POISONING RODENTS—AND THEN?

IN a recent Associated Press dispatch I was accredited with the unqualified statement that the grasshopper "plague" of the past summer, in parts of the Middle West, was attributable to the virtual elimination of rodents over large areas as a result of concerted poison campaigns. The error which I wish to correct was the failure to quote my original statement that the occurrence of such plagues of insects is one of the results to be expected from rodent elimination. Every biologist, of course, realizes that the factors determining the occurrence of grasshoppers in unwonted numbers are exceedingly complex. Doubtless there are dozens of partial checks rather than a single controlling agent. If there be added an item favorable to their increase, or if there be subtracted one that is unfavorable, there will be just that many more grasshoppers, but no one can predict with reason whether the increase will be one or a thousand per cent.

Certainly the majority of rodents are partially insectivorous. At least some, and presumably all, of the western ground squirrels are very fond indeed of catching and eating grasshoppers. In the treeless parts of the West where insectivorous birds are scarce it is likely that rodents constitute the greatest active check (as contrasted with parasites, disease and adverse meteorological conditions) with which grasshoppers have to contend. But of course this has not been proven, for no extensive investigation has been made to determine what part rodents play in the destruction of harmful insects.

I venture to state that it is universally believed by biologists that as rodents are now being virtually exterminated over large areas by means of poison, their places will be taken by other, and possibly more destructive, forms of life. In a communication to Senator Walcott during 1930 I predicted that the continuance of a federal policy for the elimination of rodents over enormous areas would result in plagues of insects, such as grasshoppers, and the great increase of certain undesirable weeds. In rebuttal, those desirous of arguing to the contrary will at once point out that plagues of grasshoppers have always occurred, from time to time, in many parts of the world. True, of course. It is merely wished to indicate that after the elimination of rodents from an area plagues of grasshoppers will undoubtedly be more frequent and more severe than formerly.

The experience of certain parts of California, poisoned several years ago with distressing thoroughness, now indicates that to the prediction of insect plagues should be added the likelihood of mouse plagues, paradoxical as this may seem. The explanation of this is probably as follows.

Under modern methods of poisoning the mortality of rodents may approach 100 per cent. and certainly reach the point at which it is impossible for local carnivores to make a living, providing of course, all these have not already been poisoned on their own account. At any rate, those remaining must either starve or emigrate, practically to the last individual. On the surface, then, it seems that all rodents and all carnivores are gone, and everything should be lovely. The insidious point, however, is that within every farm house and barn are a few house mice (*Mus*), and in a number of garden patches, not poisoned out of consideration for poultry, is an occasional meadow mouse (*Microtus*) and deer mouse (*Peromyscus*). These, finding the surrounding country untenanted, radiate and, their natural enemies being absent, multiply prodigiously. Unless other factors are unfavorable, in a few years there will be a mouse plague, more damaging to the farmer than if the status quo had been maintained. So, as a sequel to extensive poisoning of rodents (California alone has used over 14,000,000 pounds of poisoned grain and 6,000,000 of carbon bisulphide in the last 10 years) in its present thoroughness we may expect an increase in grasshoppers and more mouse plagues. But rodents do an enormous amount of damage and must be controlled where too destructive. The solution seems particularly clear. Rodents should be rigorously dealt with precisely where damage is being inflicted, and they, with their natural enemies, left alone as completely as practicable on waste land or where little loss is being suffered. Above all, no effort should be made entirely to exterminate rodents over wide areas, even when the process is couched in a less harsh and more soothing term than that of "extermination."

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TREATMENT FOR POISONING BY "POISON IVY"

THE poison in *Rhus toxicodendron* and other poisonous species of *Rhus* is in the form of an oil. Dissolving the oil and throwing it away before it has time to be much absorbed into the skin is the logical treatment and is completely effective, if used promptly, and is a help even after the skin lesions are well developed. Prepare a hundred or more pinches of absorbent cotton. Use a small saucer of alcohol, 70 per cent. to 95 per cent. strength. Change the alcohol frequently. Dip a small pinch of the cotton in the alcohol and with it sop up the poisonous oil that may be upon the skin and then promptly throw it away. Do not allow any drying of the alcohol. For a small patch of the poison repeat the procedure fifty times or so. At first do not rub, but merely sop up the poison. After doing this, say, thirty times, rub well with the wet cotton before throwing away each time. Finally rub with the alcohol and cotton very vigorously to get the dissolved poison out of the "pores" of the skin. If small blisters have already formed from the poison the hard rubbing will break them and the contained poison will then be more readily removed.

