powdered before dosing. Nankor 44E was very effective, but produced signs of intoxication (at 180 to 220 mg/Kg) in three flocks. Affected animals became seriously bloated, uneasy, listless and showed nibbling movements. No mortality, however, was recorded. Nankor 8 was only used to a limited extent. It proved effective but unsuitable because of the irritation, swelling and lameness which developed after intramuscular administration. The lameness usually disappeared after three to four days. Subcutaneous injections produced similar swellings without serious lameness. The Nankor ointments were only obtained towards the end of an outbreak and could be used locally in the eyes of only a small number of animals. It gave indications of some beneficial effect, preventing desiccation of the eyes and causing no irritation.

Gedoesia larvae were either absent or dead in all the treated animals that were autopsied after death. Many of the control sheep died even up to 30 days after onset of the disease.

Chemoprophylaxis

The results of the prophylactic trials were very unsatisfactory, because of the decline in the number of new outbreaks after dosing. Mild ophthalmic cases were still encountered in the treated groups one to three days after treatment with both insecticides. One encephalitic case was encountered after two weeks in a group treated at a level of 250 mg/Kg Dow-ET-57, one on the tenth day at 80 mg/Kg Dow-ET-57 and another case after seven days in a group dosed with Neguvon. Mortalities occurred in the Neguvon groups after eight days and in the controls at any time from the second day onwards. No fatal cases were found in the Dow-ET-57 groups. Serious ophthalmic lesions were seen after one to eleven days on one farm in a group dosed with 80 mg/Kg Dow-ET-57. Two of these cases ultimately became completely blind and another two lost their sight in one eye.

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DISCUSSION

The shortcomings in these therapeutic trials that were attempted under extremely difficult field circumstances on a disease with an unpredictable duration are self-evident. They nevertheless proved that the organic phosphorus compounds, by reducing the mortality from 35 per cent to about 4 per cent and blindness from 65 per cent to 16 per cent, have a definite larvicidal action against first stage *Gedophilus* larvae. The success of the experiments further appeared to depend mainly on prompt treatment after an early diagnosis before serious damage had been caused to the cardiovascular system, brain or eyes. In order to achieve this, careful inspection of the flocks at least once and preferably twice daily was absolutely essential.

Dow-ET-57 seemed to be the safest and most effective systemic insecticide. This safety factor is most important when it is considered that affected animals can be reinfested by the flies at any time and that such cases would subsequently require further treatment.

The development of encephalitic cases in the systemic chemoprophylactic trials indicated that the disease could not be effectively controlled by a single dose of Dow-ET-57 for a period longer than two weeks. This period of protection was even shorter after Neguvon administration. In view of the sharp decline in natural outbreaks in control groups and flocks after the commencement of the experiment, it is evident that the period of chemoprophylactic efficacy could have been shorter than two weeks. The results up to date, however, suggest that repeated prophylactic dosing with Dow-ET-57 at either low or high levels could be of value in controlling the disease during "uitpeuloog" seasons. This evidently would be the most ideal method of control.

SUMMARY

Details of chemotherapeutic and chemoprophylactic trials with systemic organic phosphorus compounds on specific oculo-vascular myiasis under field conditions are given. The results proved encouraging and showed that Dow-ET-57, Ruelene and Neguvon, in this order of efficacy, have definite larvicidal actions against the causal *Gedophilus* larvae. The mortality as well as the incidence of blindness were reduced notably by all three insecticides.

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TABLE 1.—Treatment in pilot experiment

Farm	Insecticide	Animals treated			New E.F.s after treatment	Mortality
		Total	E.F.	O.F.		
Corridor-20.....	Dow-ET-57	131	12	119	1 (recovered)	5 (4%)
Corridor-12.....	Dow-ET-57	64	9	55	—	2 (3%)
	TOTAL.....	195	21	174	1	7 (3.6%)

E.F. = encephalitic form

O.F. = ophthalmic form

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TABLE 2.—Treatment

Farm	Dow-ET-57 (80-250 mg/Kg)				Ruelene (45 mg/Kg)				Neguvon (50-62 mg/Kg)							
	Ophthalmic cases treated		Enceph. cases treated		Ophthalmic cases treated		Enceph. cases treated		Ophthalmic cases treated		Enceph. cases treated					
	Total	Devel- oping E.F.	Total	Mort.	Total	Devel- oping E.F.	Total	Mort.	Total	Devel- oping E.F.	Total	Mort.				
Corridor-12.....	63	—	10	—	8	1	—	1	7	1	46	1	15	1	4	2
Corridor-20.....	11	—	3	—	28	5	—	—	—	—	46	1	15	1	1	1
Uitspan.....	14	—	3	1	1	—	—	—	11	2	7	—	1	1	2	1
Swerweling.....	—	—	—	—	—	—	—	—	—	—	19	—	7	—	—	—
Various.....	10	—	—	—	12	1	—	—	—	—	—	—	—	—	—	—
TOTAL.....	98	—	16 (16%)	1 (1%)	49	7 (14%)	—	14 (25%)	55	—	14 (25%)	0% (0%)	18 (16.6%)	38 (32%)	3 (2.5%)	7 (57%)

Enceph., = Encephalitic Mort. = Mortality Developing E.F. = Encephalitic cases developing after treatment Blind. = Total number becoming blind after treatment. Most of these animals were only affected unilaterally

TABLE 3.—*Treatment*

	Number of cases	Mortality %			Blindness %	Developing E. cases after treatment %
		From treated O. cases	From treated E. cases	Total		
Dow-ET-57.	147	1	14	5	16	0
Ruelene....	73	0	17	4	25	0
Neguvon....	125	2.5	57	6	32	2
Dazfli.....	58	14		14	50	3
Controls....	399			35	65	

O. cases = Ophthalmic cases
E. cases = Encephalitic cases

TABLE 4.—*Controls*

Farm	Total	Blind			Mortality		
		Un.	Bil.	Total	E.F.	C.F.	Total
1. Swerweling...	75	34	2	36 (68%)	5	17	22 (27%) Eyes treated with silver nitrate
2. Lendepas....	184	58	21	79 (64%)			61 (33%) Eyes treated with various remedies
3. Uitspan.....	84						30 (35%)
4. Navarre.....	56						27 (48%)
TOTAL.....	399						140 (35%)

Un. = Unilateral
Bil. = Bilateral
E.F. = Encephalitic form
C.F. = Cardiac form

128 of the sick sheep on Lendepas were at one stage dosed with Neguvon-A