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No. 117/25.

S. of S. Circular

SUBJECT.

1924

4th December

Forwards pamphlet on:-

"Rats and how to destroy them"

Indent in 5/10/25

Previous Paper.

~~C.A. 100/2/25~~

MINUTES.

S of S. Circular despatch of 4th December 1924 - Encl (1)

E.E.
Submitted
[illegible]
for C.S.
9 Feby 1925

H.C.S.

Will you please order a copy of this work if funds are available under an appropriate sub-head.

[illegible]

11 Feby 1925.

Hon. Col. Secy.

Will you please make out an indent charging the cost of the book to your vote for incidental expenses [illegible] 18 Feb. 25

Subsequent Paper.

Hon. Col. Secretary,

Indent 336
M.P. I 10/25.

Indent for book on "Rats and how to destroy them" herewith please.

J.G. Deane
Colonial Surgeon.
24/2/25.

Sofs Circular Despatch 15/3/29

Hon. P.M.O.
Veterinary Officer

To see and for any remarks you may have to make

E.R.
Ag. C.S.
10. VI. 29

J.J.M.
11/6/29.

Jhn. 14. VI. 29.

PA. 17. VI. 29

The most complete and reliable work on Rat destruction ever printed, whether in English or any other language. Indispensable to everyone, for all are or should be interested in the extermination of this pest.

RATS

AND

HOW TO DESTROY THEM

DEALING WITH

Rats in a House, Shop, Warehouse, Outbuilding, Yard, Stable, Cow-house, Fowl-house, Pigsty, Garden, Green-house or Vinery; by a River, Stream or Ornamental Water; on a Ship, Shooting Estate, or Farm; and in Sewers

BY

MARK HOVELL, F.R.C.S.

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Extract from S. L. Bensusan's Introduction.

We have a book here by one who is, in the opinion of most of us, the greatest living expert on the subject. The writer is a man who knows every aspect of country life, and every trick practised by the oldest and most cunning buck rat that ever defied trap, snare, ferret, dog, poison, water or gun. Moreover, he has a trained mind and writes with complete authority.

Five and twenty years have passed since first I began to wage war on rats, learning all that many gamekeepers, professional rat-catchers, and a collection of clever dogs could teach me, and even becoming passably expert in trapping. From time to time I endeavoured to rouse general or local interest in the subject with very modest success and it was necessary to admit that certain difficulties of the question lay beyond any solution I could propose. Perusal of the following pages made all things clear. . . . The most complete and reliable work on rat-destruction ever printed, whether in English or any other language.

POINTS OF INTEREST FROM

"RATS AND HOW TO DESTROY THEM."

Dedicated to

THE RIGHT HONBLE. LORD ABERCONWAY, U.K.,

and

SIR JAMES CRICHTON BROWNE, M.D., F.R.S., LL.D., D.Sc., J.P.

SECTION THE HABITS OF RATS—SOME FACTS OF GENERAL INTEREST.

Cause of the prevalence of Rats.

Fecundity of Rats.

One pair and their descendants in 12 months produce 1,130.

If calculation is extended to only 2 months more the number will have reached 3,050.

The number of quartern loaves represented by corn eaten and wasted by Rats.

Two Rats in 6 lunar months eat more than 40½ quartern loaves.

100 Rats eat daily more than 12 quartern loaves.

In 6 months more than 2,034 quartern loaves.

1,132 Rats, *i.e.*, 1 pair and their descendants produced in 12 months will eat and waste **daily** more than 137 quartern loaves, and in 6 months more than 23,029 quartern loaves.

Diseases conveyed by Rats: Plague, Tape-worm, Trichinosis, Infectious Jaundice, Foot-and-Mouth Disease, Equine Influenza, Ring-worm, Mange, Distemper, Rat-bite Fever.

Stoats and Weasels do not attack adult Rats unless very hungry.

For permanently reducing number of Rats, traps must be kept set throughout the year, and someone in authority supervise arrangements made. See Summary.

SECTION TRAPS.

Advantages of a "TERRIER" SIGNAL RUN.

Kills Rat.

Requires no bait

Steel Traps. Only 5 inch Rabbit traps should be used.

"TERRIER" DEATH RUN trap. Reasons why it is the best RUN trap on the market.

Not sprung by jar.

Requires no bait.

BLOCKING trap. One of these traps caught 947 Rats in 3 months. It was admitted that more would have been caught if night watchman had been more energetic.

SECTION SIGNALS.

Necessity for signals for saving time and trouble.

SECTION FERRETS.

Drinking fountain should be kept in hutch.

SECTION MONGOOSE.

Author strongly deprecates the advice given to turn a Mongoose loose in a rat-infested area because it cannot be confined to that area and it is very destructive to poultry. Moreover, it scatters more Rats than it kills.

SECTION DOGS.

The right way to fasten a dog to a post.

Best method of training a dog to ferrets.

SECTION TRAILING.

Trailing might be used more frequently with advantage.

SECTION POISONING.

Reason why Government control for Rat destruction will never be efficient.

