Present Status of Warfarin As A Rodenticide

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Warfarin presents a completely new approach to the control of commensal rodents. It was discovered by Link and his students (3,4) who later recognized its rodenticidal potentialities (5). The material is actually 3-(α-acetonylbenzyl)-4-hydroxycoumarin. It was known for some time as compound 42 or W.A.R.F.-42. Under these names it received experimental registration and was tested rather extensively. In June 1950, it was registered for general use, and in the same month a common name, warfarin, was adopted for it. This paper attempts to portray our present knowledge of how this new material fits into the over-all picture of rat control.

Warfarin acts by inhibiting the formulation of prothrombin and by causing capillary damage. Both actions favor the production of hemorrhage, and animals killed by warfarin die from blood loss and shock. Bleeding may occur in any part of the body. The distribution apparently is determined largely by chance, and very minor trauma which under ordinary circumstances would be harmless. In rats, hemorrhages are observed beneath the skin, in muscle septa, within muscles, in the intestines, in the lungs, or retroperitoneally. Any one animal usually shows hemorrhage at a single point or, at most, at a few points. Because of the bleeding, animals poisoned by warfarin gradually develop pallor and weakness. A few of them show external bleeding, but in most of them the actual hemorrhage is not apparent.

Warfarin differs from all previous successful rodenticides in that it must be consumed on several successive days in order to kill, and it produces no acquired bait refusal (bait shyness). These characteristics make it self-prebaiting and adapted to residual control. On the other hand, they make it a slow rodenticide.

Reports already published show that warfarin may be used successfully for the control of mice as well as Norway and roof rats. Early reports by Crabtree (1) and Schein (6) showed that control could be achieved with rather high concentrations of warfarin in bait and suggested baiting practices and schedules which were effective. Hayes and Gaines (2) showed that the material was effective against Norway rats at lower concentrations (0.05 milligrams per gram or 0.005 percent). Thus far, control of roof rats has been achieved with 0.25 milligrams warfarin per gram of bait. Actually, the lowest concentration of poison in bait which will give effective control under actual field conditions has not yet been determined for any of the commensal rodents of public health importance. However, it is possible to obtain control by the concentrations just listed. Further experimental work needs to be done to determine the lower limits of effectiveness. Baits containing lower concentrations of poison would be somewhat cheaper and present slightly less hazard to man and domestic animals. However, the cost of finished bait containing 0.1 milligram of warfarin per gram of corn meal is only $8.25 per hundred pounds** and even with higher concentrations of poison (0.25 milligrams per gram) no actual difficulty with toxicity to man or domestic animals has developed yet in spite of rather extensive field trials. What probably will determine whether warfarin can be used economically as a rodenticide for public health purposes is not the cost of finished bait but the cost of protective bait stations and the cost of labor of those who actually carry out the poison-

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**Based on $4.05, the present cost of 100 pounds of corn meal to the government, and $2.15, the current cost per pound of 0.5 percent formulations of warfarin in 5-pound lots.

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ing program. So far, the experimental work has been done using protective stations for all bait placements that were accessible to children or domestic animals. Even the simplest station costs about $1.30, provided new material is used and labor is estimated at current pay scales. Thus, the cost of materials for initial poisoning for a single establishment has been estimated at about $0.46 for finished bait and $11.23 for bait and stations. Further work will be necessary to determine whether the use of many or all bait stations may be dispensed with. In the meantime, warfarin is effective for the control of commensal rodents and is economically feasible under certain circumstances. On farms and around private residences, satisfactory bait stations may be improvised of scrap materials at essentially no cost. An 8- or 10-inch board 2 or 3 feet long placed on edge and nailed against the wall and floor at about a 45° angle to form a tunnel makes a good station. On ships that do not carry children as passengers, no bait stations are required if the poisoned bait is colored and each placement is marked "POISON." Similarly, in warehouses and certain other business establishments where it is possible to warn all personnel that have access to the building, it may be possible to dispense with bait stations and simply use colored bait and prominent warning signs. Even where it is necessary to use bait stations, it may be feasible economically for rodent control units either of governmental agencies or of commercial pest operators to invest in a stock of bait stations. These stations are, after all, quite durable and, if poisoning should be carried out over a period of months and years, then the initial cost of the stations can be considered a part of the long-time operating cost.

At the present time, then, warfarin offers a form of residual rodent control previously found impossible. This control may now be obtained at a reasonable cost under certain conditions. Further experience is needed greatly to determine whether it is feasible economically to use warfarin under the general conditions existing in public health work.

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International Cooperation

CDC's cooperation with other countries has been pointed up again, with the Western CDC Laboratory at San Francisco, Calif., aiding a Canadian provincial health department in June of this year.

The Saskatchewan Provincial Department of Health, Division of Communicable Disease, sought instruction in Public Health Service field methods for a crew doing survey work on ticks and plague-infected wild rodents.

When a Western CDC Laboratory field unit was operating in Bottineau County, N. Dak., June 18-30, the Saskatchewan field unit spent 2 days studying the methods used by the Service.

Personnel of the Saskatchewan unit – representatives of the University of Saskatchewan Department of Biology – were instructed in hunting, trapping, mass fumigation with cyanide, collecting ectoparasites, animal autopsy, pathological signs of plague, record keeping, and mailing of specimens.

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