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RODENT PROBLEM IN SUGARCANE FIELDS OF CENTRAL PUNJAB*

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Pattern of rodent infestation and damage to sugarcane was studied in three districts of central Punjab. The rodents attacked mainly the roots and basal nodes. About 11 % of the canes sampled were rat damaged. In these damaged canes 19 % of the cane tissue was completely destroyed. It was estimated that rat depredations might result in 4 to 15 % of loss in sugar yield. A programme for inhibiting rodent populations in the croplands was also proposed.

INTRODUCTION

In recent years rodent damage to sugarcane in the Punjab has reached alarming proportions. As further growth of sugar industry in the province is being planned by increasing cane acreage and addition of new mills, rodent depredation in the croplands may increase further. In spite of being an essential pre-requisite for a meaningful evaluation of our plant protection policies, rodents' impact on sugar yields has never been quantitatively assessed in Pakistan.

This paper presents information on the patterns of rodent infestation and damage to the cane crop in the central Punjab. Additionally, a programme for inhibiting rodent depredation has also been developed.

MATERIALS AND METHODS

From February 4 to March 5, 1978 about 119 acres of cane fields were sampled for rat and mice damage in Faisalabad and parts of Jhang and Sargodha districts. Sampling consisted of random selection of canes at a series of points, roughly 25 feet apart, on one or more compass lines passing across the fields. Ten nearest canes to each of the sampling points were selected for examination. The intensity of sampling was uniform; there being 16 sampling points for each acre of cane fields sampled. The sampling lines were so drawn that the peripheral as well as the central parts of the fields were sampled with equal intensity.

All the ten randomly chosen canes at each of the sampling points were carefully examined and the number of damaged internodes and extent and location of injury were recorded.

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The cane fields were trapped for rodents at different stages of growth to determine the species composition.

RESULTS

Species involved

Seven species, namely, the northern plam squirrel (*Funambulus pennanti*), Indian gerbille (*Tatera indica*), bush rat (*Golunda ellioti*), soft-furred field rat (*Rattus meltada*), house-mouse (*Mus musculus*), short-tailed mole rat (*Nesokia indica*) and bandicoot rat (*Bandicota bengalensis*) infested or damaged the cane fields. The squirrels attacked canes in fields near 'doras' and villages only whereas the gerbille and the bush rat infested fields near dry and wet wastelands, respectively. These three species appeared to be of minor importance as pests of sugarcane.

The soft-furred field rat and house-mouse occurred in the cane fields in fairly large numbers. The former did eat some stalks, but they were definitely not important pests. Whether or not the house-mouse attacked the canes too could not be established. However, these two species, together with the Indian gerbille are important pests of wheat and rice (Beg *et al.*, 1977; Greaves *et al.*, 1975).

Only the mole rat and the bandicoots and especially the latter was responsible in our study area for most of the damage to sugarcane. Being tunnel dwellers these rats made extensive burrow systems. Their tunnels favoured rapid percolation of irrigation water to depths beyond the reach of the cane roots, and its wastage to non-crop areas and fields not intended for irrigation. The most common burrow sites for these rats were infield bunds, ditch banks and soil that generally stood above water levels. However, infield burrows were common particularly during winter and spring.

Injury to the cane

The bandicoots and the mole rats attacked both the stalk as well as the root. Often the roots were completely severed. Roots and basal internodes were the main sites for the rats' attack (Table 1). In fields where mole rats were predominant, damage to cane roots was usually high. This difference was apparently related to the mole rats' habit of feeding while remaining underground. Damage to the roots and basal internodes often resulted in the death or stunted growth of the canes.

Table 1. *Location of rat injuries on sugarcane stalks.*

Injury Sites	No. damaged canes	% damaged canes
Root	434	21.1
Basal internodes	694	33.7
Upper internodes	276	13.4
Root and basal internodes	292	14.2
Root and upper internodes	26	1.3
Basal and upper internodes	164	8.0
Root, basal and upper internodes	169	8.3

The rats damaged the canes by eating a portion of the stalk internodes. The stalks were usually not completely severed as a portion of the rind and pulp remained intact. Injury to the roots or the basal internodes caused lodging of the canes. Damage to distal part of the cane involving several internodes was common in recumbant stalks. Occasionally the entire stalk was deprived of most of its pulp leaving behind just a strip of the rind.

Pattern of migration

When the cane is roughly 4 to 5 months old rodent infestation of the fields began. As the crop matured the number of rats and mice in the cane fields gradually increased. First appreciable damage to the cane was noted in November, the maximum in December, and a marked decline in subsequent months.