Necessity for reducing the number of Rats in a given area before trapping is begun.

The way in which poisons should be laid.

Law with regard to sale of poisons.

Carbonate of Barium, Arsenic, Squill, Strychnine, Phosphorus the best poisons.

SECTION VIRUS.

The disadvantage of killing Rats with Virus.

Proved to be dangerous to human beings and animals.

Rabbits have been found dead from eating Virus laid for Rats.

The rabbits which have eaten an insufficient quantity to cause death may become carriers of microbe and may be subsequently killed and eaten for food.

The danger of distributing the micro-organisms which produce disease.

Statement is untrue that Rats which have eaten Virus communicate the disease to other Rats.

Virus expensive as compared with poisons.

Virus has no destructive advantage which is not possessed by poisons.

SECTION BLOCKING.

A simple and efficient method which is practically unknown for reducing the number of Rats on premises.

SECTION FLOODING.

A simple and efficient method which is practically unknown for driving Rats from their holes under outbuildings and in banks.

SECTION FUMIGATION.

Sulphur the cheapest and best essential ingredient.

SECTION VARNISH AND RAT-LIME TRAP.

Too costly and duration of effectiveness too short to be recommended for general use.

SECTION THE RODIER SYSTEM.

Inapplicable to Rats.

Only Rat-catchers dare to handle a live Rat to determine sex.

A male Rat does as much damage as a female Rat, and probably carries disease to a far greater extent than a female Rat, on account of its roving habits.

The Rodier system as applied to Rats is as follows:—

Rats are to be destroyed by every known method for a year, and after that only the females are to be killed. It follows therefore, that there must be no Poisoning, no Fumigation, no Snaring, no Ferreting or driving Rats from their holes by other methods to be killed by dogs: no use of Steel or Break-back traps, no Rats to be killed when stacks are threshed, so that the capture of Rats is reduced to Blocking and the use of RUN Cage traps, which although extremely useful are not suitable for universal application and are not sufficient alone for trapping on even a moderately extensive scale. If only these two methods are to be employed, Rat capture and destruction throughout the country will be reduced to a minimum.

SECTION RATS IN THE HOUSE, SHOP, WAREHOUSE, ETC.

Methods by which Rats enter a house.

Unprotected cellar windows.

Broken air gratings.

Worn thresholds.

Holes in the wall for floor drains.

Climbing up ivy, etc.

Destruction of Rats in houses, restaurants, hotels, shops, etc.

SECTION RATS IN THE OUTBUILDING.

Method for preventing the entrance of Rats into outbuildings.

Make good thresholds and key with iron when necessary.

Close floor drains with a grating.

Methods for ensuring continual trapping of Rats in outbuildings.

Position in door for the hole for a cat.

SECTION RATS IN THE YARD.

Necessary to keep traps always set.

The way to destroy old inhabitants.

SECTION RATS IN THE STABLE.

Rats prevent horses from sleeping.

Necessary to have a grating over all gutter drains.

Method for clearing the Rats from beneath the loft floor.

SECTION RATS IN FOWL-HOUSES.

Nesting boxes to be made movable and placed well above the ground and in a wooden house not immediately in front of the bottom of the studs.

Arrangement for trapping the Rats which enter fowl-houses from near the roof.

SECTION RATS IN THE PIGSTY.

Methods for making a pigsty rat-proof.

Essential for traps to be kept set throughout the year.

SECTION RATS IN THE GARDEN.

Continuous trapping essential.

RUN trap for keeping rabbits out of a garden secures annually a number of Rats.

SECTION RATS BY THE RIVER, STREAM, OR ORNAMENTAL WATER.

Various methods for trapping Rats in vicinity of water.

SECTION RATS ON A SHIP.

Necessity for systematic trapping of Rats on board ship, and fumigation of ships on their reaching the Home port.

Supervision urgently required at smaller ports for employment of known methods for preventing Rats coming ashore.

Swing door on gangway.

SECTION RATS ON A SHOOTING ESTATE AND FARM.

Game-keepers indifferent to Rat destruction.

Game-keepers should be provided with terriers for Rat destruction.

Cause of slackness of game-keepers with regard to Rat destruction.

Foxes and Rats.

Passage-way for cats around the inside of a barn.

Advisability to fix a rail around all granaries to ensure sacks being kept away from the wall, and thus give passage-way for cats.

Best way to prevent Rats and mice escaping from a stack whilst it is being threshed.

Reason why staddles now in use are ineffectual.

SECTION RATS IN SEWERS.

Method for driving them into a bag.

Trapping.

Poisoning.

Electrocuting.

SECTION SOME NOTES ON PLAGUE.

The manner in which plague is conveyed from Rats to mankind.

Necessity for immediately killing the fleas on a dead Rat in plague-infected area.

Rats as the cause of plague referred to in the Bible.

Roman bronze votive offering.

Rat-eating snakes kept in the Temple of Æsculapius, plague being the most serious disease of ancient days.

A snake-entwined staff, the present-day emblem of the medical profession.

