SOME ASPECTS OF THE LIFE HISTORY AND ECOLOGY OF THE WESTERN HARVEST MOUSE IN SOUTHEASTERN SOUTH DAKOTA

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INTRODUCTION

Although considerable work has been done on different aspects of the life history of the western harvest mouse, *Reithrodontomys megalotis,* most of the investigations were incidental to other work or were limited in scope.

Phases of the life history and ecology of harvest mice have been studied by various workers. Hill and Hibbard (1), Findley (2), and Fitch (3) discussed the habitats of the western harvest mouse. In addition, Svihla (4), Lerass (5), and Holding and Royal (6) studied the behavior and growth of this species and other closely related species. Pearson (7, 8) investigated the activity of harvest mice in the field. No activity rhythms of harvest mice in captivity have been studied. However, activity rhythms of other mice such as the deer mouse *Peromyscus,* (9) and the short-tailed vole, *Microtus,* (10) have been studied in captivity.

In this investigation of the western harvest mouse, particular attention was given to the natural habitat, the development and behavior of the young, and the effect of light on the rhythmic activity of these mice under laboratory conditions.

METHODS

A series of grids of traps were placed in vegetation of different types in Clay County, South Dakota, during 1960. Both live and snap traps were set within each grid. The standard bait used for the traps was a mixture of oatmeal, peanut butter, and bacon grease.

Dates, grid numbers, sexes, weights, total lengths, embryo counts, and average lengths of embryos of the captured dead specimens were recorded.

The live specimens were transferred to laboratory animal cages. A daily observation was made concerning their behavior and nest building habits. Pregnant mice were observed for parturition, and the litters produced were weighed and measured soon after birth. A daily observation of the development of the young of one litter was made for about a month.

A recording apparatus was constructed to study the activities of

the captive mice and to study the effects of photoperiod on the activity of the mice. Four experiments were conducted with this apparatus.

The apparatus consisted of a commercially built small mammal cage and a kymograph recorder. A plywood wall was constructed between the area of the nest and that of the food and water. The only passage from the nest to the food was by means of a small tin can through which a nail protruded from the top so that a mouse would have to touch the nail as it passed through the can.

With a series of five 1½ volt dry cell batteries, this trigger mechanism was connected to a signal magnet. With the aid of an ink stylus, the activities of the mice could be recorded on the kymograph paper for various lengths of time.

TRAPPING RESULTS

From a trapping period extending from June 18, 1960, through October 24, 1960, forty western harvest mice were caught in the various grids (Table I). Although more deer mice were caught in the grids, western harvest mice were common occupants of these grassland areas except in Grid No. 6, which was a wooded ravine. Other mammals were also caught during the trapping period (Table I).

In 724 trap nights, about twice as many harvest mice were caught in snap traps than in live traps (Table I). However, per trap night, more harvest mice were caught in live traps.

HABITAT

The common habitat of the western harvest mouse in southeastern South Dakota is in grassland areas. It is found most abundantly in the tall grass areas of the uplands where the basal cover is high. No mice were caught in timbered areas. In the six grids, harvest mice were found in all non-wooded areas and were not found in the wooded ravine of Grid No. 6 (Table I).

In their grassland habitat, harvest mice utilize runways as well as climb among grass stems. These mice usually make use of runways made by meadow mice (*Microtus*) and both of these mammals use the same runways simultaneously, the harvest mice at night and the meadow mice both day and night (7, 8).

Nests are either made in low shrubs or on the ground surface. The nests look like bird nests with roof of milkweed down or other fluffy material. The nest consists of an outer layer of finely shredded grass, an inner layer of cotton or fluffy material, and a roof of cotton or similar material. Harvest mice use openings at the bottom of the nest.

TABLE I
TRAPPING RESULTS

Grid Number	Distance Between Traps (feet)	Area of Grid (sq. ft.)	Traps		Number of Nights	Trap Nights	*Reithrodontomys*		*Microtus*	*Peromyscus*	*Mus*	*Onychomys*	*Blarina*	*Perognathus*	*Sorex*
			Live	Snap			Adult	Imm							
1	40	72,000	12	33	8	360	17	3	1	30	7	1	...	1	1
2	40	57,600	12	24	5	180	2	2	2	23	...	...	...	...	...
3	30	28,800	12	20	2	64	2	...	...	5	...	1	...	...	...
4	40	57,600	12	24	1	36	1	...	...	...	...	...	1	...	...
5	40	76,800	24	24	1	48	1	11	...	...	...	...	...	...	...
6	40	57,600	12	24	1	36	...	...	...	...	...	...	1	...	...

