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SUCCESS IN RAT CONTROL IN KUWAIT

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ABSTRACT: The preliminary rat survey prior to the actual attack phase of Rat Control Programme in Kuwait revealed an infestation rate with the Norway rat, *Rattus norvegicus*, in buildings ranging between 32.7% and 70.7%. The comparatively high infestation was observed in 92.5% of Kuwait buildings. Moreover the infestation reached 99% in certain districts of the country. This high infestation was associated with an increase in rat-borne diseases particularly murine typhus, salmonellosis, rat-bite fever and certain parasitic diseases.

A programme for rodent control in Kuwait was initiated through a political decision by the cabinet which gave the full responsibility of rodent control to the Ministry of Public Health coordinating with other authorities involved in the problem in addition to an independent budget to fulfill all the programme requirements. Financing, administration, guidance, public health information, field work, and research studies were all monitored by the High Committee in addition to Supervising and Following up Committee.

The first phase of the programme began in the late months of 1979. It included geographical reconnaissance, survey of rodents and their ectoparasites, establishment of the general plan, and a skeletal organization for the programme. The second phase was the attack phase. It highlighted biological and epidemiological studies, bioassays of pesticides and training of personnel, which was followed by the actual chemical attack of the incriminated rodents and their ectoparasites for three consecutive years. In addition, sanitation and health education were involved. The third phase, i.e., the maintenance phase, began in August 1982. It is still running to maintain the drastic drop of the Norway rat infestation and to control the house mouse.

Kuwait's control programme, based on a scientific basis and with a well-organized administration, has successfully realized 99.7% reduction in the infestation rate, with a 99.6% density of infestation Of Norway rats remaining at the end of the attack phase. However, the control of the house mouse produced a reduction of only 71.4% in the infestation rate, and 20% in the density of infestation, possibly indicating intraspecific competition between the two species or less-effective control measures against the mice.

INTRODUCTION

The successful Rat Control Programme in Kuwait, which actually started in the late months of 1979, has been considered a subject of wide interest. Reports on this project in its different stages, whether submitted by visiting experts from abroad or by the professional staff who contributed in executing the programme, have pointed out this success. A review on the work achieved has been recently accomplished by the Head of the Supreme Committee of Rat Control in Kuwait (Al-Sanei 1983). The present paper is to provide a better understanding of this successful work against the Norway rat (*R. norvegicus*).

Before the beginning of the control programme the Norway rat was the predominant species exhibiting high infestation rates in different ecological areas of the State of Kuwait. The infestation amounted to 70.7% in primitive animal and poultry farms, 57.3% in industrial areas, and 52.4% in inhabited areas inside the City of Kuwait (Al-Sanei et al. 1982). These areas constitute 92.5% of the total buildings of Kuwait State (Table 1). Moreover, detailed studies revealed 90% infestation rate with the Norway rat in certain districts of the state (Anonymous 1982).

Even though the original home of this rat is inner Asia (Hinton 1931), it has now a world focal distribution and can establish itself and compete well with other species (Salit 1972). The geographical situation of Kuwait on the Arabian Gulf with active navigation, international traffic roads, high standard of living with huge amounts of garbage disposal, and residences of various nationalities with different social characteristics, in addition to reclamation of lands for new housing in the desert areas, has paved the way for the Norway rat to enter and establish itself (Al-Sanei et al. 1983). This rat has successfully competed with other species in the area, as was observed by Salit in his report following his visit to Kuwait in 1979.

The increase of rat-borne diseases, particularly murine typhus, salmonellosis, rat-bite fever, and certain parasitic diseases (Al-Awadi et al. 1978, Bezjak and Thorburn 1981 and 1982, Zakaria and Zaghoul, 1982) attracted the attention of the health authorities that a National Rat Control Programme was indispensable.

METHODS OF ACCOMPLISHMENT

The programme as mentioned by Al-Sanei (1983) has been initiated through a political decision by the cabinet giving the full responsibility of rodent control to the Ministry of Public Health which coordinated with other authorities involved in the problem. An independent budget financing all needs

Table 1. Number of buildings infested with Norway rats (*Rattus norvegicus*), and the density of infestation in different ecological areas before control in Kuwait in 1979.