Outbreaks of plague not unusual in British ports.

Reason of comparative immunity of Great Britain from plague.

Danger to crew from plague-infected Rats.

Mortality from plague in India.

Pneumonic plague very fatal and infectious disease.

Part played by domestic animals and poultry in spreading plague.

Excreta of infected fleas contain plague bacillus.

Manner in which the flea spreads plague.

Fleas of the Brown Rat as capable of spreading plague as the fleas of the Black Rat.

Statue of St. Roch in Westminster Abbey.

SECTION SOME NOTES ON CANCER.

Cancerous growths often met with in Rats and mice.

Manner in which Rats become infected with Gongylonema neoplasticum.

Neither tape-worm nor round-worm is the actual cause of cancer.

SECTION COCKROACHES.

Cancer-houses infested with cockroaches, and Rats or mice frequent the premises.

Manner in which new houses become cockroach-infested.

Migration of cockroaches.

Attention to state of bakeries, laundries and kitchens urgently required.

Cockroach poisons.

SECTION MICE.

Trapping mice.

COLIN PULLINGER balance mouse trap.

Prevalence of mice largely due to traps not being kept continually set.

Destroying mice in a garden.

Poisoning mice in a stack.

SECTION SPARROWS.

Sparrows drive away insect-feeding birds.

Means of preventing increase of sparrows.

Sparrow traps.

SECTION CONCLUSION AND RECAPITULATION.

Loss due to Rats probably not less than £1,000,000 per week.

Necessity for legislation to deal with Rat destruction.

Farce with regard to inspection of cattle for tuberculosis.

Destruction of Rats to be placed in the hands of the County Council and not a Local Council.

Revenue to be obtained from Rat destruction.

Object of fines to protect the deserving, not as a punishment for the offender.

Everyone must be held responsible for the Rats on his premises, and they must be killed at his expense if he does not have them destroyed.

Free licenses for dogs used for Rat destruction.

Dog licenses a gross injustice to Rat-catchers.

Official view with regard to Rats' holes.

Necessary to keep traps always set.

All poultry yards and all pigsties should be trapped.

Disadvantage of fumigation with Bi-sulphide of Carbon.

Method for destroying Rats in cities or towns.

Method proposed for preventing refuse heaps becoming a centre for Rats and flies.

All stacks not built on staddles to be threshed before a given date.

Arrangement for providing a sufficient quantity of threshing machines.

Necessity for placing all stacks on staddles which are to be left standing.

SECTION SUMMARY.

Methods for keeping the number of rats at a minimum.

SECTION APPENDIX.

Utilising the Police Force throughout the country for Rat destruction.

Organization and supervision of Rat-catchers.

Rat-pits would induce areas to be kept Rat-infected.

Rat clubs a philanthropic and not a business method.

Payments should be made for a Rat's head, never for a Rat's tail.

A Rat rate would be an injustice and would defeat its object.

SECTION A SCHEME FOR THE ORGANIZED DESTRUCTION OF RATS THROUGHOUT GREAT BRITAIN.

Official control.
Inspection.
Organization.
Rat-catchers.
Bye-Laws.
Fines for non-compliance with laws.
Office arrangements.

PART 2.

Details connected with :—
Manufacture of traps.
Signals.
Snaring.
Making a door suitable for a ship's gangway.
Making staddles unclimbable.
Making expanding frames for catching Rats in sewers.
COLIN PULLINGER mouse trap.

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CIRCULAR.

(1)

Downing Street,

4th December, 1924.

Sir,

I have the honour to request that the attention of the appropriate Departments, and more particularly those dealing with Agricultural and Sanitary questions, may be drawn to the enclosed prospectus of a book on "Rats and how to destroy them," which has been brought to my notice by the Advisory Medical and Sanitary Committee, and which it is thought might perhaps be found useful in combating this pest in the Tropics.

I have the honour to be,

Sir,

Your most obedient, humble servant,

L. S. AMERY.

The Officer Administering

the Government of

CIRCULAR.

Downing Street,

15th March, 1929.

Sir,

I have the honour to transmit to you copies of a leaflet and memorandum regarding the destruction of rats, which have been prepared by the Ministry of Agriculture and Fisheries, and to request that they may be brought to the notice of the medical and agricultural authorities in the territory under your administration.

I have the honour to be,

Sir,

Your most obedient, humble servant,

L. S. AMERY.

The Officer Administering
the Government of

MEMORANDUM.

Red Squill as a Rat Poison.

The Ministry advocates the use of red squill poison in baits intended for the destruction of rats and mice, in preference to other stronger poisons sometimes used, such as strychnine, arsenic and phosphorus. Red squill is particularly recommended for use on farms and in places where, owing to the presence of poultry, live stock, domestic animals or stored food supplies, special care is necessary.

Red squill poison is extracted from the red squill bulb (*Urginea maritima*) which grows on the sandy shores of the countries bordering the Mediterranean Sea. It may be used in powdered or liquid form in baits consisting of bread (or oatmeal), fat, syrup and a few drops of aniseed, or in biscuit or other forms supplied by firms who deal in rat destruction preparations and appliances.