Do not sop or rub more than a few moments with each bit of cotton, but throw it away almost at once. Allowing the alcohol to dry merely redeposits the poison on the skin and tends also to spread it. Do not use the same swab for repeated dipping. Throw each away at once. One hundred such pinches of cotton is enough to treat, say, two patches of poison each as big as a silver dollar. More extensive poisoning merely calls for more extensive treatment with more swabs.

This treatment is completely effective in all cases in which I have seen it tried promptly. I have not seen it tried in old cases of severe poisoning. I have never known other treatment, potassium permanganate, juice of *Impatiens fulva* or the dozens of commonly recommended "remedies," to do any recognizable good. Logically, washing the hands repeatedly in *many changes* of very strong soapsuds should remove some of the oil and throw it away, but it is seldom, if ever, carried out effectively, and at its best is far less effective than alcohol.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

TESTING THE REACTION OF DISTILLED WATER

IN talking to various scientific workers, the writer has found that a considerable number of them have the idea that pure distilled water should have a pH of 7 or near that when in contact and equilibrium with the air. Because of this erroneous conception, the writer has been prompted to write the following note of explanation.

Kendall,[1] on the basis of his own investigations and also those of others, concluded that the conductance of carefully purified water is due practically solely to carbonic acid absorbed from the atmosphere. Conductivity and pH measurements of distilled water taken directly from a still may be very misleading and largely meaningless, because under these conditions the content of carbonic acid may vary, depending upon the method of distillation, the temperature at which the water comes from the still and duration of exposure. Unless distillation takes place from an alkaline solution, or other special provisions are made, and the distillate is in all cases properly protected, there is bound to be carbonic acid present in the water. For most purposes, it is folly to go to the trouble of distilling in such a way as to remove the carbonic acid, because it will be quickly absorbed again during ordinary storage or usage of the water. Johnston[2] states that it takes only about ten minutes for unstirred water in an open beaker to come to equilibrium with the carbonic acid of the air. Since most of our experimental work involving the use of distilled water is carried on in a manner which permits contact of water with the air, it should be recognized that the water in these cases dissolves carbonic acid in accordance with the partial pressure of the carbon dioxide in the atmosphere.

On the basis of Kendall's conductivity measurements already mentioned, pure water at a temperature of 25° C. in equilibrium with the atmosphere has a pH of 5.7. A test by Kendall,[3] with the indicator method of water under similar conditions, gave a pH of 5.8. Ordinary and even considerable changes in the temperature of water, causing changes in the amount of carbonic acid dissolved, influence the pH of the water but little, due to a compensation in degree of ionization of the carbonic acid which takes place. Using the indicator method, the writer has found pure water, when in equilibrium with the atmosphere, to have a pH of 5.6 to 5.8. This, as will be noted, checks remarkably well with Kendall's measurements already referred to. Laboratory air sometimes contains enough more carbonic acid to materially change the pH. The pH is, of course, also influenced by various impurities which are present in air in greatly varying amounts. The amounts of ammonia and various acids in laboratory air are often high enough to change profoundly the pH of water exposed to it. Ammonia is often present even in outdoor air in sufficient amount to affect the pH of water. During a rain or snow, this ammonia is largely washed out, and a noticeable change in the pH of water in equilibrium with the air before and after a rain or snow can often be detected with the indicator method to be described. This change is especially marked during periods of infrequent precipitation.

Neutral brom cresol purple is an excellent indicator for testing the pH of distilled water. To make the

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[1] J. Kendall, *Jour. Am. Chem. Soc.*, 38: 1480–1497, 1916.

[2] J. Johnston, *Jour. Am. Chem. Soc.*, 38: 947–975, 1916.

[3] J. Kendall, *Jour. Am. Chem. Soc.*, 38: 2460–2466, 1916.