DAMAGES CAUSED BY COTTON RAT, *Sigmodon hispidus zanjonensis*, ON SUGAR CANE IN SAN PEDRO SULA, HONDURAS

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ABSTRACT: Technical assistance was given to Compañía Azucarera Hondureña, S.A. (Agro-Industrial Co.), Honduras, Central America, to determine if a campaign against noxious rodents to agriculture crops was needed. Several trappings were carried out at different places using snap traps to determine the population structure of rodents associated with the crop, and live traps to determine the index or density of the Sigmodon hispidus rat population, which was identified as being responsible for the damage to sugarcane. Results were 43.24% adult males, 14.86% young males, 31.41% adult females, and 10.47% young females. Of the adult females captured, 54.83% were pregnant with an average of 3 to 4 embryos per rat.

A control demonstration combat was carried out at one of the experimental stations with a bait prepared with 2% zinc phosphide in a place where it had been previously determined there was a population of 39 rats per hectare. After such control, the population was reduced to 18 rats per hectare, which represents an efficiency of 53.85%. An evaluation of damages was also measured at different places to determine the degree of loss caused by the rats, which proved to be 22.79% damage. The size of the sample was estimated in 3 samples per hectare, with a level of confidence of 95%.

INTRODUCTION

This work was carried out in January 1977 with technical advice from biologists, of Rodents National Campaign of Direction General of Plant Protection of the Ministry of Agriculture and Hydraulic Resources, to the sugar mills called Compañía Azucarera Hondureña, S.A., in San Pedro Sula, Honduras, C.A. The aim of the technical advice was to present the basic points for establishing a campaign against rodents.

The first data concerning rat damages on sugarcane crops were collected from the cultivated area that serves the sugar mills. First, in 1964, these damages were very small, but they gradually increased and action was taken to apply chemical control consisting of thalium sulfate or warfarin applications. In 1974, rodent populations had increased considerably but were controlled satisfactorily.

In 1976, the sugarcane production was in danger because of the increased rodent populations, especially in regions where crops were not harvested on time; then warfarin and zinc phosphide were applied for control but without any success.

The major damage caused by rats was found to be in the stems of sugarcane; based on this point, several surveys or studies were conducted to determine population structure, methods of control, and to evaluate damage.

GENERAL DESCRIPTION OF THE SURVEY AREA

The sugar mill Compañía Azucarera Hondureña, S.A. is located 15 km NE San Pedro Sula and 12 km West Santa Matilde sugar mills; the region is characterized by a high rainfall annual average estimated at 1,510.84 mm, and the most humid months of the year are generally September and October. It was on San Jose property that the rodent control project was started.

MATERIALS AND METHODS

In order to know some aspects concerning the biology of rats that damage sugarcane, 9 samplings were carried out using snap traps which were placed in a transect around the different lots. The information obtained enabled us to find out the associated species, the most important ones, and the population structure of the species identified as harmful to the crop.

A test control had been applied in an area of 7.21 ha. using zinc phosphide; the rodent population was estimated before and after the poison application. During the sampling, Sherman live traps were used to catch animals; they were placed in net formation to cover an area of 1 ha. We used the catching and marking methods of Lincoln and Petersen.

Before the beginning of the test control, acceptance trials of different bait compositions were conducted using the formulation of the sugar mills and another one suggested by the biologist team, as follows:

Sugar mills formula	
Cereal husk	74.50%
Lard (fat)	4.58%
Molasses	18.48%
Zinc phosphide (94%)	2.44%
	100.00%

Biologists team formula	
Cracked corn	80%
Sugar	8%
Corn oil	8%
Zinc phosphide (94%)	2%
	100%

For this trial the baits were packed in 50 bags of 10 grams each, 50 bags of 50 grams, and 50 bamboo cans of 226 grams, placed in the cultivation area with an interval of 5 meters combining different positions so as to determine which presentation is best and well accepted by the rodents.

The bait distribution in the area of the experiment consisted of placing 102 bamboo cans with a content of 226 grams each, and placed around the chosen area at a distance of 20 meters from the cultivated area, and approximately 10 meters between each bait. Two days after the application the baited traps were checked and 5 days later the population estimates were made again.

In different regions that provide raw materials to Santa Matilde sugar mills, 5 samplings were carried out to estimate rat damage. The methodology consisted in choosing at random 20 meters of furrow and to count the damaged and nondamaged sugarcane.

