PREDATION UPON SOUTH AMERICAN PEST RODENTS: EVALUATION OF ITS CHARACTERISTICS FOR THE FUTURE IMPLEMENTATION OF CONTROL METHODS

SUMMARY:

South American rodents of the subterranean genus *Ctenomys* are known to be injurious for plant crops, affecting mainly cereal fields and fruit tree plantations. Other above ground rodents of the family Cricetidae inhabiting agroecosystems in the Buenos Aires province were reported as vectors of the Junin virus which is responsible for the Argentine Hemorrhagic Fever.

This project aims to study the incidence of predation by owls and mustelid carnivores on rodent populations and to evaluate its characteristics for implementing control methods in the future.

Field work will be conducted at Necochea, Buenos Aires province, where potential effects of predation upon rodents will be assessed through the observational/comparative method. Live and kill trapping of prey species will be conducted to evaluate density and ecological traits of populations. Predator densities will be estimated through live captures and observational censuses and diet composition through regurgitated pellet and scat analysis. Data obtained from this study will be modelled using computer facilities to evaluate consequences of manipulation of predator densities on rodent population.

Introduction

Crop losses in agricultural fields were generally ascribed to insects, diseases and weeds, and less importance was given to vertebrate pests. Nowadays it is widely accepted that vertebrates have also a significant impact as agricultural pests (Contreras, 1973).

Among vertebrates, mammals in general and particularly rodents have been considered plagues because of their irruptions in areas where man has established any form of settlement. Rodent nuisances to human activities are caused by different kinds of interference such as damage and consumption of plant crops and stored grains, transmission of diseases to both humans and domesticated animals, etc.

South American caviomorph rodents of the genus *Ctenomys* (locally known as tuco-tucos) are the most numerous in species of all fossorial rodents. Of about 125 living species of rodents of hypogeic habits, 55 belong to this genus. Tuco-tucos are known to share a combination of attributes which are connected with their subterranean life (Reig et al., 1990). Size varies in different species from 100 grams body weight and 220 mm. total length the smallest species (C. pundti) to 1100 grams and 430 mm. in the largest (*C. conoveri*). External body form is adapted for fossorial life, with short head, strong incisors, dorsally located eyes, thick and short neck, moderately haired tail and short limbs. The fur is usually uniform in coloration, from sandy brown to dark brown, homocromous with the soil color. *Ctenomys* has a wide geographical distribution covering a great area of South America, and occurs in each one of Argentinean provinces in a wide variety of habitats.

This genus affects grasslands by harvesting vegetation and by carrying soil to the surface as individuals dig their tunnels and push loosened soil out of the burrow. Since the soil of mounds is not protected by vegetation for some time , loss through accelerated wind and water erosion may occur. *Ctenomys* is known as and agricultural pest affecting mainly maize, oats and barley crops, pasture crops and natural pastures. It also produces great damage to root systems leading to defoliation and partial or complete drainage of citric plantations. The exposure of damaged areas in roots facilitates the entrance of *Phytophthora parasitica*, a fungi that attacks citrus.

Economic losses caused by *Ctenomys* are also related to damages produced on the crop field structure and on the irrigation channel system (Contreras, 1966). In Brazil *Ctenomys torquatus* has been reported a pest destroying pasture (Fernandes, 1967). Tuco-tucos compete directly with livestock by consuming plants from above or below-ground (Contreras, 1973).

In 1954 the genus *Ctenomys* was declared a national pest in Argentina by resolution number 1347 (Ministerio de Agricultura y Ganadería de la Nación) and also an pest for agriculture in Santa Fe province by state resolution number 01507 in 1955.

Rodent communities in the Pampean region (Buenos Aires province) are also characterized by the presence of other above ground cricetid species that coexist with the genus *Ctenomys* in every locality where it occurs. The species more abundantly represented in cultivated fields, and in natural and modified pastures that represent their borders are *Calomys laucha*, *C. musculinus*, *Akodon azarae*, and *Oligoryzomys flavescens* (Crespo, 1966; Busch, 1984). The former three species were reported to be reservoirs and vectors of the Junin virus, an endemic human disease which affects circulatory system (Parodi, 1959; Sabattini et al., 1977; Kravetz et al., 1986).

The population biology of these cricetids as well as some aspects of their coexistence have been studied during the last decade (Kravetz, 1978; Busch, 1988). All four species occur in cultivated fields and their borders but in different proportions. *Calomys laucha* is the most abundant species in cultivated fields while Akodon azarae predominates in borders. *Oligoryzomys flavescens* occurs predominantly in borders but it is much less abundant than *Akodon azarae*. *Calomys musculinus* does not show any patter of abundance related to field or border habitats.

Relative abundances of these species in borders could be explained in part by interference competition (Busch, 1987) which results in the larger and more aggressive *Akodon azarae* dominating these habitats. Periodic perturbations in cultivated fields associated with differences in life history traits would permit *Calomys laucha* a better colonization and adjustment to the conditions prevailing in these unstable type of habitats.

A basic problem in the development of control techniques has been the little importance given to the biology of endemic species involved as pests, and the application of control methods developed elsewhere for different cultures, species and environments of developed countries, which may not be applicable for South American rodent species. Management of agricultural pests should be based necessarily in the scientific knowledge of the species involved. Species relationships should be adequately identified and quantified before proceeding to take any management decision.

Predation has been and is still being debated as a major force structuring communities of rodent prey species (Anderson and Erlinge, 1977; Erlinge et al., 1984; Jaksic, 1986). The interpretation and evaluation of predation effects upon an assemblage of rodent species is essential for further implementation of control methods.

