

NOTES AND REPORTS

CONTROL OF PLAGUE IN TARANTO, ITALY, 1945/1946 **An Account of a Successful Programme of Rodent Extermination**

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Manuscript received in November 1949

When plague struck in Taranto in September 1945, there was no effective organization to cope with an outbreak of pestilential disease which had reappeared in Italy after a lapse of perhaps half a century.

Port health-services were in a chaotic state through lack of trained public-health officers, and the destruction of port sanitation stations, with consequent looting and loss of essential equipment such as ship-fumigation apparatus, etc. The administration of some ports was still in allied military hands and that of others had only just been handed back to the Italian civil authorities. The national public-health service, with headquarters in Rome, was in an even worse condition than the local port health-services. Whereas the military authorities had accepted the responsibility of maintaining sanitary measures in occupied ports and had offered supplies and assistance in administration in decontrolled ports, the central civilian authority was in a developmental stage ; it was emerging from the collapse of the former régime and was being nursed back to normal, but at the same time it was handicapped by control in respect of the maintenance of military objectives. Only a nucleus of medical personnel existed, and no stores or transport were available.

Notes on the Epidemiology of the Outbreak

Such then was the state of the civilian public-health organization when the first case of plague was notified in September 1945. The British Army was using the port of Taranto for the evacuation of personnel and stores, and, while the control was in the hands of the military, the Assistant Director of Medical Services (ADMS), 52 Army Area, applied sanitary measures over the area for the protection of troop concentrations there, but, as commitments grew less, authority was handed back to the civilian administration. This state of ineffective control had been foreseen when the United Nations Relief and Rehabilitation Administration (UNRRA) was

brought into being, and the Division of Health of UNRRA was therefore charged with carrying on the active functions of epidemic control.

The first case with a confirmed diagnosis of plague was notified on 6 September 1945, and the last case on 29 November 1945 ; altogether, 28 civilian cases and one case among army personnel were notified. All the 15 deaths which occurred were civilian cases, the case fatality-rate being 51.7%. The incidence of the various forms of the disease was :

<i>Type of case</i>	<i>Number of cases</i>	<i>Number of deaths</i>	<i>Death-rate</i>
Bubonic	15	1	6.7%
Pneumonic	—	—	—
Septicaemic	14	14	100.0%

Of the total cases notified, seven had been inoculated against plague, particulars being as follows :^a

<i>Date inoculated</i>	<i>Onset of plague</i>	<i>Type</i>	<i>Results</i>
9 September	18 September	septicaemic	died 23 September
20 "	22 "	"	" 29 "
10 "	23 "	"	" 24 "
10 "	23 "	bubonic	discharged 17 October
7 "	23 "	"	convalescent
13 "	23 "	"	"
20 "	28 October	"	"

It will be noted that the septicaemic form of the disease was 100% fatal, even though antiplague inoculation of one case had taken place 13 days before the onset of the disease.

Until the end of October all cases reported were resident either in Taranto or within a radius of about 15 kilometres from the city, and all had clearly demonstrable contact with the primary focus of infection ; but early in January 1946 disturbing news came from the port of Reggio-di-Calabria, where a case of plague was notified and the diagnosis confirmed. Subsequent investigation, however, showed this to have been a transferred case from Taranto.

Source of infection

The exact source of infection was never clearly established. The disease may have existed in the form of a dormant epizootic in the Italian naval arsenal dock area for some considerable time before manifesting itself by human infection. Strong suspicion centred on a cargo of imported rags, stored in a shed in the arsenal, from which the infected rodents may have spread to other parts of the arsenal. The first cases notified had all been working in the vicinity of the shed, but, subsequently, infections

^a Data taken from Report ADMS 52 Army Area (obtained from UNRRA Health Division, Rome)

occurred in persons situated in two other places. One of these persons was a military policeman on duty outside the arsenal, at a place where a broken drain might have given direct access to rodents, and the other was a civilian ; it was not possible to trace the source of infection of the latter.