From experiments recently carried out on behalf of the Ministry, the following general conclusions were arrived at :—

(*a*) Female rats are killed by doses of red squill approximately only half as great as those generally needed to kill male rats.

(*b*) The finer the red squill powder is ground the more toxic it becomes.

(*c*) The best red squill baits for general use are those made from a finely ground and completely dried product of the bulb itself.

(*d*) The average lethal dose for male and female rats is, approximately, .50 and .27 grammes respectively.

(*e*) The white squill (used for medicinal purposes) is useless as a rat poison.

A series of experiments was also carried out with calves, sheep, pigs and rabbits, which were given red squill powder in their feed, and, in spite of the fact that they had been given no other food for the preceding 24 hours, it was found almost impossible to induce the animals to eat any appreciable quantity of the poisoned feed. It would appear, therefore, that on the grounds of palatability alone, there is little danger of such animals eating a sufficient quantity of red squill baits to cause ill effects. In those cases where the animals were induced to take the poison, it was found that unless a considerable quantity of the poison was consumed no ill effects were noticed. Experiments with fowls showed that they took

the poison more readily, but even then it was found that to kill a fowl required a dose between 20 and 30 times as large as that necessary to kill a rat.

These experiments appear to show that, while fatal to rats, red squill poison is comparatively harmless to larger animals, and Rat Officers are urged to consider the desirability of using preparations containing this toxic agent, particularly in those cases where domestic animals and poultry are kept in the vicinity.

Ministry of Agriculture and Fisheries,
10, Whitehall Place,
London, S.W.1.

1*st August*, 1927.

Form No. A. 494/L.P.

(2187) Wt. 6549—0309. 500. 7/28. Wy. & S., Ltd. Gp. 2.

MINISTRY OF AGRICULTURE AND FISHERIES.

The Destruction of Rats.

Under Section 1 of the Rats and Mice (Destruction) Act, 1919, it is a statutory obligation upon the occupier of land or buildings to take such steps as may, from time to time, be necessary and reasonably practicable for the destruction of rats and mice, on or in such land or buildings and for preventing such land or buildings from becoming so infested. In default the occupier is liable, on summary conviction, to a fine not exceeding £5, or, where he has been served with a notice under the Act requiring him to take such steps, not exceeding £20. The Local Authorities responsible for the administration of the Act are County Councils, County and Metropolitan Borough Councils, Port Sanitary Authorities and the City of London, and, where powers have been delegated, the District Councils. If, after taking all steps possible, an occupier is unable to clear his premises, or if he is of the opinion that the source of infestation lies outside his control, he should communicate with the Local Authority concerned.

Two kinds of rats are found in Great Britain: the Black Rat (*Rattus rattus*) with a variety named *Rattus r. alexandrinus* which has developed a harsher fur and darker belly; and the Brown Rat, sometimes called the Hanoverian, Field, or Sewer Rat (*Rattus norvegicus*). A black race of this latter species is found in Ireland and has been named *Rattus hibernicus*. The Black Rat, which has been longer established in this country, is the more common carrier of the plague and is, in some places, increasing in numbers. It is the smaller of the two and is more lightly built, but its ears are slightly larger and it has a thin tail eight or nine inches long, or about an inch longer than the rest of its body. The upper part of its fur is of a grey-black colour, the under parts being a dark grey. The brown rat is generally longer in the body, but shorter in the tail, which is never as long as the head and body combined. It has a blunter muzzle, and its fur is grey-brown above and white below. The fur of the brown rat, moreover, is rather coarser than that of the black rat.

The females of both species breed at a very early age, and although they go with young for from three to four weeks they have several litters in the year, each litter comprising

from six to fourteen young. Rats, therefore, increase in numbers very rapidly if sufficient food is available.

Damage done by Rats.—Rats are omnivorous feeders, but they are by choice dependent on the food supplies which man prepares for himself and his domestic animals, or on the waste of such food. They accordingly frequent dwelling-houses (the brown rat generally only the lower floors), barns, granaries, poultry yards, slaughter-houses, sewers, and other places where food supplies are stored, or the waste is thrown away. They also frequent rabbit warrens, and take to the fields when food is to be found there, returning to shelter and to live in corn stacks in the autumn.

Apart from the food consumed by rats, much damage is done to buildings, floors, and all kinds of woodwork from their power of gnawing holes and passage ways. It is also known that rats are responsible for spreading plague to human beings by means of fleas from infected rats, and for spreading animal diseases such as trichinosis. It is, therefore, highly desirable, both from an economic and a sanitary point of view, that rats should be destroyed.

Preventive Measures.—A number of measures may be adopted to prevent damage by rats, and to discourage their presence and prolific breeding by cutting off all food supplies. Among these measures may be mentioned:—

(*a*) Building corn stacks on staddles, and granaries on rat-proof piles, or, in the case of stacks, protecting them with rat-proof fencing. Rat-proof piles may consist of stone piers surrounded by a wide-inverted pan or saucer-shaped rim of tin sheeting; the piers should be 3 to 3½ feet high, with the protective rim near the top.