RESULTS

Species Identified. Sigmodon hispidus zanjonensis was found as the main damage agent; the other associated species that were caught in the same area, but in lower numbers, are Oryzomys palustris couesi, Mus musculus, Rattus rattus and Liomys salvini. The last species was not considered serious because analysis of the contents of its cheek pouches proved to be wild leguminous seeds.

POPULATION STRUCTURE OF Sigmodon hispidus zanjonensis

Assuming that the cotton rat has a reproduction cycle, with two or more demographic explosion periods, it was necessary to know the sex proportion (number of females and males) in order to find out in which phase of the cycle the explosion occurred. Based on the number of captured specimens, the number of males was slightly higher than for females; and the percentage of adults showed an increase in relation to young specimens. The results of these findings are shown in Figure 1.

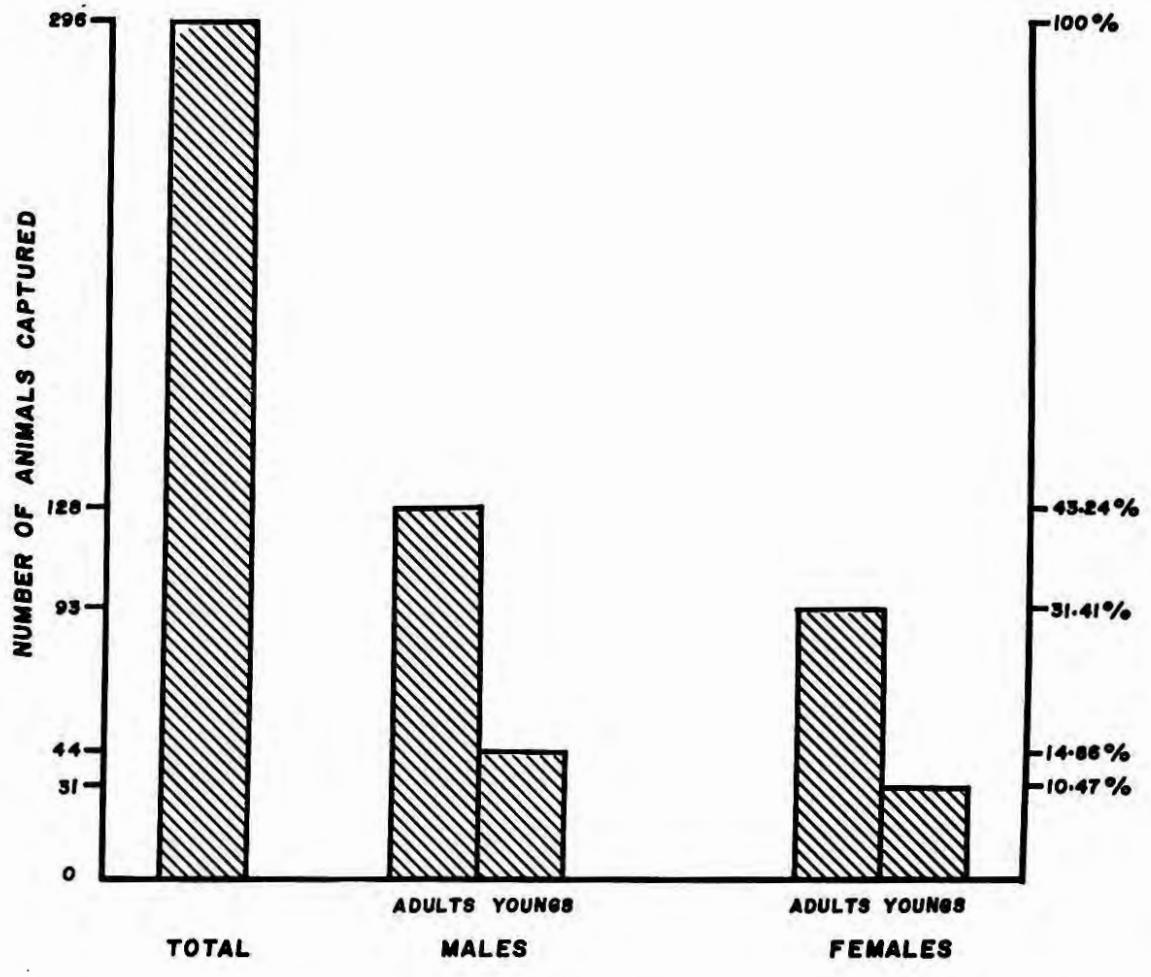
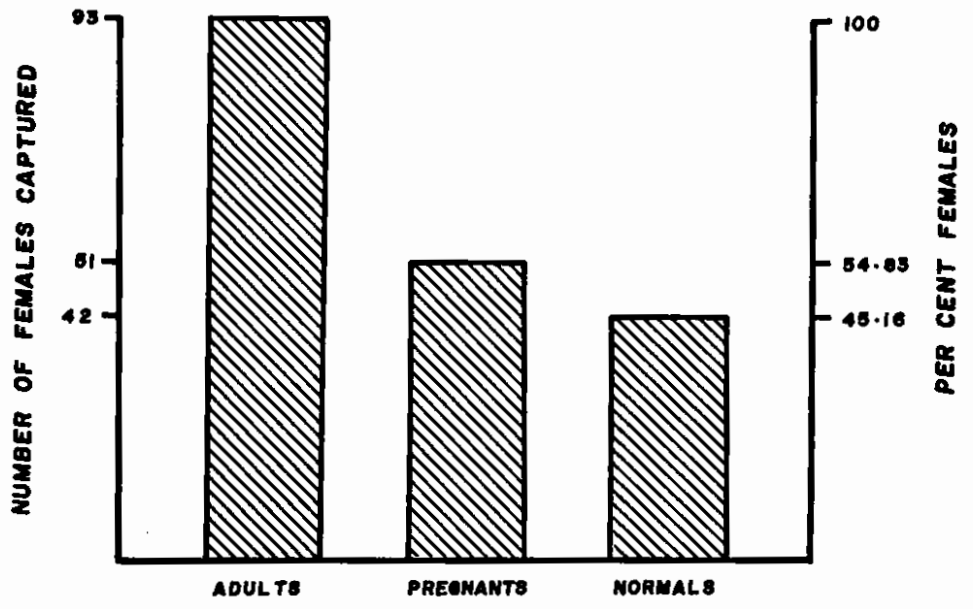