The barque "Cherso" came under suspicion because the cargo of rags, which was stored in the shed and was later considered to be the primary source of infection, had been unloaded from it on about 28 July. The origin of the cargo is unknown ; the ship may have come from Malta or some other port in an area where plague is endemic. Only the following movements of the ship are known exactly :^b

<i>Port</i>	<i>Arrived</i>	<i>Sailed</i>
Naples	2 July	2 July
Cagliari	7 "	8 "
Messina	10 "	12 "
Catania	12 "	15 "
Taranto	16 "	21 "
Gallipoli	21 "	27 "
Taranto	28 "	

Seizure of the ship was carried out when she arrived in Venice harbour on about 8 September. The results of the investigation are not known.

Initial Anti-Rodent Precautions

Immediately after the notification of the first case of plague, precautions were taken by the staff of ADMS 52 Army Area on behalf of both the civil and military population. The personnel of the 36th British Field Sanitation Section carried out active anti-rodent measures, and a "contacts team" was organized by the Deputy Assistant Director of Hygiene.

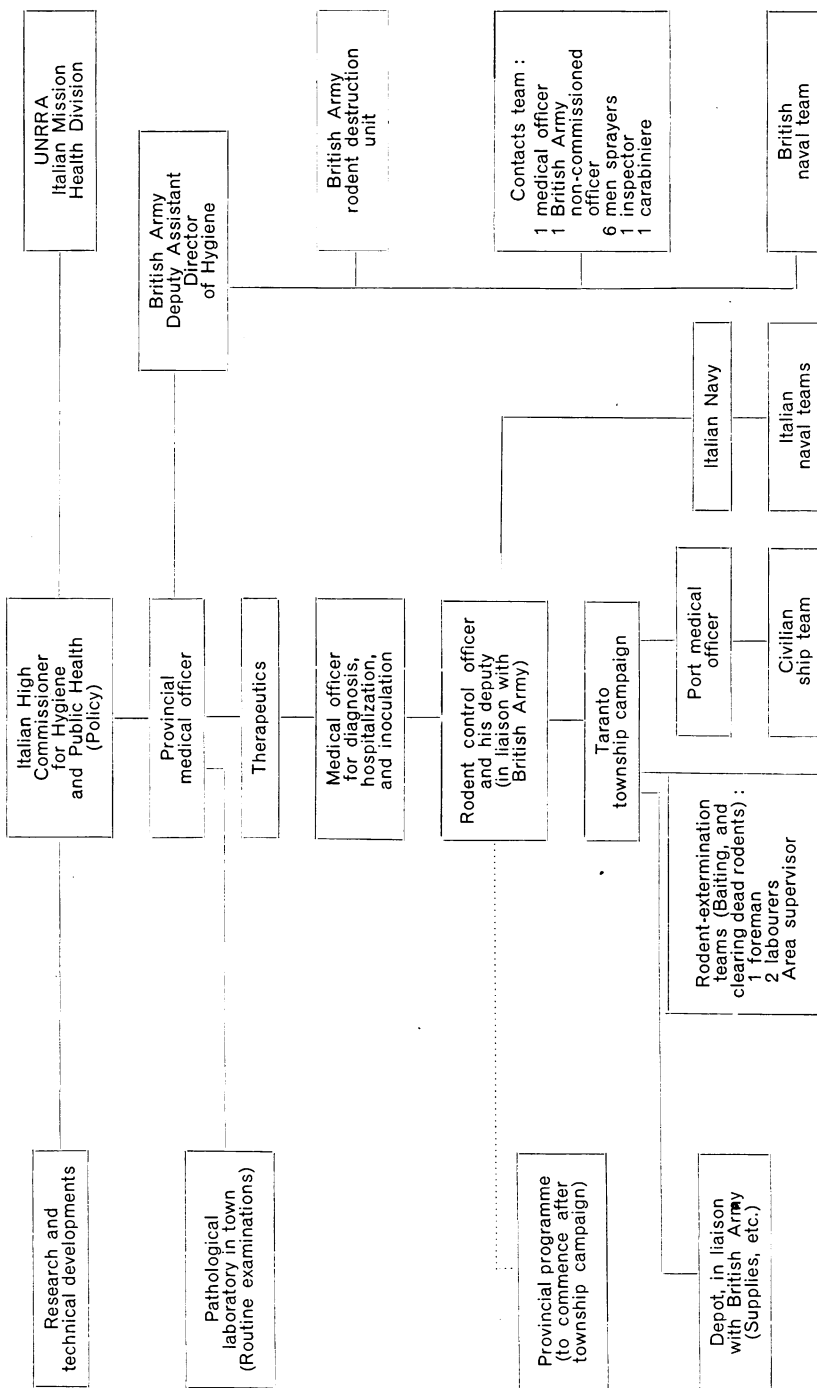
The shed suspected of being infected was immediately cleaned, the rags were burnt, and DDT in solution was sprayed everywhere in the vicinity. Concurrently, an anti-rodent programme, based on a system of pre-baiting followed by poison baiting, was put into operation ; the poisons used were barium carbonate and red squill. The poison baits were first laid in the arsenal, particularly round the primary source of infection, but later they were extended to cover adjacent portions of the town.