(*b*) Rendering buildings as rat-proof as possible, by means of concreted foundations, brick-work laid in cement, and galvanized iron sheeting. Floors of buildings should be made of, or laid directly on, concrete.

(*c*) Proper construction, protection and repair of drain pipes, ventilators, and basement windows, so as to make each dwelling or building as far as possible rat-proof. Basement windows may be protected by a covering of heavy galvanized wire netting of one-half inch mesh. The lower parts of the doors of buildings may usefully be covered with thin metal sheeting.

(*d*) The use of concrete or metal grain and meal bins in stables and elsewhere. The angles of wooden receptacles already in use should be covered with tin sheeting, or the whole receptacle should be covered with heavy, galvanized wire netting of one-half inch mesh.

(*e*) Burrows under floors or in walls from which rats have been driven should be filled with concrete, a mixture of cement, sand, and broken glass or crockery, or a mixture of broken glass and tar.

(*f*) The disposal of garbage, refuse and waste food, so that it is not available for rats: this is particularly important on the farm, in slaughter-houses, and in factories. Garbage and refuse of all kinds which might form food or shelter for rats should be burnt or kept in rat-proof receptacles pending disposal. Waste food should not be left in stables, cow-houses or poultry runs. This is a point to which great attention should be paid, as food left about in this way forms one of the principal attractions to rats in farm buildings and stables. *It should be recognized that the existence of rats is strictly dependent on the food they are able to obtain and that they will not remain or increase in places where food is not easily procured.*

Rubbish heaps, and all places which may afford shelter for rats to breed, should be cleared away if possible. Stores of old materials should be frequently moved and examined and kept thoroughly clean and tidy. Receptacles for refuse should be covered, and preferably constructed of metal. Steps should be taken to kill rats in Municipal dust heaps and sewage farms, and such steps should be repeated at regular intervals.

(*g*) Ships should have efficient rat guards properly attached to mooring ropes when in port. The captain of a vessel is responsible for taking reasonably practical steps for preventing the escape of rats and mice from his ship whilst in a British port.

(*h*) Protection, where practicable, of the natural enemies of rats should be given. In rural areas the *natural enemies of rats* are numerous, and in considering the prevalence of rats, these enemies are deserving of every recognition. Owls, hawks, buzzards, ravens, seagulls, stoats, and weasels, are all enemies of rats, mice and voles.

Remedial Measures.—The various methods employed in the destruction of rats may be grouped under four heads:—(1) *hunting;* (2) *trapping and snaring;* (3) *the use of poisons;* (4) *gassing.*

(1) *Hunting.*—Ferrets are frequently employed to cause rats to bolt from their burrows to be killed by dogs or with sticks or a shot gun.

Threshing operations provide excellent opportunities for destroying large numbers of rats. Each stack, before the threshing machine arrives and while being threshed, should

be surrounded by a rat-proof fence, 4 ft. in height and slightly sloping towards the rick, and at a sufficient distance from the rick to prevent rats jumping over it from the rick. Rats, although they may be able to run or climb up this fence, cannot jump over it from ground level, and may be killed by dogs, or with sticks, &c.

In stack yards, stables and granaries, the flashing at night of a powerful light such as that from an acetylene or motor lamp has the effect of temporarily dazing rats and gives a dog an opportunity to kill several, before they recover and escape.

(2) *Trapping.*—Many types of trap are employed with success. These include the spring trap, which kills the rat at once when the spring is released, after the manner of a guillotine; the ordinary steel gin or toothed spring traps, which, however, may not only prove a source of cruelty, owing to rats being left in them for hours, but are unsatisfactory because the squealing of the animal in the trap gives warning to other rats; the wire trap, on the eel-basket principle, which the rat can enter easily when attracted by the bait but cannot leave; the snare; sunk pit or well traps; the large barrel traps with hinged covers, which tilt under the weight of a rat, and are brought back to position by a counterpoise; the break-back trap; the varnish or rat-lime trap.

In the last-named type of trap, strong lithographic varnish or rat-lime is used. This is suitable for all ordinary places, but a stronger varnish should be used in very hot kitchens, boiler-houses, &c., where steam is kept up all night. One pound of varnish or rat-lime is sufficient to make six traps 15 in. by 12 in. If the varnish is too thick to spread easily, it should be warmed by placing the container holding it in boiling water. After warming, it will run, in which condition it should be spread to a thickness of $\frac{1}{16}$th to $\frac{1}{8}$th of an inch over stout cardboard, using a painter's stripper or other suitable tool. The cardboard should measure about 15 in. by 12 in. and should have a margin of an inch left free from varnish. The bait should be placed in the centre where it will adhere. The traps should then be placed along the "runs" or near the rat holes, and in infested places should be laid nightly so long as rats continue to be caught. In the case of a hole in the floor, a good plan is to cut out a hole in the cardboard rather larger than the hole in the floor and to place the cardboard so that the varnish or rat-lime entirely surrounds the hole. It should be noted that chickens and young animals other than rats and mice are liable to be caught on varnish or rat-lime traps, and care should be taken to prevent this.