BEHAVIOR

In captivity harvest mice construct nests similar to those found in their natural habitat. While rearing the young, one female *Reithrodontomys* appeared to be less combative than a female deer mouse (*Peromyscus*) with a litter. There is also no evidence of antagonism between the sexes of harvest mice. Harvest mice seem to be less inquisitive to outside disturbances than do deer mice.

Harvest mice prove very sensitive to noises, reacting conspicuously to squeaky sounds of any sort. Slight disturbances cause the mice to sit up and twitch their ears; whereas, harsh irritations cause them to run and hide. This animal is capable of hearing sounds inaudible to the ordinary human ear (11).

REPRODUCTION AND DEVELOPMENT

The adult females which were caught were either pregnant or showed placental scars (Table 2). The litter size ranged from three to seven. Litter sizes from one to seven were also reported (2, 12).

I was unsuccessful in determining the gestation period of harvest mice, but Svihla (4) estimated the gestation period to last no longer than 26 days. Zuckerman (13) reported the gestation period to last 24 days. Even though the western harvest mouse is polyestrous, the breeding period in the northern part of its range extends

TABLE II
ADULT FEMALES

Date	Grid No.	Wt. (g.)	Length (mm.)	Embryos	Average Length of Embryos (mm.)
June 24	1	9.7	115	4	13
June 24	1	14.4	125	3	11
July 15	2	12.3	125	7	8
July 23	1*			4†	33‡
Sept. 16	3	12.1	127	**	
Sept. 30	1*			0	
Oct. 1	1*			6††	30‡‡
Average		12.2	123	4.8	

*Live
**Showed a single placental scar
†Born on same day of capture
††Born on October 3
‡Average length of the four young
‡‡Average length of the six young

from March to October with a tendency toward reduced breeding in midsummer (5, 12). Immature males and females were caught from August 20 to October 24. Pregnant mice were caught as late as October 1.

The young which were born in captivity are typical altricial animals, *i.e.*, naked at birth and confined to the nest.

At birth the young which were observed had a mean weight of 1.5 grams and mean length of 33 millimeters. No orifices for the eyes, ears, genitalia, and anus were noticed at birth. Within 24 hours after birth a pigmented dorsal stripe appeared and became darker each day. The hair first develops on the dorsal surface of the body and later on the ventral surface completely covering the animal by 12 days.

From seven to fourteen days after birth, several morphological changes occur. Teats become rather well defined, at which time sexes can be distinguished. Nails appear on the hind feet, and the presence of teeth is detected. The eyes open from eleven to thirteen days. At about this age they are developing a juvenile pelage which

TABLE III
ADULT MALES

Date	Grid No.	Weight (g.)	Length (mm.)
June 18	1	12.2	130
June 24	1	10.1	120
July 8	1	11.3	122
July 8	1	11.3	124
Aug. 11	1	13.0	127
Aug. 11	1	11.6	122
Sept. 7	1	8.3	106
Sept. 7	1	8.9	112
Sept. 7	1*		
Sept. 26	2	14.1	130
Sept. 30	1	9.4	130
Sept. 30	1	8.0	117
Sept. 30	1	9.7	110
Oct. 8	3	10.2	121
Oct. 24	5*		
Average		10.6	120.8

*Live

is described by Hooper (14). The young weighed 4.2 grams at 15 days.

Development from this time on is mostly in size and weight. After the eyes have opened the young are weaned and become independent of their mother in 15-21 days at which time they move about with agility. In five weeks the young had the subadult or post-juvenile pelage and also obtained measurements of immature mice. One captured immature male weighed 5.6 grams and measured 97 millimeters in total length. Five trapped immature females ranged in weight from 5.1 to 6.9 grams and ranged in length from 99 to 113 millimeters. The captive mice later obtained adult measurements (Tables 2, 3) and possess the adult pelage. The adult mice have at least one annual molt, in which the new adult fur replaces the old.

ACTIVITY RHYTHMS

An investigation was made to determine some effects of photoperiodicity on the rhythmic activity of western harvest mice (Figure 1).