Figure 1. Population structure of cotton rat Sigmodon hispidus, Finca San Jose C·A·H·S·A

According to the information obtained from 9 trappings, with a total of 93 adult females, 54.83% of them were pregnant and 45.17% had given birth and were lactating or were in normal condition.

The uterus of the captured females was analyzed, and the number of embryos per female varied from 2 to 5, and the average for this population was 3 to 4 young per litter. The size of the embryos varied between 0.70 mm to 47 mm. It is important to mention that, in this population cycle, births were recorded almost daily during this time of year. The results are mentioned in Figure 2.



BREEDING ANNALYSIS OF *Sigmodon hispidus*

NO. EMBRYOS FOUND	2	3	4	5
FRECUENCY OF FEMALES PREGNANT CAPTURED	8	29	12	2
PER CENT OF FEMALES CAPTURED	15·68%	56·86%	23·54%	3·92%

AVERAGE OF EMBRYOS FOUND FOR PREGNANT FEMALES = 3·5
NUMBER OF EMBRYOS FOR FEMALE 2 — 5 THE MOST COMMON 3 — 4

Figure 2. Population structure of Sigmodon hispidus females at Finca San Jose C·A·H·S·A

RAT CONTROL EVALUATION

The information obtained from bait trial determined the bait type which had the best acceptance; this bait was prepared by mixing cracked corn and sugar; but the one prepared with cereal husk and molasses was not successful. Bait put out in bags of 10 g and bamboo cans of 226 g were accepted best.

An estimate of the rodent population was 39 rats (according to Lincoln Index method) and 39.39 rats (according to Petersen method) per ha. Using this technique the population totaled 385.32 adult rats in the whole lot. The population density after the control was reduced to 18 rats per ha. (53.85%) (Fig. 3).