Such a trap is effective for about four days, when, if varnish be used, the old varnish should be scraped off and fresh applied. With rat-lime traps, however, the old lime should not be scraped off, but a little fresh lime should be added and stirred in. Varnish is useless in wet places or where there is much fine dust.

It should be understood that the experience on which these recommendations are based was gained entirely within premises. Practically no opportunity afforded itself for outside investigations. Attention is drawn to the following possibilities of failure outside:—

(*a*) If the feet of the rat become covered with moisture the adhesive matter will prove not sufficiently holding.

(*b*) If the varnish or lime trap is laid in a current of air, the draught may cause a hardening of the surface of the adhesive substance which will prevent the feet of the rat sinking in sufficiently deeply to hold.

It should always be borne in mind that the baits used for rats should be of a different type from the food the rats usually obtain, and that a change of bait is sure to be of value. For example, in fish shops meat, cheese or bread should be used; in grain stores, warehouses or restaurants, bloaters, red-herrings or cheese are effective.

(3) *Poisons, &c.*—Rat poisons are sold throughout the country by chemists, oilmen and grocers, and proprietary poisons are advertised in agricultural, trade and general newspapers. Many of these consist of a phosphorus paste. Baits containing barium carbonate or red squill, either as bulb, powder or liquid extract, are suggested by the Ministry, and if used as directed, and with proper precautions, are less dangerous than baits containing such poisons as arsenic, strychnine and phosphorus. *It should be noted, however, that Barium Carbonate is now a scheduled poison, and baits containing this preparation can be purchased only through a chemist or druggist.* Red squill is the safer, and it is advisable to use it in preference to other toxic agents for application on farms and in places where special care is necessary owing to the presence of poultry, live stock, domestic animals or stored food supplies. Owing to the peculiar chemical nature of red squill in its various forms, as sold for the destruction of rats and mice, users of these preparations should satisfy themselves that they obtain guaranteed toxic red squill raticides.

When using barium carbonate baits, special care should be taken to prevent domestic animals or poultry gaining access to the laid baits, otherwise fatalities may occur.

The following recipes are recommended as easy to prepare and effective in use:—

Barium Carbonate Baits.

1. Barium carbonate powder ... ... 1 part by weight
   Cheese grated (or mixed kipper) ... 1 part „
   Dripping ... ... 1 part „
   Fine oatmeal ... ... 1 part „
   Melt the fat, and mix it thoroughly with the dry ingredients to form a thick paste.
2. Barium carbonate powder ... ... 1 part by weight
   Rolled Oats ... ... 2 parts „
   Dripping ... ... 1 part „
   Prepare as for No. 1. *Note.*—In summer rather less fat should be used.
3. Barium carbonate powder ... ... 1 part by weight
   Fine oatmeal ... ... 2 parts „
   Castor sugar ... ... 1 part „
   Rub all the ingredients through a fine sieve and mix well.

A very slight flavour can be imparted by adding a trace of aniseed oil, and is an additional attraction. In using the above recipes the quantity to be used for each bait is one small teaspoonful for rats and half this quantity for mice.

The baits can be laid wrapped in small twists of tissue paper.

Red Squill Baits.

1. Red squill powder ... ... 1 part by weight
   Fine oatmeal (or rolled oats) ... ... 2½ parts „
   Dripping ... ... 1½ parts „
   Melt the fat and mix it thoroughly with the dry ingredients to form a thick paste.
2. Red squill powder ... ... 1 part by weight
   Fine oatmeal ... ... 2 parts „
   Castor sugar ... ... 2 parts „
   Rub all the ingredients through a fine sieve and mix thoroughly.
   Baits of similar quantities should be used as described for barium carbonate.

Liquid extract of red squill can now be obtained through any local chemist, and if directions for use are not supplied therewith, add some of the mixture to an equal quantity of boiled and cooled milk, and steep sufficient bread in the mixture to form a thick paste. Lay the bait in saucers or tin lids in places frequented by the rats. If the extract is not readily procurable, a very good substitute can be made by simply mixing red squill powder into thick bread and milk, using 3 or 4 ounces to every pint of milk. When using poison baits, it is well to treat liberally at the first application, and to lay at least 10 times as many baits as the number of rats estimated to be present, *i.e.*, for 10 rats lay 100 baits. It must be remembered too that rats are very suspicious, and if they find any number of their fellows die after eating any kind of food, they will avoid such food for some time. It will be as well, therefore, to vary the form and appearance of the poison bait at intervals. Thus, after using poisoned bread for a while, oatmeal, carefully treated, may be used.

Apart from the risk of a possible prosecution under the Acts which deal with the use of poisoned grain, meal, or meat, it is necessary when using poisons to take precautions to avoid injury to other animals or to human beings, for no rat poison, however "safe," can be regarded as absolutely free from all risk of poisoning other animals if they eat sufficient. The Protection of Animals Act, 1911, which restricts the use of poisoned matter, provides that it shall be a defence that the poison was placed by the accused for the purpose of destroying rats, and that he took all reasonable precautions to prevent access thereto of dogs, cats, fowls, or other domestic animals.