Between 13 September and 20 October, 12,400 pellets of bait containing barium carbonate and 42,025 pellets containing red squill were laid ; 5,700 of the former and 19,674 of the latter were taken.^c A "DDT zone" was then laid down, all civilian houses 2- to 3-blocks deep in the area surrounding the arsenal dock area being carpeted with a layer of DDT in solution and in powder. This work was carried out by 3 teams consisting

^b Data taken from Report ADMS 52 Army Area (obtained from UNRRA Health Division, Rome)

^c Data taken from Report ADMS 52 Army Area (obtained from UNRRA Health Division, Rome)

FIG. 1. ORGANIZATION OF STAFF ENGAGED IN ANTIPLAGUE CAMPAIGN IN TARANTO, 1945/1946



of 4 supervisors and 24 workmen. All persons living in the DDT zone were invited, by means of radio loudspeakers and notices, to visit special dusting centres once weekly. This DDT barrier was renewed constantly throughout the campaign.

The contacts team consisted of a medical officer, a British Army non-commissioned officer, six labourers forming a mobile anti-rodent and DDT team, one official from the civil public-health department and a carabinieri. The cases were immediately isolated, contacts were inoculated and kept under surveillance for 10 days, and their houses were sprayed with DDT and cleared of rodents. So successfully did the team operate that it was retained in its original form until the rodent-extermination programme had been completed.

Large-Scale Anti-Rodent Campaign

Because of the continuing notification of cases, it was necessary to transfer the initiative to the civil authorities as the military commitments decreased in Taranto. UNRRA came into the project owing to its obligation to carry out active anti-epidemic work. Supplies of wheat and barley and rodenticides were available on a large scale, and administrative procedure and operational instructions were immediately worked out for the inauguration of a city-wide rodent-extermination programme.

An independent organization was set up within the provincial administration and consisted of a rodent officer, operating under the Provincial Medical Officer (Medico Provinciale), with a staff of about 90 workmen. The organizational chart is shown in fig. 1.

The campaign was conducted in three cycles :

1st cycle : a period of organization and preparation, in which a survey of the whole city was made to estimate quantities of materials and number of personnel required, and to determine where baiting points should be situated.

2nd cycle : prebaiting with a bait-base was carried out, followed by poisoning, and removal of the dead rodents and poison baits.

3rd cycle : mopping-up phase in which another bait-base was used, followed by poisoning with a different poison, and removal of dead rodents and poison baits.

First cycle, commenced 23 October 1945

A plague committee was set up to supervise the activities of the rodent-extermination organization, and a well-ventilated warehouse, with water laid on, was established. The rodent officer organized his personnel into 25 squads, as follows : 20 squads each consisting of 1 supervisor and 2 workmen for the buildings ; 4 squads of 1 supervisor and 3 workmen for the sewers ; and 1 squad of 3 men for the warehouse. The men pro-

ceeded to familiarize themselves with the town, which was divided into blocks, separated by natural boundaries, such as roads or open squares, on all sides. Sewers in a given area were treated at the same time as the buildings. Record sheets were drawn up as to presence of rodent infestation, and a block plan of all premises in the zone to be treated was drawn on the back of the record sheets. Places thought suitable for baiting were indicated by a paint mark and a ring on the wall immediately above, in which was placed the serial number of the baiting point. This number also appeared on the block plans.

