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Abstract:

A laboratory system to study microtine rodents has been developed that avoids many of the intrinsic restrictions of earlier laboratory and field studies. The system is composed of two interconnected plexiglas tables with a soil substrate and hay cover. The system permits unconstrained visual observation of voles as they move within a runway network of their own construction. The flexibility of the system facilitates its use in various avenues of microtine research.

Introduction:

Social behavior of microtines has been of interest to investigators for many years. However, the study of these rodents under natural conditions is difficult. Microtines are small, elusive animals that live in subterranean tunnels or surface runways under dense cover.

Previous studies have gone only part way in solving these inherent problems of visibility. Field studies must rely solely on remote sensing methods, as unrestricted visual observation of microtines is impossible. Thus, althought trapping grid (Koplin 1968, Krebs 1977), dropping board (Brown and Conway 1961, Justice 1961), remote photography (Pearson 1960) and radio-telemetric studies (Chute et al. 1974, Madison 1980) have been able to investigate some attributes of vole social behavior they fail completely to examine the propinquitous behavior of two or more individuals. Laboratory studies (Banks et al. 1979, Gets 1962, Novak 1980, Turner and Iverson 1973) permit the unrestricted observation of vole interactions. However encounters are usually examined within glass aquaria, which are small and offer no cover or means for mutual avoidance. Laboratory studies are therefore highly artificial and conclusions from these studies must remain tentative.

It is clear that a system which combines, ease of observation within a naturalistic environment would contribute considerably to the study of microtine social behavior.

The system we developed was an attempt to combine the best of field and laboratory studies with as few of their intrinsic compromises.

The system:

The system at its simplest is composed of two 4'x4'x1/4" plexiglas tables joined by two unidirectional plexiglas tunnels (Figure 1). Each table is filled with a soil/peat substrate to a depth of one inch.

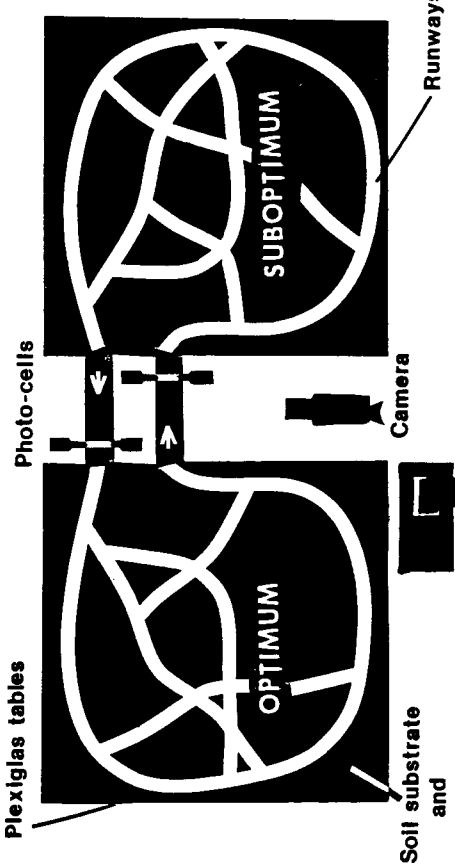

Figure 1: A system for observation of microtines under semi-natural conditions.

In each table, runways, (modelled on those built by two voles over a 21 day period), are constructed and covered with hay. In current experiments in our laboratory, the system is being used to assess competition within and between two microtine species. This is accomplished by varying the quality of the habitat in the two tables. One table is designated optimum and has a dense covering of hay and a variety of food. The suboptimum table has sparse hay cover and only rat chow as food.

Unrestricted observation of animals is possible from beneath the tables. Individuals can be easily seen through the plexiglas and identified by toe or fur clipping.

Movement of individuals between habitats (tables) is monitored using photo-cells (placed across each tunnel) connected to a single frame 8mm movie camera and a printing counter. In this way social behavior can be observed and duration of residency of individuals in each habitat can be continuously recorded.

Applications:

This system constitutes a naturalistic habitat for microtines and facilitates continuous unconstrained visual and remote monitoring of their social behavior.

At present, intraspecific and interspecific social behaviors of meadow and pine voles are being examined within the system as described. However, the system is very adaptable and with minimum alterations could be used to study a variety of microtine research topics.

Habitat preference could be readily examined by altering, for example, substrate texture and moisture or by varying the depth and type of cover. Effects of, light duration and intensity, temperature variation, and humidity on vole behavior, fecundity, and longevity could easily be examined using this controllable laboratory system. Food preference and caching behavior could be examined by regulating the quality and availability of food sources between otherwise identical tables. Study of bait acceptance would obviously follow the same basic design and would be invaluable in determining field consumption of poison bait in the presence of alternative food sources.

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