In any case, poisoned baits should be laid only by authorized and responsible people. The whereabouts of the baits should be carefully recorded, and they should be visited regularly and destroyed if not taken within a short period. The strictest precautions should be taken to prevent the baits being eaten by domestic animals, and, if necessary, notices should be exhibited in places where baits are laid, to warn people to keep dogs or other animals away from the place. When poisoned baits are laid by a Rat Club or other organization, it would be well to insist that each group of baits should be numbered, and its situation, success, or failure and ultimate destruction recorded in a book.

Rat viruses consist of cultures of microbes causing intestinal diseases in rats, which in some cases at any rate are infectious, the infected rat conveying the disease to his fellows through fouling their nests or food. The uncertainty with which this method is attended is due partly to the difficulty of securing a successful infection in all cases, and partly to the fact that, if only slightly infected, rats recover and thereafter become more or less immune to the disease. Apart from these objections there is a risk of human beings becoming infected, and for these reasons the employment of virus is not recommended.

The warning as to the use of poisoned baits applies equally to the employment of rat viruses, and it is important to avoid contamination of any material likely to be used for food by the virus or the droppings of the infected rat.*

(4) *Gassing.*—In banks, hedgerows, rubbish tips and in other place in the open, gassing may often be employed in order to destroy rats and, in the hands of skilled operators,

* An outbreak of enteritis among the employés of a large business establishment in London, attributed to the use of these viruses in the building, was reported on by Drs. Handson, Williams, and Klein in 1909. According to Dr. Hans Wreschner, several cases of death and many cases of illness in human beings are on record, caused by using bacteriological preparations for killing rats and mice.

it has proved efficacious. It is not, however, generally suitable for use in dwelling-houses, or in places where food is stored, or domestic animals kept, unless great care is exercised. For burrows in the open—hedgerows, banks, open sheds—carbon bisulphide may be employed. Owing, however, to the comparatively high cost of this chemical, its use in England is not general. A large wad of cotton wool, rags or similar absorptive material should be soaked with the liquid, at once inserted in one of the main burrows, and the outlets and inlets closed up. The liquid evaporates, permeates through the burrows and asphyxiates the rats.

In using the bisulphide care should be taken not to inhale it freely or in a confined space, as it is poisonous. The gas is highly inflammable, and therefore no naked light should be brought near it: the operators should on no account even smoke. Acetylene, generated from calcium carbide, can, with care, also be used, and, in many cases, the exhaust fumes from any petrol engine prove effective.

In recent years much thought and ingenuity have been applied to the construction of portable gassing machines, and the use of chemical agencies which generate gases that speedily kill rats. As a result, several machines have been placed on the market which are simple in construction and easy to use.

The materials which generate the gas (usually a sulphurous gas) are often contained in rocket cases, which are inserted in the machine, and ignited. The process of combustion generates the fumes, which act quickly.

Most of the rockets continue burning and generating gas for about 20 minutes, thus enabling the operator to gas a considerable area at a comparatively small cost.

Recent experiments have been made with calcium cyanide dust for fumigating rat runs. The dust is blown into the holes of the runs with a special "dusting" machine, and the moisture of the soil, acting on the powder, generates hydro-cyanic acid gas. Owing to the great toxicity of the gas so generated, the utmost care is necessary in the use of calcium cyanide.

Further information on the various types of apparatus and materials used for gassing rats can be obtained, on application, from the Ministry of Agriculture and Fisheries.

Gassing has the advantage of killing both large and small rats at a minimum cost, and the fumigated burrows, if not immediately destroyed, will not be used again for some time.

Deodorants.—If by mischance a rat should die in such a position that its carcass cannot be recovered without trouble, and a stench results, chloride of zinc will be found a good

deodorizer, and combines with and neutralizes the offensive chemical products of putrefaction. If possible, a hole should be bored with a bit and brace in the vicinity of the supposed origin of the odour. Some perfume or pinewood oil can be added to the zinc chloride, which should be applied through the hole. A cork will close the orifice, and can be withdrawn from time to time to ascertain whether the nuisance has abated.

Nitrate of lead (half a dram mixed in one pint of boiling water, added to a pail of cold water in which 2 drams of common salt are dissolved) makes a deodorant solution. A large cloth should be saturated in this solution and hung in the room in which the smell is prevalent.

Ordinary disinfectants such as lysol and carbolic acid powders can also be used for this purpose.