No.	Ecological areas	Buildings		Infestation %	Rat density
		No.	% of total buildings		
I	Sea ports, airports, beach houses and Gulf shores	2519	2.6	32.7	0.5
II	Industrial factories and bungalows of construction companies	11186	11.5	57.3	0.2
III	Sheep yards, cattle and poultry farms	1224	1.3	70.7	0.6
IV	Inhabited buildings and premises	77347	79.8	52.4	0.3
V	Other areas	4752	4.8	27.5	0.2
	Total buildings	97028	100.0	50.7	0.3

and supplies was allocated. In addition to warning the public of the hazards of rats and rat-borne diseases through intense public-health education service, a law was issued to facilitate the achievement of rat control operations even in closed buildings. This policy gave free hand for financial and administrative affairs, which were the backbone of the control operations. It is noteworthy that a financial balance system, in addition to cost accounting, were successful in achieving the best accomplishments (Al-Sanei 1983).

Moreover, financial and administrative affairs have been discussed in detail in an annual report of the project (1982) and summarized in the aforementioned review of Al-Sanei (1983). The leadership of the Ministry of Public Health in the High Committee, coordinating with ministries and other agencies involved, in addition to the Committee of Supervision and Follow-up, gave the different programme activities fruitful results. Financing and administration, education and public-health information, and field and research studies, were all followed up by the aforementioned committee.

The Rat Control Programme which actually began in the late months of 1979 included three main phases, namely, the preparatory phase, the attack phase, and the maintenance phase. The preparatory phase included the following activities:

- Mapping, enumerating all buildings.
- Survey of rodents and their ectoparasites with particular interest to certain rodent-borne diseases such as murine typhus, salmonellosis, rat-bite fever, and certain parasitic diseases.
- A field pilot project for training and evaluating different activities before establishing the general plan of the countrywide control programme.

The second phase was the attack phase. It was carried out for three consecutive years and included:

- A countrywide campaign for chemical control of ectoparasites and rodents on a total coverage basis particularly in the potential sites of infestation, namely, rat burrows, rat runways, manholes, and main sewerage system.
- Financial and administrative activities, health education, and biological and epidemiological studies were carried out continuously.
- The maintenance phase started in August, 1982, following the complete success in controlling the predominant species, i.e., the Norway rat (*R. norvegicus*). However, this resulted in the appearance of a higher infestation of the house mouse (*Mus musculus*). The strategy of control was then changed to focus control on the Norway rat, whether it was being imported from abroad or the few residues that had survived the attack phase. Control activities in the maintenance phase also have been directed at the control of the house mouse. This required dividing Kuwait State into four sectors, each of which is responsible for achievement of different activities in the corresponding area, but all come under the supervision of the central rodent control unit.

Throughout the chemical control activities, dusting of rat burrows and runways for ectoparasite control was performed using 1% bendicarb. Coumatetralyl (0.0375%) was used in all phases where rodenticides were used against the Norway rat. Brodifacoum (0.005%) was applied on a small scale during the second and third years of the attack phase, while calciferol (0.09%) was introduced in the third year of the attack phase for house mouse control. Coumatetralyl, calciferol and brodifacoum, in addition to the rotary multiple-catch live trap, other cage traps, and snap traps are all tools being used for rodent control in the maintenance phase.