Second cycle, commenced 10 November 1945

Prebaiting with wheat soaked in water for 30 hours was carried out in order to condition the rodents to taking such food before using it as a base for the poison. Since baiting points had also to be established in artificial situations near rat runs, the period of prebaiting was necessary to conquer the rodents' fear of unfamiliar objects, and to encourage them to take food from these places. A bait-base, such as wheat, which would be acceptable to the rodents, was chosen, and was used in a form in which the rodent had to feed on the spot and could not carry away the bait and store it in the burrows.

Conditioning of the rodents to the bait-base was allowed to continue for four or five days. Discarded tins were cut into scoops which delivered approximately 60 g. of wet wheat and were used by the workmen when laying the bait. The points baited were kept under observation. Some baits were untouched; others had been partly consumed and were replenished until an exact amount had been laid, so that an indication of the number of rodents apparently feeding at one point could be obtained. Baits not touched were not replaced with poison baits.

On the fourth day the preparation of poison baits began; the unpoisoned wheat was removed from all points where the rodents had established feeding points, and was replaced by poisoned wheat. The poison used was zinc phosphide (Zn_3P_2) which has an average lethal dose of 80 mg. per kilogram of body-weight; 5% by weight was added to the soaked wheat and mixed thoroughly in a well-ventilated room. The operation took on an average two days to complete; special squads were sent out to remove dead rats and unused poison baits on the morning following the completion of the operation.

Third cycle, commenced 4 February 1946

The third cycle was necessary to ensure that any residual rodent population, which had escaped the first poisoning, would be eradicated. Under these circumstances it was necessary to ensure that even those rodents which had become prejudiced to both bait-base and poison bait would take poison when laid again. Consequently barley was used as a base and

prebaiting was continued as in the second cycle. The poison used with the new bait-base was purified arsenious oxide (As_2O_3) which has an average lethal dose of 180 mg. per kilogram of body-weight ; 10% by weight was incorporated in the soaked barley. Methods of procedure remained the same as before.

Appreciation of the Operation

In tables I and II part of the progress of the campaign from 5 November to 16 December, when the operations were suspended for about two weeks, is shown.

TABLE I. PROGRESS OF ANTI-RODENT CAMPAIGN IN TARANTO, ITALY, BETWEEN 5 AND 24 NOVEMBER 1945

	First half of arsenal	6 blocks of town	6 blocks of sewers	Total
Dates :				
Survey	5-10 November	5-10 November	5-10 November	—
Preparing baits	10 November	11 November	11 November	—
Prebaiting and checking	12-17 November	12-18 November	12-18 November	—
Placing poison baits	19-20 November	19-21 November	19-22 November	—
Collecting poison baits and dead rats	23-24 November	22-24 November	23-24 November	—
Labour :				
Number of squads	8	13	4	25
Number of men	26	40	16	82
Number of working days	510	979		1,489
Analysis of results :				
Prebaits :				
Number of points	4,069	8,711	1,862	14,642
Weight of wheat	385.5 kg.	816.5 kg.		1,202 kg.
Poison baits :				
Number of points	3,404	5,100	1,559	10,063
Total weight	181.4 kg.	399.2 kg.		580.6 kg.
Weight of poison*	10.0 kg.	16.3 kg.		26.3 kg.
Number of dead rats found	161	1,695		1,856
Species of rats	{ 60% <i>R. norvegicus</i> 40% <i>R. rattus</i> }	<i>R. rattus</i>		—

* Zinc phosphide (Zn_3P_2)

Table III shows the figures for the complete work carried out in the second cycle of the campaign and table IV gives the figures for a completed portion of the final cycle.