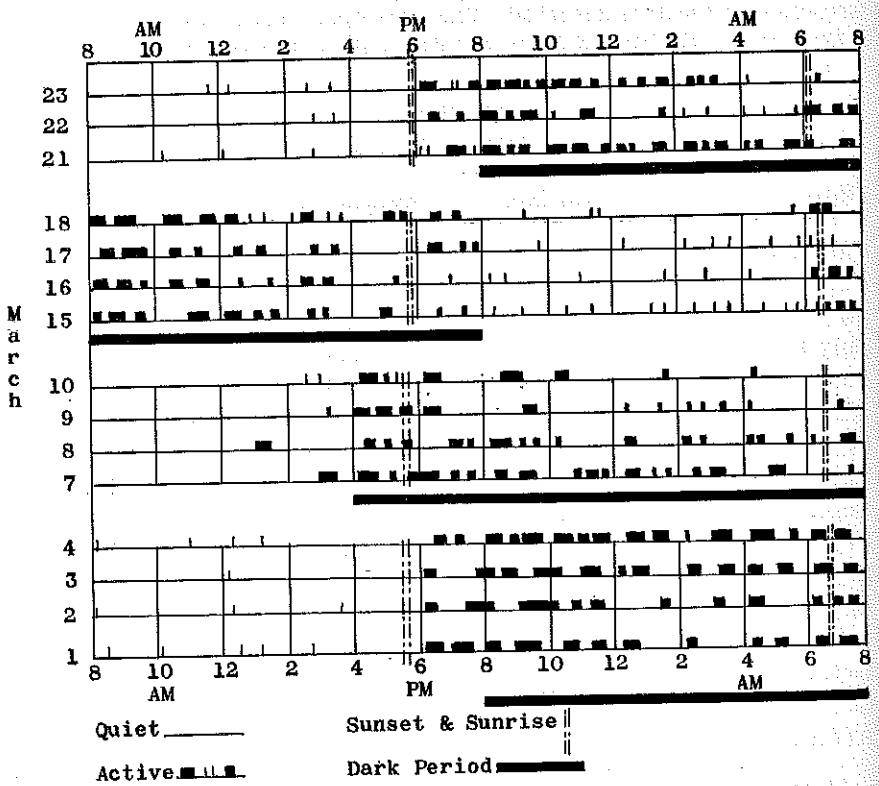

Fig. 1. Effects of photoperiodicity on the activity of harvest mice.

In the four experiments conducted under laboratory conditions, harvest mice had a peak of activity about one to two hours after the dark period began and retired to their nests before the light period commenced.

Subjected to a 12 hour dark period and a 12 hour light period, the two harvest mice became active shortly after sunset, although this was nearly two hours before the dark period commenced, and their activity ceased shortly before the beginning of the light period, which was one to two hours after sunrise.

Under the influence of a 16 hour dark period and an 8 hour light period, the same two mice became active shortly after the beginning of the dark period which, in this case, was before sunset, and were relatively quiescent during the light period.

Subjected to a reversal of light and dark periods, the two harvest mice showed a reversal of activity. The mice were, however, more active during the light hours than during the light hours of the previous experiments.

CONCLUSIONS

The western harvest mouse is common in grassland areas of southeastern South Dakota. It is found to be most abundant in the tall grass areas of the uplands where the basal cover is high. These mice are frequently associated with activities of meadow mice, both using the same runways. Meadow mice are active during the day and night; harvest mice are strongly nocturnal. Nests are frequently made in low shrubs and also on the surface of the ground. The nests are spherical in shape, hollow, and the mice use an opening at the bottom of the nest.

Harvest mice breed from March to October with a low in reproductive activities in midsummer in the northern part of their range. Gestation is 24-26 days and litter size ranges from three to seven.

The young are naked when born and have no evidence of orifices for the eyes, ears, genitalia, and anus at birth. Hair first develops on the dorsal surface and later on the ventral surface of the body. The eyes open within 11-13 days and the young move about with agility. After the opening of the eyes, the young become weaned and are independent of their mother in 15-21 days. The young are fully haired in twelve days. In five weeks the mice weighed approximately three times more than at birth. At this age they have the subadult pelage. Continued growth results in an increase in size and weight, and eventually culminates with the adult pelage.

Harvest mice are very sensitive to noises. They are relatively non-combative and live quite peaceably with each other.

Under laboratory conditions harvest mice express a 24-hour rhythmic activity. Subjected to a normal 12-hour light period and a 12-hour dark period, the mice showed an initiation of activity shortly after sunset even though the dark period began two hours after sunset, and they ceased their activity by the beginning of the light period which was about one to two hours after the seasonal sunrise. Under a longer dark period, the mice became active at the beginning of the dark period which was two hours before sunset. The period of activity is reversed when the light-dark sequence is reversed. On reversed conditions, the mice are more active during the light period than those under the normal light-dark sequence.

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