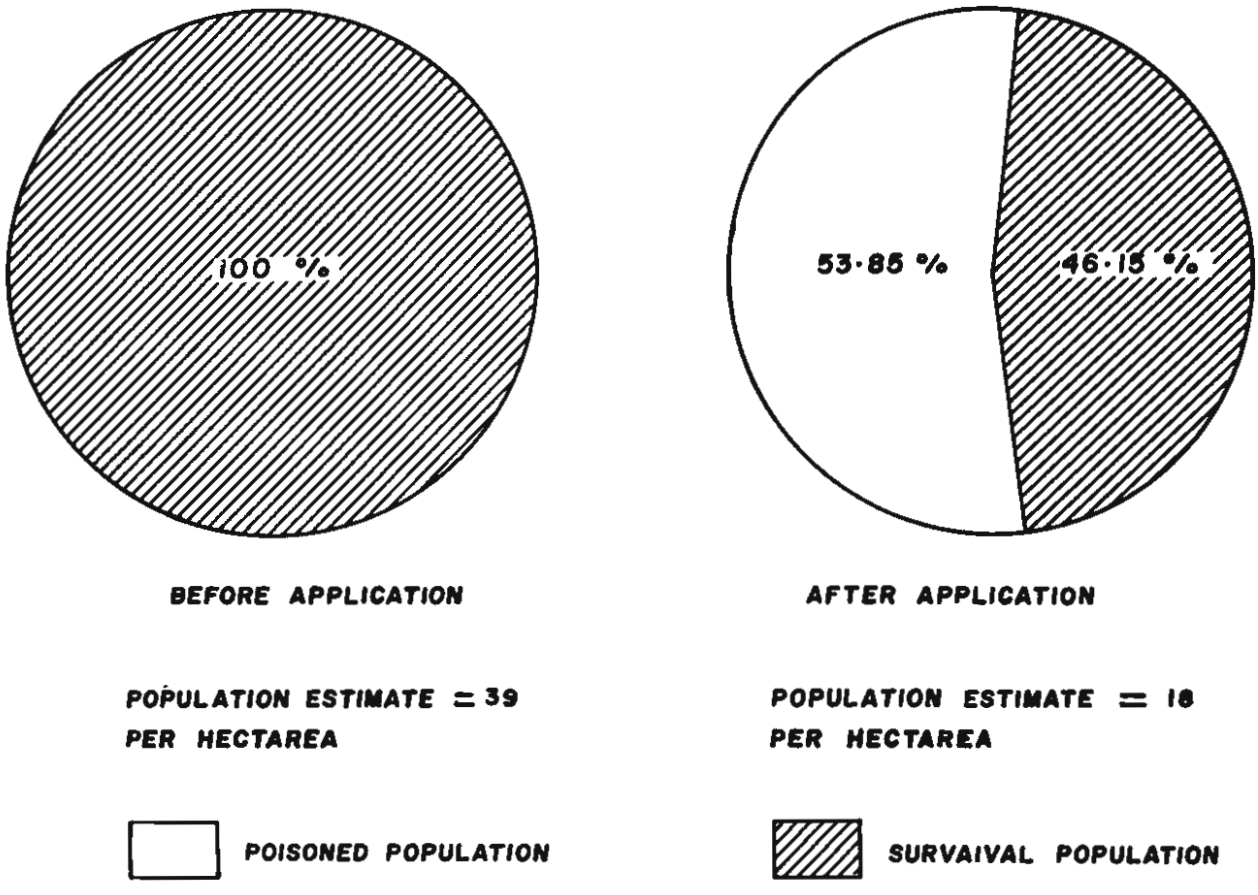


Figure 3. Field test of (2.0%) zinc phosphide application at Finca San Jose C·A·H·S·A

DAMAGE CAUSED BY RAT

The information obtained concerning the amount of sugarcane damage (Fig. 4) was considered preliminary data, but to have the sample size relate to number of damaged stems, it was basically important to take into account the following equation:

$$n \geq 2\left(\frac{\sigma}{\delta}\right)^2 \left[t_{\alpha}(r) + t_{2(1-p)}(r)\right]^2$$

where: n = sample size, σ = standard deviation, δ = the smallest difference desired to be detected, r = degree of freedom, α = significance level, p = desired probability for which the difference could be significative, and t = statistical table value.

For a confidence level of 90%, it was necessary to carry out 3 samplings per ha (furrow of 60 meters), in order to evaluate the sugarcane damage. Subsequently, the correlation factor which existed between the percentage of none damaged and damaged sugarcane stems was established within a lot of 3.32 ha. This correlation is mentioned in the following equation:

$Y = 0.574 + 0.0891X$, where X = % of damaged sugarcane stems.

The standard error of the regression line was 0.170 and the correlation factor: $r = 0.857$ with 95% of confidence limit.