The co-occurrence of subterranean and above-ground rodents in Necochea, Buenos Aires province, poses an interesting situation for study. Differences not only in prey species habitats but also in prey size face predators with a wide set of alternatives, constituting a highly prized work if properly documented.

On the belief that basic ecological knowledge of species interactions should always precede any tentative manipulation of natural systems, we have started in 1988 a descriptive and interpretative study of this topic with the aim of disentangling what predators regulate or could regulate, if properly managed, what prey species.

Methods

Field work will be conducted at Necochea (38°36'50"S; 58°48'00"W), Buenos Aires province. The study site is limited by a 4-10 Km. wide coastal dune fringe, which grades into the

inland grassland presently characterized by rotational maize and sunflower plantations. Natural pastures occur between cultivated fields and the dune fringe and are composed mainly of *Poa* sp, *Panicum racemosus*, *Stipa tricotoma*, *S. neesiana*, *Bromus unioloides*, and *Calystelgia soldanella* (Comparatore et al., 1989).

Dominant rodent species in the area are *Ctenomys talarum*, *C. australis*, *Akodon azarae*, *Calomys laucha* and *Oligoryzomys flavescens*.

Predator species most abundantly represented are *Athene cunicularia* (Burrowing owl), *Asio flammeus* (Short eared owl), *Tyto alba* (Barn owl) and *Galictis cuja* (Grison).

Potential effects of predation upon rodents will be assessed through the observational/comparative method. Live and kill trapping of prey species will be conducted to evaluate density and ecological traits of populations. Predator densities will be estimated through live captures and observational censuses and diet composition through regurgitated pellet and scat analysis. Data obtained from this study will be modelled using computing facilities to evaluate consequences of manipulation of predator densities on rodent populations.

Density of prey:

For both ctenomyne and cricetid rodents density will be estimated from live capture-mark-recapture grids. Capture of cricetid rodents will be carried out with medium sized Sherman live traps and ctenomynes using plastic tube live traps. Captured animals will be marked with numbered metal tags. Arrangement of trapping grids will be set according to habitat characteristics (cultivated fields and natural and modified pastures).

Traps for cricetids will be set in 8x8 grids, 10 m. between trap stations, in each habitat type (replicated three times), baited with rolled oats and peanut butter. Plastic tube traps for ctenomynes will be set in fresh mounds made by these species, observed in a 1 ha. grid, in each habitat type.

Trapping will be carried out bimonthly during five consecutive days. Density estimates will be based on the minimum number of animals known to be alive for each species and trapping period.

Prey population characteristics:

Weight, sex, external reproductive condition (palpation of fetuses, vaginal condition, testicle position) will be established for live captured animals in each period. Additionally steel leg trap and snap dead capture grids, for ctenomyne and cricetid rodents respectively, will be set in order to obtain data on age structure, reproductive condition and dietary habits (to be carried out by other members of the research group an not included in this proposal) of rodent populations. Captured animals will be stored in freezer for conservation until autopsied.

Age of animals will be determined by comparing the degree of closure of epiphyseal ossification within humeri, with a graded series of reference bones (Pearson et al., 1968) for both ctenomyne and cricetid rodents. For cricetid rodents relative age will be determined also by comparing tooth wear of captured animals with a graded series of reference skulls (Bellocq and Kravetz, 1983).

Female and male reproductive traits will be determined on the basis of uterus and vagina condition, and presence of spermatozoa in the epididimus respectively (Pearson et al., 1968)

Pelvic bones and skulls of captured rodents will be prepared for differentiating sex and species, and to estimate weight of predated rodents (Bellocq and Kravetz, 1983; Vassallo et al., 1989).

Predator density:

Burrowing owl density will be estimated through direct observation in different areas of natural pastures, where these birds establish their burrows.

Barn owl density will be estimated by direct counting of nests and animals in coastal cliffs during light hours.

Short eared owl density will by assessed by counting number active nests found in natural pastures and of observed individuals perching in wire fences.

Grison density will be estimated through live capture-mark-recapture grids using National live traps, baited with flesh and situated over the study area where any sign of activity of these animals (active caves, remains of eaten prey, scats, etc.) is observed. Weight, sex and general condition of captured animals will be noted.

Predators' diet:

Diet composition will be estimated by analysis of skeletal remains in regurgitated pellets of owls and scats of grisons.

Prey species will be identified according to characteristics of teeth and bones compared with a reference collection prepared from a sample of captured animals. Body weight of predated individuals will be estimated from regression models adjusted for each species with data taken from captured animals (Pagels and Blem, 1986). Sex of predated individuals will be determined according to pelvic morphology (Dunmire, 1955).

Number and species of prey taken by predators will be noted and these data will be then projected to each predator population to estimate consumption rates at different prey densities.

Predation effects on rodent populations:

Data obtained from sampling of rodent populations will be arranged in a life table for each species and compared with those of predated individuals to see what fraction of each rodent population is affected in its numbers, if any, by what predators.

Pairs of prey-predator species showing this, will be then modelled and simulated by computer at different density conditions from that observed in the study to foresee useful and practical management techniques to manipulate predator densities and control rodent populations.

Time schedule:

Live and kill trapping of rodent populations will last two years (May 1990 to May 1992) as well as estimation of predator density and diet composition. One more year will be dedicated to the processing of data and computer simulation of predator-prey models for implementing future management techniques.

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