Deprived of their food and shelter in harvested fields the cane rats and mice migrated to wheat fields. Diggers like the bandicoots and the mole rats, however, stayed for varying lengths of times in harvested cane fields before migrating to elsewhere. By the time the wheat crop began to mature all the cane species and the Indian gerbille had infested wheat fields in large numbers. In April when the weather had become hot and dry and wheat crop had been harvested, the rodents moved to vegetated ditch banks and fodder crops. During monsoon season and in early fall these animals affected paddy, corn, and fodder crops in large numbers.

Assessment of damage

Of a total of 18970 canes examined for rodent damage, 2055 (10.8%) were damaged to varying extents by the rats (Table 2).

Table 3 presents information about the extent of damage to the stalks. This was estimated by counting the total number of internodes present in a stalk, and the number of rat damaged internodes and the proportion of damaged

tissue in each internode. On the average about 19% of the cane tissue of the affected stalks was destroyed by the rats.

Table 2. *Rat damage to sugarcane in central Punjab.*

District	Area sampled (acres)	Sample points	No. canes examined	No. canes damaged(%)
Faisalabad	101	1617	16170	1651 (10.2)
Jhang	10	154	1540	208 (13.5)
Sargodha	8	126	1260	196 (15.6)
Total	119	1897	18970	2055 (10.8)

Table 3. *Damage to cane tissue in cane stalks attacked by rats.*

Extent of damage	No. damaged stalks (%)	Percent tissue damaged
2 internodes or less	788 (48.6)	6
More than 2 internodes upto half stalk	515 (31.7)	16
More than half stalk	318 (19.6)	40
Av. damage		18.5

DISCUSSION

Because of lasting and relatively better cover, mild climatic conditions and possibly better food conditions, the cane fields favoured existence of a large number of rats and mice. Further, sugarcane cultivation in the area in combination with the practice of multiple cropping (highly desirable from a land-use view point) has transformed the croplands into highly variable environmental complexes that can sustain high numbers of rodents.

Patterns of migration

Habitat selection in the species that infested the croplands appeared to be related to specific food condition and to the life-form of the vegetation. In June when sufficient cover had developed, the rats and mice began to infest the cane fields. During the monsoon and post-monsoon periods their populations built up, partly as a result of immigration from the 'kharif' crops and partly due to an increase in the rate of reproduction (Beg and Ajmal, 1977; Rana and Beg 1976, 1978; Adeeb 1978).

Density peaks and maximum damage to the canes came at a time when paddy and some other kharif crops had been harvested, whereas mid-winter

decline appeared to be a result of cessation of recruitment of young to the population and emigration. Winter-spring massing of the rats and mice in the wheatlands (see Beg *et al.*, 1977) was, therefore, not only due to increased rates of reproduction but also due to immigration especially from the cane fields.

Assessment of losses

About 11 per cent of the canes were damaged by rats, mainly by bandicoot and mole rats. Maximum damage was inflicted upon roots and basal internodes as it could very rightly be expected from these tunnel dwellers. Approximately 19 % of the tissue in rat affected canes was damaged.

Porquez and Ledesma (1970) in Phillipines estimated that in a sample, in which 15% of the cane stalks were rat damaged, sugar yield was reduced by approximately 5 %. Using this index to the present data it was computed that rat depredations would have reduced sugar production in our study area by at least 3.7%. But, as the bandicoots and mole rats may not necessarily damage the canes with the same intensity as do the rats in the Phillipines this index may not be very useful.

It has been reported that canes sustaining 1 to 3 injuries per stalk suffered a loss of 14.7% in sugar yield (see Hood, 1968). Since more than 51% of the stalks sampled in this study had more than two of their internodes injured by rats, the impact of this damage on sugar yield must have been much greater than 15%. The present sampling was carried out at harvest time, whereas canes receiving severe damage early in the season might have decayed by that time. Further our sampling method was not adequately sensitive to detect damage to underground parts of the cane; damage to roots might result in drying of the cane or stunted growth. Thus a loss of 4 to 15% in sugar yield due to rats should be treated as a very conservative estimate.

Implications for control

From the patterns of movement of the rats and mice in the cropland it is amply clear that any plant protection measure taken against them in the cane fields alone will fall much short of the target. The following programme for inhibiting rodent populations has been developed based on the information on their seasonal movements, reproduction, and damage patterns:

1. Control measures in the cane fields should begin in October, when the crop becomes susceptible to rat damage and should continue till harvest. Apart from surface baiting, all active burrows in freshly

harvested cane fields should be treated with a suitable toxicant, so that the rats are killed before they could migrate to the wheatlands.

2. Treatment of the wheatland should start in January when damage to tillers becomes appreciable. This should include surface as well as in-burrow baiting.

3. As soon as the wheat is harvested, all active burrows in the field as well as those on the banks of irrigation ditches and other likely places should be treated.

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