

# FIELD TRIALS OF MOLLUSCICIDE ( WL 8008 ) IN DEZFUL BILHARZIASIS CONTROL PROJECT AREA, KHUZESTAN, IRAN\*

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**ABSTRACT** Field trials of molluscicide WL8008 (N-tritylmorpholine) were carried out in Khuzestan, Iran. The liquid 2 (FX/28), a 16.5 w/v emulsifiable concentrate in tetrachloroethylene in concentrations of 0.25 ppm and 0.5 ppm was used against *Bulinus truncatus* and *Lymnaea gedrosiana* in standing and running water systems. Bio-assay tests and laboratory experiments were made parallel to the field trials.

Only a few of the *B. truncatus* were affected by 0.25 ppm of N-tritylmorpholine, but *L. gedrosiana* proved to be more susceptible to the chemical and an almost complete kill of *L. gedrosiana* was achieved.

A concentration of 0.5 ppm completely killed both *B. truncatus* and *L. gedrosiana*, but had no effect on egg-masses. N-tritylmorpholine may play an important part in future snail control projects, particularly on *Lymnaea* snails.

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**INTRODUCTION** The use of molluscicides will remain the most effective method of interrupting the transmission of schistosomiasis. Field trials to determine the preferred molluscicide from the stand-point of efficacy, ease of handling and comparatively low cost of application are necessary. The search for better molluscicides continues and commercial organizations have recently shown an increasing interest in developing them. Limited quantities of WL8008 (Shell Chemical Company) became available and field trials were subsequently arranged to test its efficacy under local conditions in Khuzestan, Iran, where the intermediate host of *S. haematobium* and *S. bovis* is *Bulinus truncatus* and the intermediate host of *Ornithobilharzia tarkestanicum* and *Fasciola gigantica* is *Lymnaea gedrosiana*, which occurs in a variety of habitats (2,3,7,8).

**MATERIAL AND METHODS** WL8008 (N-tritylmorpholine), the Shell trade-name of which is "Frescon", is produced in different formulations of which the liquid 2(FX/28), a 16.5% w/v emulsifiable concentrate in tetrachloroethylene, was used.

#### *Water courses*

The choice of water courses for these trials was governed by the following conditions: (1) an adequate density of *B. truncatus* and *L. gedrosiana* and (2) a sufficient volume of water-flow to carry the chemical along the entire length of the canal during the planned contact period. For these purposes 2 canals and 2 ponds were treated with 0.25 and 0.5 ppm of molluscicide and one canal and one pond were kept as controls.

#### *Methods of application*

Liquid WL8008 was mixed with canal water in 200 litre drums to achieve the desired concentration. The drum was placed at the head of the trial canal and the contents were stirred from time to time to ensure that the concentration of the compound was the same throughout. The chemical was discharged into the canal through an outlet valve at the base of the drum. For the ponds, a motor-operated dispenser was used and the chemical solution was sprayed evenly over the ponds.

#### *Sampling procedure*

To determine snail densities, the drag deep net was used in both pre-treatment and post-treatment surveys. Samples were taken at fixed places in ponds and in canals 200 meters and 1000

meters below the application point. The survey was continued monthly for up to 8-9 months after application.

#### *Bio-assay tests*

Bio-assay tests were made by immersing 100 freshly collected field snails (50 *B. truncatus* and 50 *L. gedrosiana*), placed in wire bags, into the canals during the period of treatment.

Some tests were also carried out in the laboratory on the initial molluscicide effect of WL8008 in clean water and in the presence of mud on *B. truncatus* and *L. gedrosiana*.

**CONCLUSION** Pre-treatment densities were determined one day before the application of the chemical and a post-treatment survey was conducted one day after treatment and was repeated at monthly intervals for 8-9 months. The results, given Tables 1 and 2, indicate that in the canal treated with 0.25 ppm of Frescon, one day after treatment *Bulinus truncatus* were partially killed and no live *Lymnaea gedrosiana* reappeared after one month. In the canal treated with 0.5 ppm of the chemical, no live *B. truncatus* were found for 3 months but the canal was free of *L. gedrosiana* for only one month, after which it seems that live *L. gedrosiana* were introduced from up-stream. Frescon had no effect on egg-masses and out of 248 *Lymnaea* eggs exposed to the chemical, 218 eggs developed into young snails.

Two ponds were treated with 0.25 ppm and 0.5 ppm by the motor pump spraying method. The results given in Tables 3 and 4 indicate that 0.25 ppm partially killed *B. truncatus* but a complete kill of *L. gedrosiana* was achieved. A concentration of 0.5 ppm completely killed both *B. truncatus* and *L. gedrosiana*. *L. gedrosiana* reappeared in the ponds two months after treatment.