RESULTS AND DISCUSSION

As shown in Table 2, and in Table 3, an overall reduction of 87.8% in the infestation rate, and 96.7% in the density of infestation of the Norway rat have been achieved as a result of the first round of control. Another reduction of 63.4% and 50% was observed, respectively, in the infestation and density of infestation of the house mouse. Thenceforward a progressive reduction in the infestation rate (99.7%) and in the density of infestation (99.6%) were realized in the Norway rat at the end of the three-year attack phase. On the other hand, only 71.4% infestation rate and 20% density of infestation were obtained with the house mouse at the end of the aforementioned phase. In the meantime, wild rodents were encouraged in localities where the Norway rat disappeared. It seems that the Norway rat succumbed to the rodenticides used more than the house mouse. This could be accounted for by the high efficacy of the anticoagulant coumatetralyl on the Norway rat, as well as the large amounts of the poison baits consumed (Zaghloul and Zakaria 1982). Helal et al. (1979) attributed this phenomenon to the higher haemobiotic activity of the Norway rat. On the other hand, because of the house mouse's nibbling behaviour in feeding, it may have led to sublethal intake. Hence, anticoagulant rodenticides seem not highly recommended against house mouse infestation. Moreover, it seems that both the house mouse and wild rodents are ousted by the Norway rat as mentioned by Salit et al. (1974).

Table 2. The extent of infestation of domestic and wild rodents in the three stages of the Rat Control Programme in Kuwait.

Stages of operations		Percentage of infested buildings			Percentage of reduction		
		N	H	W	N	H	W
First	B.	50.7	14.5	0	-	-	-
	A.	6.2	5.3	0	(87.8)	(63.4)	0
Second	B.	2.3	7.6	0	-	-	-
	A.	0.2	3.1	0	91.3 (99.6)	59.2 (78.6)	0
Third	B.	0.6	9.3	0.2	-	-	-
	A.	0.17	4.15	0.025	71.7 (99.7)	55.4 (71.4)	(87.5)

B = Before control operations
A = After control operations
() = From initial infestation

N = Norway rat
H = House mouse
W = Wild rodents

Table 3. Population densities of Norway rat, house mouse and wild rodents in the three successive stages of rodent control in Kuwait.

Stages of operations		Population densities per buildings			Percentage of reduction		
		N	H	W	N	H	W
First	B.	0.3	0.1	0	-	-	-
	A.	0.01	0.05	0	(96.7)	(50)	0
Second	B.	0.01	0.22	0	-	-	-
	A.	0.001	0.10	0	90.0 (99.6)	54.5	0
Third	B.	0.005	0.25	0.003	-	-	-
	A.	0.001	0.08	0.0002	80.0 (99.6)	68.0 (20)	(93.3)

B = Before control operations
A = After control operations
() = From the initial density

N = Norway rat
H = House mouse
W = Wild rodents

Table 4. Number of buildings infested with Norway rat (*Rattus norvegicus*) and the density of infestation at different ecological areas in Kuwait in 1982.

No.	Ecological areas	Buildings		Infestation	Population density	% Reduction	
		No.	% of total buildings			Infestation	Population density
I	Sea ports, airports, beach houses and Gulf shores	13786	7.02	0.2	0.002	99.5	99.6
II	Industrial factories and bungalows of construction co.	24162	12.3	0.3	0.003	99.4	98.5
III	Sheep yards, cattle and poultry farms	3429	1.74	0	0	100.0	100.0
IV	Inhabited buildings and premises	139702	71.1	0.15	0.001	99.7	99.6
V	Other areas	15419	7.84	0	0	100.0	100.0
	Total buildings	196498	100	0.15	0.001	99.7	99.6

It is noteworthy from the results shown in Table 4 that, at the end of the third year of the attack phase, the Norway rat had disappeared from certain highly infested areas such as animal husbandry farms and other favorable areas for the living and breeding of this rat. An overall reduction of not less than 99.5% in the infestation and the density of the Norway rat has been successfully achieved. It might be indicated from Table 1, compared with Table 4, that improved housing sanitation was going on with the well-organized and strictly supervised control operations, as previously mentioned in this manuscript. All the different activities, which have been enthusiastically performed, have resulted in astonishing success in getting rid of the Norway rat problem in Kuwait.

The backbone of this rodent control success has been due to sanitation and health education, in addition to the rodent and ectoparasite control programme, all of which have been based on a solid scientific foundation and executed during strictly defined operational phases. In addition, there has been a well-organized administration and an independent budget to cover all requirements.

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