

## A CONCENTRATE OF RED SQUILL AS A RAT POISON, AND ITS TOXICITY TO DOMESTIC ANIMALS

BY S. A. BARNETT, J. D. BLAXLAND, F. B. LEECH AND MARY M. SPENCER  
*Ministry of Agriculture and Fisheries, Infestation Control Division, London;*  
*and Veterinary Laboratory, Weybridge*

### INTRODUCTION

The powdered bulbs of a Mediterranean plant, red squill (*Urginea maritima*), have been widely used as a rat poison, since the toxic action of red squill is relatively specific to rats. Freeman (1950) has reviewed the use and action of red squill preparations. The main objection to red squill is that its toxicity depends on its place of origin, the season of harvesting, and possibly on its subsequent treatment; powders of high toxicity to rats are therefore sometimes difficult to get. A possible solution to this problem would be the use of the toxic agent of red squill alone. This has been shown by Stoll & Renz (1941) to be a glucoside, scilliroside, which can be obtained in a highly concentrated form from the bulbs. Such a concentrate is marketed by Messrs Sandoz of Basel, under the name 'Silmurine'. This paper describes investigations into the effectiveness of Silmurine as a rat poison and its toxicity to some farm animals.

### MATERIALS AND METHODS

The Silmurine used contains scilliroside in the proportion of not more than 0.7%. The analysis of the mixture was:

Moisture	1.6%
Lactose	75.0%
Plant extractive	20.0%
Dye, etc.	3.4%

The methods for field trials were the same as those described in the preceding paper (Barnett & Spencer, 1949).

The method of bio-assay was to select white rats at random from an inbred strain and to feed them for 1 day on flour and water paste; they were then starved for 24 hr. On the third day the Silmurine was made up in a small pellet with flour and water, which was usually eaten readily. Deaths were recorded for 5 days.

Domestic animals were given doses orally in gelatin capsules.

### RESULTS

#### (a) Field trials

Eleven tests were done against *R. norvegicus* (Table 1). The degree of success was only moderately good. However, tests 51 and 52 were both done on sites subject to reinvasion from sewers, and it is doubtful whether they can be regarded as satisfactory trials. Of the other tests, nos. 54, 55, 56, 152, 153 and 154 were all done in exceptionally bad weather which probably affected the results. These facts have to be borne in mind before any direct comparisons are made between this series of tests and others, such as those reported in the previous paper.

Five tests were done against *R. rattus*, with results, also summarized in the table, which suggest that, like red squill powder itself, Silmurine is not a satisfactory poison for this species.

#### (b) Toxicology

*Rats.* The result of bio-assay on female white rats (weights 150–285 g.) was as follows:

Dosage (mg./kg.)	3.0	4.0	4.2	5.04	6.05	7.26	8.0
No. tested	10	10	20	10	10	10	10
No. killed	0	3	4	4	8	9	10

LD<sub>50</sub> = 5.0; approximate range ( $P = 0.05$ ): 4.9–5.2.

and on males (190–280 g.):

Dosage (mg./kg.)	15.0	20.0	27.0	36.0	48.0
No. tested	10	10	10	10	10
No. killed	0	2	6	9	10

LD<sub>50</sub> = 25.2; approximate range ( $P = 0.05$ ): 15.8–40.3.

A small test was done on female *R. rattus* which had been trapped and kept in the laboratory:

Dosage (mg./kg.)	8.0	14.0	25.0	44.0
No. tested	4	4	5	2
No. killed	0	1	3	2

This test is too small for calculation of LD<sub>50</sub>.

Only very high dosages (250 mg./kg.) caused sudden death without previous signs of poisoning. Smaller doses caused lethargy at first, and later con-

Table 1. *Results of field tests*

Test no.	Habitat	Bait base	Silmurine (%)	Census 1 average g.	Census 2 average g.	Estimated success (%)
<i>R. Norvegicus</i>						
53	Bombed house	Sugar meal	1.0	657	0	100
154	Hedges near slaughterhouse	Barley	0.25	4906	102	94.6-98.3
101	Waste ground in park	Sugar meal	1.0	1797	72	95.2-96.1
371	Oat stack and hedge	Rusk	0.5	1430	97	93-94
359	Refuse tip	Barley	0.25	793	46	87-95
152	Slaughterhouse	Barley	0.25	3280	263	87.2-93.8
356	Refuse tip	Barley	0.25	6700	657	88-91
401	Rick	Rusk	1.0	935	127	83.5-91.6
56	Woodland by sewage works	Sugar meal	1.0	1113	140	85.7-89.4
309	Vicarage	Barley	0.25	367	48	81-90.4
151	Butcher's shop	Sugar meal	1.0	1177	127	84.7-89.7
55	Refuse tip	Sugar meal	1.0	1690	247	78.7-87.1
153	Chicken run	Barley	0.25	1130	220	73.6-86.1
54	Refuse tip and chicken run	Sugar meal	1.0	680	143	76.5-80.2
51	Shop and bombed house	Sugar meal	0.5	1712	425	69.4-75.4
402	Rick	Rusk	1.0	110	32	54.6-89.5
403	Rick	Rusk	1.0	333	108	55-79
52	Slaughterhouse and bakery	Sugar meal	1.0	960	318	62-69.2
<i>R. Rattus</i>						
102	Cafe	Rusk	1.0	122	0	100
301	Flour mill	Rusk	1.0	207	18	87.9-91.9
104	Skin-drying factory	Rusk	1.0	1800	363	70.9-80.4
57	Warehouse	Rusk	1.0	772	312	55.3-61.6
110	Restaurant	Barley	1.0	513	317	34.7-45.9

