

Molluscicidal Qualities of ICI 24223 (HCl) Revealed by 6-hour and 24-hour Exposures Against Representative Stages and Sizes of *Australorbis glabratus**

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In a continuation of comprehensive laboratory evaluations of candidate molluscicides, ICI 24223 (HCl) (isobutyltriphenylmethylamine), a product of Imperial Chemical Industries, Ltd., has been tested for molluscicidal activity against representative stages of Puerto Rican *Australorbis glabratus* snails. A standardized procedure that has been described in a previous report from this laboratory^a was used for this study.

Results

24-hour exposures. ICI 24223 (HCl) in concentrations up to 2.0 p.p.m. produced negligible mortality among eggs of *A. glabratus* that had incubated 1-6 hours, 24-30 hours, and five days prior to testing. Such mortality as occurred was entirely unrelated to the concentration of chemical. Furthermore, during 24 hours' observation no deaths occurred among young snails that hatched from treated eggs.

Results of tests on six categories of hatched snails are summarized in Tables 1 and 2. Newly hatched forms (24 hours or less in age) were surprisingly resistant to ICI 24223 (HCl). The LC₅₀ and LC₉₀ for this stage were respectively 0.125 p.p.m. and 0.39 p.p.m. as compared with respective values of 0.06-0.07 p.p.m. and 0.1-0.125 p.p.m. for mature snails (Table 1). Excluding the newly hatched group, LC₅₀ and LC₉₀ values increased regularly according to the size of the snails, resulting in an over-all 3½-fold increase in LC₅₀ between 3-5 mm (juvenile) and 18-20 mm (mature) snails, and an approximately 2-fold increase in LC₉₀ over the same size range.

In regard to 100% mortality end-points, 0.1 p.p.m. was sufficient to kill all 3-5 mm (juvenile) snails. All other size groups except the newly hatched were killed with 0.2 p.p.m. An average of 14% of newly hatched forms survived 0.3 p.p.m. but the dilution series was not extended in an attempt to determine the 100% mortality end-point for the group (Table 2).

6-hour exposures. Concentrations of ICI 24223 (HCl) as high as 4.0 p.p.m. elicited negligible mortality in incubated *A. glabratus* eggs in this test. Again, as in the 24-hour exposure test, treated eggs hatched normally and the young snails survived for at least 24 hours, at which time they were discarded.

LC₅₀ and LC₉₀ values for hatched snails other than the newly hatched group are summarized in Table 1. The pattern of mortality for newly hatched snails in a series of seven concentrations (see Table 3) was such that it was not practicable to devise a special series for the purpose of determining the LC₅₀ and LC₉₀ for the group. For other groups the LC₅₀ increased from 0.03 p.p.m. for 3-5-mm snails to 0.07 p.p.m. for 13-15-mm forms and then doubled to 0.145 p.p.m. for old 18-20-mm snails. The LC₉₀ increased from 0.09 p.p.m. to 0.3 p.p.m. between 3-5-mm and 18-20-mm snails but there was a less regular correlation between concentration and snail size.

As shown in Table 3, evidence obtained in 24-hour exposure tests that newly hatched snails exhibited a high degree of tolerance to ICI 24223 (HCl) was confirmed in the 6-hour exposure test. Mortalities did not exceed 16% throughout a range of concentrations extending from 0.025 p.p.m. to 6.4 p.p.m., except at 2.0 p.p.m. in which there was 33% mortality. In contrast, total mortality of other test groups was obtained with concentrations ranging from 0.3 p.p.m. for 3-5-mm snails to 0.6 p.p.m. for 13-15-mm forms.

The data summarized in Table 4 indicate that ICI 24223 (HCl) acts rapidly on *A. glabratus*. In only two instances, with 3-5-mm and 13-15-mm snails, was it necessary to increase the concentration required for the 24-hour exposure 100% mortality end-point by as much as threefold in order to effect total kill with 6-hour exposure, while in two other cases only twice as much chemical was required. In regard to LC₅₀ and LC₉₀ values, the ratio between 24-hour and 6-hour exposure values was no greater than 1:2.1. This is in contrast to results obtained with Bayluscide^a for which there was a disproportional increase in chemical requirement for 6-hour exposures as compared with 24-hour exposures.