DISCUSSION AND CONCLUSIONS

From the samplings it was found that Sigmodon hispidus zanjonensis was the dominant rat which causes great damage to sugarcane; the number of males captured was higher than females; it is suggested that at that time the rat population had just passed a period of overpopulation based on the proportion captured; consequently, there was noted a great deal of damage in sugarcane stems.

With respect to Rattus rattus and Mus musculus, it is convenient to establish a constant survey due to the fact that they presently are not very harmful since these species have a preference to establish in urban places, where they can then be more harmful and more hazardous to man than Sigmodon hispidus zanjonensis.

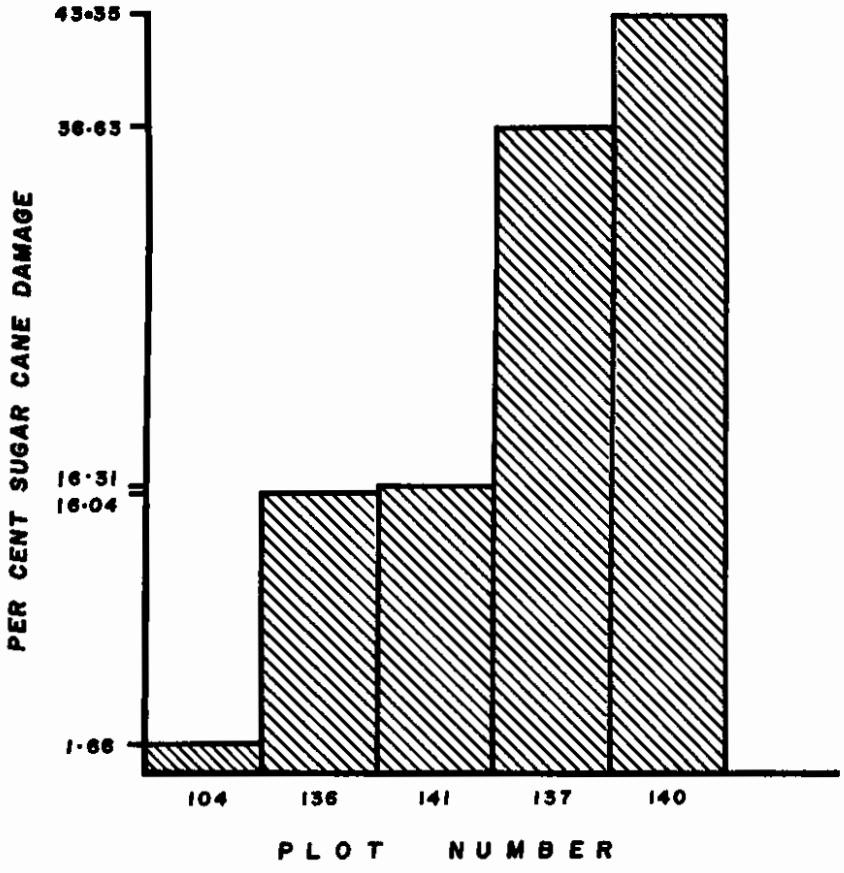


Figure 4. Percent sugarcane damage in five plot samples at Finca San Jose C·A·H·S·A

On the basis of trials to determine the acceptance of different baits (cracked corn and cereal husk) poisoned with zinc phosphide, it was proved that due to their habits, rats prefer hard grains like corn. Moreover, the bait with molasses and cereal husk deteriorated due to fungus and the rats were repelled by it.

According to these results, bait acceptance of cracked corn was best. Before bait was applied the population was calculated at 39 rats per ha.; 5 days after treatment the population was reduced to 18 rats per ha., and the bait was still effective. Based on these results we suggest that baits be prepared with hard grains (corn, sorghum, wheat, etc.) and put in 10 gr bags; however, bamboo cans also gave good results but they allowed the rats to displace a lot of bait which was eaten by ants, as we observed at the end of the trial.

The number of sugarcane stems (healthy and damaged) allows us to estimate the sample size, which allows us to calculate in a representative form the weight (tons) of sugarcane lost due to activity of rats by means of 2 samplings per ha. in the different fields. If the estimated damage percentage is found to be high, it is recommended to start a rodent control program to prevent sugarcane damage.

The correlation between healthy and damaged sugarcane stems was good, based on these results, so we conclude that as the number of stems increase, the damage increases too. When 1.16% damage is obtained, approximately 3 damaged stems on each 20 m of sampling, it is necessary to start a rodenticide treatment.

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