Deterrents.—In many cases the use of deterrents which tend to make the surroundings distasteful to rats is often very desirable, particularly in such places as slaughter houses, refuse dumps, and in any accumulations of trade waste materials. A cheap and effective deterrent which can be applied in such cases is iron sulphate (green vitriol), which is a cheap waste product of modern gas works. The method of preparation is to dissolve one handful of the sulphate crystals to each quart of hot water (or 1 cwt. to 40 gallons). In addition a teaspoonful of crude carbolic acid may be added to this quantity of the solution, and the mixture can be made in large quantities and used very liberally. For the systematic treatment of freshly deposited household and trade refuse the deposits should be thoroughly moistened with the solution by means of a watering-can with a rose. If the solution is used liberally, especially in spring, it has the effect of destroying the maggots of the house fly in addition to making the potential food supplies of rats obnoxious. For use inside buildings the solution should be applied through a funnel into the holes in floorings and skirtings of rooms. In addition the woodwork and masonry in places frequented by rats should be painted with the solution. In order that the material so treated should become thoroughly impregnated with the mixture it may be necessary to apply several coatings, but eventually the rats will gradually avoid the premises. In some cases the use of the liquid is not practicable, and in these instances a liberal dusting of powdered iron sulphate will be found effective in keeping rats away from the places so treated.

Other deterrents which can be used are silicate of soda (water glass), or a mixture of gas water and creosote on rags. Naphthalene, camphor and wild mint placed in sacks of seed corn tend to keep rats and mice at bay.

Warning to Poultry Keepers.—Poultry food, eggs and young chicks attract rats. The following points are therefore repeated and emphasized for the benefit of poultry keepers:—

Prevention (*see* pp. 2-3).—(1) New houses and chicken coops should be made rat-proof as far as possible. (2) Food should be kept in rat-proof receptacles.

Destruction.—Old houses can seldom be made rat-proof. Rats must therefore be fought by every method, but special precautions are necessary.

(1) Poison (*see* pp. 5-7).—Preparations containing red squill are probably safest. Recent experiments have shown that it requires about 20 times as much red squill to kill a fowl as to kill a rat. If barium carbonate be used, special care must be taken to ensure that poultry cannot gain access to it, since a sufficient dose will kill poultry. Preparations containing phosphorus, arsenic or strychnine should be avoided, as a very small dose will be fatal to any bird or animal.

(2) Gassing (*see* pp. 7-8) must be employed with great care wherever food is stored.

Need for Combined Effort.—The destruction of rats is essentially a matter for local effort, but local effort does not necessarily mean isolated or unsystematic effort. In many places it is true that rats can be kept down by cats, traps, and occasional rat hunts, and this is the case in most dwelling-houses, especially if the kitchen and outhouses are kept in a clean and tidy state so that the rats find it difficult to procure an abundance of food and provided also that drains and buildings are in good structural repair. It is also true of many farms where the buildings are well kept; but in other cases on farms, or in mills, malt-houses, and other establishments where large supplies of food are stored, especially where several such buildings stand close together, combined effort is essential. The occupiers of a group of farms or buildings should therefore join together with a view to a systematic attempt to *exterminate* the rats over as large an area as can be conveniently dealt with.

For this purpose, reliance should not be placed on any one of the methods referred to above, but as far as is possible *all these methods should be employed.* A combined effort should be made simultaneously, the attack in each instance commencing on the boundary and working gradually towards a central spot, such as a group of ricks, where is is considered that the final work of destruction can be accomplished with least difficulty. Every precaution should be taken to see that no rats escape outwards. Their holes should be closed, and

their runs and nests destroyed as the cordon is gradually drawn closer.

In the case of large districts, a number of adjoining areas such as that described above might usefully be mapped out and dealt with simultaneously. Circular D.R.1 (copies of which can be obtained on application to the Ministry of Agriculture and Fisheries) describes the organizing of such a campaign.

Mice.—When rats are being attacked, mice should not be neglected, as they are rats in miniature and are also very harmful. The remarks as to keeping foodstuffs in stores and dwelling houses as far as possible in vermin proof receptacles, and generally as to preventing access to food which offers attraction, apply equally to mice. A good cat, if given only a little milk, will soon clear ordinary premises. Mice are more readily caught in traps (baited with toasted cheese or fat bacon) than rats. The traps should be kept scrupulously clean by frequent immersion in boiling water. Poisons to be used should be applied most cautiously and in portions no larger than a small haricot bean. Barium carbonate prepared with a suitable bait is one of the most suitable poisons. Several proprietary articles sold for the destruction of mice contain strychnine or phosphorus. If such preparations are used in larders or stores, great care must be exercised to prevent contamination of food. After laying poison all mouse holes should be stopped with a suitable substance. A very good material to use for this purpose is a paste consisting of equal quantities of barium carbonate and dripping well mixed. This causes mice to take a poisonous quantity while trying to nibble their way out. A piece of paper should then be pasted over the hole to prevent domestic animals getting at the bait. Mice should not be encouraged by being permitted an opportunity of eating seeds thrown by birds out of their cages.

Field Mice may be destroyed with preparations containing barium carbonate, or, under safe conditions, a phosphoric or arsenical preparation. The same precautions as those advocated for rat destruction are necessary.

Voles will take poisoned meal, and as their runs are often in light sandy soil and better suited for gassing, carbon bisulphide or sulphur-dioxide will often effect a clearance.

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