Laboratory tests as given in Table 5 indicate that the effect of 0.25 ppm of chemical in the presence of mud on *B. truncatus* was poor and after 16 hours exposure some snails were still alive; however, 0.5 ppm killed all *B. truncatus* after 8 hours exposure. The effect of Frescon on *L. gedrosiana* under laboratory conditions, as given in Table 6, indicates that this snail is very susceptible to Frescon and no live *L. gedrosiana* were found during the 2nd hour of exposure. The results of bio-assay test are given in Table 7. It is clear that exposure to 0.25 ppm of Frescon was not enough to kill all *B. truncatus*, but it did completely kill *L. gedrosiana*. A complete kill of *B. truncatus* was achieved with 0.5 ppm.

The effect of the chemical diminished one kilometer downstream toward the end of the canal. The chemical seems to have

settled in the mud down-stream and become ineffective; our laboratory experiments in the presence of mud also support this idea. This has also been observed by Davood and Dazo (5). Crossland (4) reported that a concentration of 0.025 ppm of N-tritylmorpholine produced a 100% kill of *Biomphalaria pfeifferi* within 2-3 days. Fenwick (6) showed similar results working in the same area. Amin (1), using 0.025 ppm for 30 days in Sudan in running waters, reported that *Biomphalaria* were more susceptible to Frescon than were *Bulinus*. In the present study, a few of the *B. truncatus* were affected by 0.25 ppm of N-tritylmorpholine, but *L. gedrosiana* were more susceptible to the chemical than *B. truncatus*. In this respect we agree with Amin (1) that the activity of N-tritylmorpholine differs according to the snail genus and species. It is concluded that N-tritylmorpholine may play an important part in future snail control projects, particularly on *Lymnaea* snails.

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TABLE 1

Snail Population Densities in Salarabad Canal No. 1  
treated with WL8008 Concentration 0.25 ppm \*

Date of Study	<u>Bulinus truncatus</u>				<u>Lymnaea gedrosiana</u>			
	First Part (200 <sup>m</sup> )		End Part (1. km)		First Part (200 <sup>m</sup> )		End Part (1. km)	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead
2 Aug. 1967	60	0	0	0	100	0	8	0
3 Aug. 1967	Treatment with WL8008 concentration 0.25 ppm							
4 Aug. 1967	20	43	0	0	0	50	0	10
4 Sept. "	182	3	53	2	27	2	42	2
4 Oct. "	80	2	55	1	10	3	27	0
4 Nov. "	180	0	54	0	32	2	77	0
4 Dec. "	84	0	165	1	44	8	166	7
4 Jan. 1968	109	3	311	1	45	7	10	4
4 Feb. "	68	0	87	0	22	0	9	9
4 March "	23	0	32	0	4	0	14	0
4 April "								

\* Snail populations are per 10 scoops in 200 metres and 1. Kilometre below the place of application.

TABLE 2

Snail Population Densities in Salarabad Canal No. 2  
treated with WL8008 Concentration 0.5 ppm \*

Date of Study	<u>Bulinus truncatus</u>				<u>Lymnaea gedrosiana</u>			
	First Part (200 <sup>m</sup> )		End Part (1. km)		First Part (200 <sup>m</sup> )		End Part (1. km)	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead
12 Aug. 1967	0	0	7	0	210	0	850	0
13 Aug. 1967	Treatment with WL8008 concentration 0.5 ppm							
14 Aug. 1967	0	0	0	6	0	47	0	98
14 Sept. "	0	0	0	1	0	15	0	23
14 Oct. "	0	0	0	0	3	5	1	21
14 Nov. "	0	0	3	0	22	4	5	2
14 Dec. "	2	0	12	1	38	2	39	4
14 Jan. 1968	1	0	4	0	17	2	11	2
14 Feb. "	0	0	0	0	4	3	1	9
14 March "	0	0	1	0	4	7	2	0
14 April "								

\* Snail populations are per 10 scoops in 200 metres and 1. kilometre below the place of application.