For explanation see previous paper (Barnett & Spencer).

vulsions, including the typical rolling and purgation of red squill poisoning. The higher susceptibility of females is similar to that found with red squill.

*Fowls.* Groups each of six adult Rhode Island Red hens were given 50, 100, 200, 400 and 800 mg./kg.; only the two highest doses were fatal, and in these groups only six of the twelve treated fowls died. This indicates a much lower toxicity to fowls than to rats. The first symptom of poisoning was leg weakness; later the affected fowls fell asleep crouched in a sitting position, their heads falling forward; they gradually became comatose and immediately before death appeared to be completely anaesthetized, breathing slowly and almost imperceptibly. Only one bird died within 24 hr. of dosing, and in several instances death did not occur for 4-5 days.

Another group of thirty hens was offered a single feed of 1% Silmurine in 300 g. rusk. The hens ate the feed as readily as they had previously taken untreated rusk. No toxic effects were observed.

*Pigs.* Five young pigs were given 4, 8 and 16 mg./kg., two pairs receiving the 4 and 16 mg. doses and a single pig receiving 8 mg. Shortly after dosing profuse salivation was observed in those pigs which had crushed the capsule in their mouths; one became very staggery and 'lost consciousness' temporarily

in a fit. The next day all five were off their food, but rapid recovery followed.

Six other young pigs refused to eat sausage rusk containing 1% Silmurine, although they had readily eaten a similar quantity of plain rusk the previous evening.

*Cats.* 4, 8 and 16 mg./kg. were given to three pairs of cats. The capsule broke in the mouth of two of the cats, and profuse salivation followed; one cat vomited the dose within an hour; another refused normal food the day after dosing; no other symptoms were observed.

*Dogs.* Three dogs were given the same dosages as the cats; for them the capsule was wrapped in meat. By the next morning all had vomited and two were walking unsteadily; all three made an uneventful recovery.

Four other dogs refused to eat rusk containing 1% Silmurine although they had previously eaten plain rusk readily; they appeared to be able to detect the drug immediately and champed their jaws for a few seconds as though trying to rid themselves of the taste.

*Man.* In two instances accidental poisoning resulted in man through inhaling the powder. The symptoms were headache, vomiting, and diarrhoea

within 10 hr., followed by lethargy and loss of appetite. There were no prolonged effects.

#### DISCUSSION

The results of the field tests, though not wholly satisfactory, suggest that Silmurine is comparable to red squill powders of high toxicity as a poison for *R. norvegicus*. On the other hand, the results of the five tests on *R. rattus*, none of which was interfered with by weather or human intervention, suggest that Silmurine should not be used against this species. The difference between the two species is the same as that encountered with red squill powder itself. Since Silmurine is highly toxic to both species it seems likely that superior gustatory acuity enables *rattus* to escape, to a considerable extent, poisoning by baits containing Silmurine. If this inference is justified it illustrates very well that high toxicity in a rat poison is not enough; the material must also be palatable.

Silmurine can be considered safe for general use in the farmyard: fowls can tolerate large doses without showing evidence of toxicity, and it is unpalatable and relatively non-toxic to pigs, dogs and cats; it also causes vomiting in dogs, cats and man.

Silmurine is, in fact, 'specific' to rats in the same

way as the powder. This specificity raises a number of questions. The pathology of red squill or scilliroside poisoning is unknown. If the mechanism were known it might be possible to devise more satisfactory and more specific poisons for rodents. The fact that rodents do not vomit, whereas in many other species red squill causes vomiting, is not the whole story, since some mammals are relatively unaffected by red squill yet do not vomit it (Freeman, 1950).

#### SUMMARY

1. A preparation containing 0·7 % scilliroside (the glucoside of red squill) has been tested as a poison for *Rattus norvegicus* and *R. rattus*.
2. The preparation has been found to be effective in the field against *norvegicus* but not against *rattus*.
3. Assayed against a strain of white rats, the preparation had an LD 50 for males of about 25 mg./kg., and for females of about 5 mg./kg.
4. The LD 50 for adult Rhode Island Red fowls was greater than 400 mg./kg. Pigs, dogs and cats were treated with doses up to 16 mg./kg. without fatal results.
5. Silmurine was unpalatable to pigs, dogs and cats, but fowls readily consumed a mash containing 1 % Silmurine.

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