The second cycle, in which prebaiting and poisoning were carried out throughout Taranto city and port, which embraces an area of more than 7 square kilometres and has a population of about 185,000, took about 80 days to complete. A maximum total of 96 men worked a total of

TABLE II. PROGRESS OF ANTI-RODENT CAMPAIGN IN TARANTO, ITALY, BETWEEN 26 NOVEMBER AND 16 DECEMBER 1945

	Second half of arsenal	Second portion of town	Sewers in second portion of town	Total
Dates :				
Survey	26 November-2 December	26 November-1 December	26 November-1 December	—
Preparing baits	2 December	2 December	2 December	—
Prebaiting and checking	3-9 December	3-8 December	3-8 December	—
Placing poison baits	10-15 December	10-12 December	10-12 December	—
Collecting poison baits and dead rats	15 December	13-15 December	16 December	—
Labour :				
Number of squads	6	16	4	26
Number of men	28	48	16	92
Number of working days	533	1,130		1,663
Analysis of results :				
Prebaits :				
Number of points	3,305	7,344	2,244	12,893
Weight of wheat	299.4 kg.	773.8 kg.		1,073.2 kg.
Poison baits :				
Number of points	1,842	5,417	2,036	9,295
Total weight	204.1 kg.	401.0 kg.		605.1 kg.
Weight of poison *	10.2 kg.	22.2 kg.		32.4 kg.
Number of dead rats found	171	656	1,082	1,909
Species of rats	majority R. rattus	R. rattus		—

* Zinc phosphide (Zn_3P_2)**TABLE III. RESULTS OF SECOND CYCLE OF ANTI-RODENT CAMPAIGN IN TARANTO, ITALY, 1945/1946**

	New town (including arsenal)	Old town	Buffoluto	Dockyards of Tosi	Total
Dates :					
Treatment commenced	5 November 1945	7 January 1946	14 January 1946	3 February 1946	} approximately 80 days
Treatment completed	5 January 1946	26 January 1946	23 February 1946	23 February 1946	
Labour :					
Composition of squads		House squads of 3 men Sewer squads of 4 men			
Number of men		Varied from 82-96			
Number of working days	3,278	1,354	879	143	5,654
Analysis of results :					
Number of premises treated	7,207	2,326	876	229	10,638
Number of prebaiting points	29,465	8,215	3,844	1,099	42,623
Poison baits :					
Number of points	21,361	5,950	2,642	790	30,743
Weight of poison *	70 kg.	20 kg.	8 kg.	2.35 kg.	100.35 kg.
Total weight of wheat used in second cycle	3,900 kg.	1,100 kg.	470 kg.	143 kg.	5,613 kg.
Number of dead rats found	3,807	1,164	85	19	5,075
Number of rats examined for plague	273	35	—	—	308
Results of examination of rats	Negative	Negative	—	—	—

* Zinc phosphide (Zn_3P_2)

5,654 days to lay bait-bases in 42,623 baiting points situated in 10,638 premises. The actual number of poisoned baits laid was 30,743 and the total quantity of zinc phosphide used was 100.35 kg. The total amount of wheat used during the cycle was 5,613 kg.

As the effectiveness of the campaign can be judged only by the absence of rodent infestation, and not by the number of dead rats found after poisoning, the number dead is not really an indication of the success attained. In this campaign over 5,000 dead rats were found after poisoning. In the dock area (the primary source of infection) 60% of the rats found dead were *Rattus norvegicus*, whereas in the town itself they were almost exclusively *Rattus rattus*.