TABLE 3

Snail Population Densities in a Pond treated with  
WL8008 (Frescon) Concentration 0.5 ppm in Salarabad \*

Date of Study	<u>Bulinus truncatus</u>			<u>Lymnaea gedrosiana</u>		
	Live	Dead	Egg Masses	Live	Dead	Egg Masses
30 July 1967	135	0	10	152	0	20
31 July 1967	Treatment with WL8008 concentration 0.5 ppm					
1 Aug. 1967	0	145	5	0	70	12
1 Sept. "	0	12	0	0	10	0
1 Oct. "	0	11	0	2	10	0
1 Nov. "	0	7	0	4	7	0
1 Dec. "	0	12	0	2	5	2
1 Jan. 1968	0	4	0	2	5	11
1 Feb. "	0	6	0	4	8	0
1 March "	0	7	0	2	19	1
1 April "	0	2	0	21	2	5
1 May "	0	6	0	91	4	3
1 June "	1	6	0	120	8	4
1 July "	3	4	0	125	3	0

\* Snail populations are per 10 scoops.



TABLE 4

Snail Population Densities in a Pond treated with WL8008 (Frescon) Concentration 0.25 ppm in Bayatian \*

Date of Study	<u>Bulinus truncatus</u>			<u>Lymnaea gedrosiana</u>		
	Live	Dead	Egg Masses	Live	Dead	Egg Masses
25 July 1967	90	0	5	110	0	10
26 July 1967	Treatment with WL8008 concentration 0.25 ppm					
27 July 1967	45	47	4	0	117	7
27 Aug. "	40	10	0	0	16	0
27 Sept. "	32	2	23	2	0	0
27 Oct. "	171	3	7	25	2	0
27 Nov. "	147	5	18	43	2	5
27 Dec. "	362	3	2	14	4	8
27 Jan. 1968	210	0	4	16	1	0
27 Feb. "	185	7	8	3	4	0
27 March "	85	9	1	2	3	0
27 April "						

\* Snail populations are per 10 scoops .

TABLE 5

Initial Effect of WL8008 on Bulinus truncatus with concentrations of 0.5 ppm and 0.25 ppm in clean and turbid water in the laboratory

Exposure Time (hours)	Mortality (%) of 10 <u>B. truncatus</u> at an initial concentration of 0.50 ppm and 0.25 ppm			
	Clean Water		Presence of Mud	
	0.25 ppm	0.5 ppm	0.25 ppm	0.5 ppm
2	8/10	10/10	8/10	5/10
4	1/10	1/10	4/10	3/10
6	4/10	1/10	8/10	1/10
8	0/10	0/10	6/10	3/10
10	0/10	0/10	6/10	0/10
12	0/10	0/10	7/10	0/10
14	0/10	0/10	6/10	0/10
16	0/10	0/10	1/10	0/10
18	0/10	0/10	0/10	0/10
20	0/10	0/10	0/10	0/10
24	0/10	0/10	0/10	0/10

(%) No. of live snails / No. of snails exposed.

TABLE 6

Initial Molluscicidal Effect of WL8008 (Frescon) on Lymnaea gedrosiana in clean water and in the presence of mud in the laboratory, concentration 0.5 ppm and 0.25 ppm

Exposure Time (hours)	Mortality (%) of 10 <u>L. gedrosiana</u> at an initial concentration of 0.5 ppm and 0.25 ppm					
	Clean Water			Presence of Mud		
	0.25 ppm	0.5 ppm	0.5 ppm	0.25 ppm	0.5 ppm	0.5 ppm
1	1/10	0/10	0/10	3/10	0/10	0/10
2	0/10	0/10	0/10	0/10	0/10	0/10
4	0/10	0/10	0/10	0/10	0/10	0/10
6	0/10	0/10	0/10	0/10	0/10	0/10
8	0/10	0/10	0/10	0/10	0/10	0/10

(%) No. of live snails / No. of snails exposed.

TABLE 7

Comparison Snail Bioassay in Salarabad No. 1 & No. 2 Canals  
during application of WL8008, 0.25 ppm and 0.5 ppm

Distance from Point of Application	Exposure Time (hours)	(WL8008) 0.25 ppm Mortality (No. of live snails/ No. of snails exposed)		(WL8008) 0.5 ppm Mortality (No. of live snails/ No. of snails exposed)	
		<u>Bulinus truncatus</u>	<u>Lymnaea gedrosiana</u>	<u>Bulinus truncatus</u>	<u>Lymnaea gedrosiana</u>
In Cage 200m	6	6/50	0/50	0/50	0/50
In Cage 1.km	6	31/50	0/50	0/50	0/50
In Canal 200m	6	20/63	0/50	0/0	0/47
In Canal 1.km	6	0/0	0/10	0/6	0/98
200m 1.km	<u>Snail Densities before Treatment</u>				
	60/60	100/100	0/0	210/210	
	0/0	8/8	7/7	850/850	

Water temperature during application ranged from 22° to 27°C.