PRESENT STATUS OF THE RAT PROBLEM ON THE SUGAR-CANE PLANTATIONS OF HAWAII*

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Four kinds of rats, *Rattus rattus rattus* (Linn.), *Rattus rattus alexandrinus* (Geoffroy), *Rattus norvegicus* (Erxleben), and *Rattus hawaiensis* Stone, live in our cane fields and chew our cane. The total tonnage of sugar which they destroy and the monetary losses which they cause the industry cannot be accurately estimated from the meager statistical data which have been developed over the years, but unquestionably the losses are great. Most of our plantations consider them so and endeavor to reduce them. The yearly amount which is spent in the cause is partly obscured by inaccurate or incomplete accounting, but it has averaged well over $300,000 per annum during the last 3 years. Because of increased concern with the problem, and because of rising labor and material costs, this figure can be expected to increase in the future.

It is this writer's opinion that if such a considerable sum is to be spent wisely and with the greatest returns possible, marked improvement will have to be attained in the rodent abatement practices of even our most progressive plantations. Improvement will have to come primarily through increased care and effort on the part of each individual plantation, rather than as a consequence of extra-plantation research on the improvement of baits, poisons, and methods of application. Research, of course, is advisable and is continuously in progress both in our own Station and in many other scientific centers of the world. The results of research, however, cannot be applied blindly in the field with reasonable expectation of success, or at least without expectation of unnecessary waste. The history of rat abatement in the industry shows that our plantations in the past, and to a large extent the present, have neglected to recognize this truth.

The neglect is amply evident in the dearth of data on each plantation in regard to its own particular rat problems. The situation has improved of late but it is still true that most of our plantations possess only a hazy notion—or no notion at all—of the species of rat predominant in their fields, of the distribution of the species in the various regions of the plantation, of their periodic population fluctuations, of the actual amount of damage which they cause, of the money which is, has been, or should be spent in control measures, and lastly of the results—if any—which are obtained by these measures.

Obviously there is room for more improvement; and the writer believes that improvement will not come until a basic misconception which hampers rat work everywhere is rectified. This is the misconception that rat control is easy and can be accomplished on the basis of a few generalizations arrived at from observations made elsewhere or dreamed up comfortably in a swivel chair. This is definitely not the case. Rats, like even the simplest of living beings, are wondrously complicated organisms, and their complexity is reflected in the behavior of their populations. Even if

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only one species of rat existed in Hawaii and all the members of the population were large and exposed to view, as cats or dogs are, the problems involved in its control would still be difficult. With our 4 species, and with their cryptic and varied habits, the difficulty is multiplied many times; and then multiplied again by the extremely diverse ecology of our plantations.

It behooves our plantations to recognize these facts and to realize that their own individual problems cannot be solved elsewhere, but only through their own effort, by their own men, and in their own fields.

Firmly convinced of this, the writer has constantly campaigned since 1955 for the establishment on each plantation of a rat abatement organization capable of guiding and evaluating its own practices in accordance with its own particular needs and conditions. The recommendation has been well accepted in principle, but in practice only three of our larger plantations, two on Kauai and one on Hawaii, are presently operating such organizations.

On these 3 plantations, the abatement organization is a division of the department of agriculture, as has always been the case in the past; but on 2 of the 3 plantations the actual management of the division has been made the responsibility of an independent supervisor, who has become, from the nature of his job and responsibilities, the key to the present and future success of the program. This man is not only responsible for the efficient and honest day-to-day running of all operations but, more important, he is required to develop, analyze and properly present at reasonable intervals of time the accumulated data from which the progress and the success or failure of the program are to be judged.

As the control programs are based on the exposure of anticoagulants, about equally divided at present between Warfarin and Ratafin, and other poisons in rolled oats, a large and important part of the data to be accumulated is simply measurements of the “take” or consumption of bait. If these measurements are done carefully and with sufficient correlation to time and place, many essential facts about the distribution and fluctuation of rat populations can be derived from them.

Other facts can only be ascertained by actual trapping of specimens, and on the 3 plantations in consideration large-scale trapping is conducted in a routine and standardized manner. This is done by means of ordinary household snap traps which are laid in “lines” of 100 or more and are always baited with fresh coconut and “read” on 2 successive days, being reset on the first day, if this is made necessary by their being snapped without capturing a victim. The rodents trapped, including mice and mongooses, are all carefully identified and recorded as to sex, species and degree of development, and from the catch there are developed indices of population which are expressed in terms of animals per 100 trap days. The accumulated data is expected to yield in time very important and badly needed information, related not only to the practical and immediate aims of the abatement programs but also to the biological and ecological facts which make rat control necessary and underlie its cost and difficulty.

Of the many questions which the new plantation programs are expected to help elucidate, the most urgent and interesting have to do with the development of Norway rat populations in the cane fields. Present findings already corroborate the long-held belief that this species is the most destructive to cane and that large populations of it develop as a rule only in cane fields and areas immediate to them. It is hoped that
when sufficient data is accumulated, we may be able to correlate the unexplained development of large populations with the cyclical abundance of some specific source or sources of protein, and that through the elimination of these sources we may be able to attain a cheaper and more complete control of *Rattus norvegicus* than we can by poisoning the animals themselves.

If such a basic and highly desirable approach to the problem should not prove feasible, it is probable that the rising cost of manpower will eventually drive our plantations to the distribution of rat poisons by aircraft. And in this connection, also, the new plantation programs are expected to serve an essential and unavoidable role, for the application of poison baits by aircraft is itself so expensive that it cannot afford to be wasteful, and wastefulness will not be avoided unless and until increased knowledge of rat biology and ecology enables us to apply the baits at the proper time and place. This Station has been working on the development of appropriate baits for aircraft distribution, and at least 2 such baits are already available for use; but a number of experiments on Hawaii and Kauai have shown that the possession of a good bait is not enough and that the accurate timing and placing of an application will always constitute the essence of its success. Accuracy is not possible without thorough understanding of local conditions, and that understanding cannot be developed without a great deal of work and the continued cooperation of all concerned.

**DISCUSSIONS**

of the papers by J. W. Doty and F. A. Bianchi

Note: Unfortunately, the tape recordings of the discussions following the presentation of these 2 papers were garbled. The meeting was well attended and the discussions prolonged and profitable. Among those who participated in the discussions were F. A. Bianchi, R. E. Doty, C. W. Waddell, R. H. Farquhar, M. V. Lacson, J. P. Sexton, D. T. Silver, R. Toyofuku, J. L. Chalmers and W. R. Smythe.

Areas covered in the discussions were bait shyness, problems involved in the application of poisoned baits from airplanes, possibilities of control through sterilization and liberation of males by radiation, effect of poisons on bird life and danger to human populations on plantations. Other subjects covered the various species of rats damaging cane in several countries and methods of measuring economic losses to rat-damaged cane fields. Mr. Bianchi particularly stressed the need for greater care and attention to the application of poisons, the evaluation and distribution of rat populations within cane fields, a thorough study of the ecology of the different species and the handling of such work by qualified persons on a full time basis.