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^a Ritchie, L. S., Berrios-Duran, L. A., Frick, L. P. & Fox, I. (1963) *Bull. Wild Hlth Org.*, 29, 281-286.

TABLE 1
TOXICITY OF ICI 24223 (HCI) FOR A SIZE ARRAY OF PUERTO RICAN *AUSTRALORBIS GLABRATUS* IN 6-HOUR AND 24-HOUR EXPOSURES

Snail group	LC ₅₀ in p.p.m. (and 95% confidence limits)		LC ₅₀ in p.p.m. (and 95% confidence limits)	
	6-hour exposure	24-hour exposure	6-hour exposure	24-hour exposure
Newly hatched	Not tested	0.125 (0.1 to 0.15)	Not tested	0.39 (0.27 to 0.55)
3-5 mm (juvenile)	0.03 (0.015 to 0.075)	0.02 (0.017 to 0.027)	0.09 (0.03 to 0.3)	0.06 (0.04 to 0.08)
8-10 mm (adolescent)	0.05 (0.04 to 0.06)	0.04 (0.02 to 0.07)	0.15 (0.1 to 0.2)	0.07 (0.03 to 0.2)
13-15 mm (mature)	0.07 (0.05 to 0.09)	0.06 (0.05 to 0.07)	0.2 (0.1 to 0.35)	0.1 (0.06 to 0.2)
15-18 mm (mature)	Not tested	0.07 (0.06 to 0.09)	Not tested	0.125 (0.07 to 0.2)
18-20 mm (mature)	0.145 (0.1 to 0.19)	0.07 (0.06 to 0.09)	0.3 (0.2 to 0.35)	0.125 (0.1 to 0.2)

TABLE 2
MOLLUSCICIDAL ACTIVITY OF ICI 24223 (HCI) AGAINST SIX SIZE GROUPS OF PUERTO RICAN *AUSTRALORBIS GLABRATUS* IN 24-HOUR EXPOSURES

Concentration (p.p.m.)	Snail mortality (%)					
	Newly-hatched	3-5 mm (juvenile)	8-10 mm (adolescent)	13-15 mm (mature)	15-18 mm (mature)	18-20 mm (mature)
0.025		63	15			
0.0375	7					
0.05		82	84	23	16	20
0.075	31					
0.1		100	95	89	80	77
0.15	49					
0.2		100	100	100	100	100
0.3	86		100	100		

TABLE 3
MOLLUSCICIDAL ACTIVITY OF ICI 24223 (HCI) ON FOUR SIZE GROUPS OF PUERTO RICAN
AUSTRALORBIS GLABRATUS IN 6-HOUR EXPOSURES

Concentration (p.p.m.)	Snail mortality (%)				
	Newly hatched	3-5 mm (juveniles)	8-10 mm (adolescents)	13-15 mm (mature)	18-20 mm (mature)
0.025	11	24	10		
0.05		88	68	45	0
0.1	15	93	87	57	
0.2		97	98	100	70
0.3		100	98	97	
0.4	10		100	97	100
0.6			100	100	100
0.8	15			100	
1.6					
2.0	33				
3.2	16				
6.4	15				

TABLE 4
INCREASE IN CONCENTRATION OF ICI 24223 (HCI)
REQUIRED TO GIVE INDICATED RESULTS AGAINST
AUSTRALORBIS GLABRATUS IN 6-HOUR EXPOSURE AS
COMPARED WITH 24-HOUR EXPOSURE ^a

Snail group	Increase (-fold) required for:		
	LC ₅₀	LC ₉₀	100% mortality
3-5 mm (juvenile)	1.6	1.5	3.0
8-10 mm (adolescent)	1.4	2.1	2.0
13-15 mm (mature)	1.0	1.8	3.0
18-20 mm (mature)	2.0	2.1	2.0

^a 24-hour exposure = 1.