**TABLE IV. RESULTS OF THIRD CYCLE OF ANTI-RODENT CAMPAIGN
IN TARANTO, ITALY, 1945/1946**

	New town
Dates :	
Commencement of treatment	4 February 1946
Completion of treatment	16 March 1946
Labour :	
Number of squads	45
Number of men	144
Number of working days	1,437
Analysis of results :	
Number of premises treated	3,882
Number of prebaiting points	12,182
Poison baits :	
Number of points	7,404
Weight of barley	450 kg.
Weight of poison *	45 kg.
Total weight of barley used in third cycle	1,300 kg.
Number of dead rats found	269
Number of rats examined for plague	350
Results of examination of rats	Negative

* Arsenious oxide (As_2O_3)

In some cases baits were taken from the time prebaiting was commenced ; the best results were obtained from baits laid on the outside of the buildings, especially along the wharves and places where refuse and other garbage was to be found. Some baits laid indoors were not touched, and the bait-bases were taken more readily than the poison baits. Rat carcasses had a swollen appearance ; some rats had died on the baiting-point, some lay close by, while others had travelled quite long distances and had died on the surface or in inaccessible places.

A total of 308 rodents were examined for plague but were all found to be negative. Indeed, no further human cases were reported after 29 November, and damage done by the presence of rodents was reduced to a negligible quantity.

The results for the third cycle of the campaign are available only for the "new city", in which the second cycle had been completed by 5 January 1946. In the third cycle, which began a month later, only 1,300 kg. of barley and 45 kg. of arsenious oxide were used, as compared with the 3,900 kg. of wheat and 70 kg. of zinc phosphide used in the second cycle. A shorter time was worked on the area and a greater number of men were employed in the project. In the final cycle only 269 dead rats were found, as opposed to the 3,807 found in the second cycle.

* * *

It is considered on epidemiological grounds and on evidence of infestation that the operation was not only successfully carried through, but also that no damage resulted from the large quantities of poison used. The operation was intended to serve as a model for anti-rodent campaigns to be carried out throughout Italy, particularly in the seaports.

ACKNOWLEDGEMENTS

The following people played an essential part in bringing the campaign to a successful conclusion :

Colonel T. B. H. Tabuteau, Assistant Director of Medical Services, 52 Army Area

Major R. M. Giles, Deputy Assistant Director of Hygiene, 52 Army Area

Dr F. Martorana, Provincial Medical Officer, Taranto

Dr A. Trillo, Port Medical Officer

Captain A. Maricondo, Italian Navy

Dr V. Simonetti, Rodent Officer

Personnel of the 36th British Field Sanitary Section and ratings of the Italian Navy, who were responsible for supplying the bulk of the labour required.

SUMMARY

A small epidemic of plague occurred in the port of Taranto, Italy, in 1945. At that time there was no effective local health organization to cope with the epidemic and the initial control measures were carried out by the British Army. As military commitments decreased, however, the responsibility was transferred to the Italian civil authorities who worked in collaboration with the United Nations Relief and Rehabilitation Administration (UNRRA).

The first case appeared on 6 September and the last on 29 November 1945 ; altogether 28 cases among civilians and one case among army personnel were notified. There were 15 fatal cases, the case fatality-rate being 51.7%. While the case fatality-rate from bubonic plague was only 6.7%, that from septicaemic plague was 100%. There were no cases of pneumonic plague.

The exact source of infection was not clearly established, but strong suspicion centred on a cargo of rags imported from an unknown place and stored in a shed in the dock area of the town.

Immediately on the notification of the first case a number of precautions were taken, including the burning of the suspect rags, the spraying of DDT in the vicinity, and the putting into operation of an anti-rodent programme based on a system of prebaiting and subsequent poison baiting ; the poisons used were barium carbonate and red squill.

The actual operations of the large-scale anti-rodent campaign were conducted in three distinct stages. During the first stage the city was surveyed to estimate personnel and quantities of materials required and determine the points where baits should be laid. The second stage was devoted to prebaiting with wheat soaked in water for 30 hours and subsequent poison baiting with wheat containing 5% (by weight) zinc phosphide (Zn_3P_2). The object of the prebaiting was to overcome the rodents' fear of unfamiliar objects. During the third stage efforts were made to ensure that even rodents which had become prejudiced to both bait-base and poison bait would take poison when laid again. The bait-base used in this stage was barley and the poison was purified arsenious oxide (As_2O_3).

The various aspects of the anti-rodent campaign are described in detail. The progress of the campaign from the point of view of labour, time, and analysis of results is described and explanatory tables and a chart are included.