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(Peromyscus boylii) in Kansas With Description of a New Subspecies, by  
Charles Alan Long**

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LAWRENCE  
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# Natural History of the Brush Mouse (*Peromyscus boylii*) in Kansas With Description of a New Subspecies

BY  
CHARLES A. LONG

In order to determine the geographic distribution of the brush mouse in the state, 15 localities, chosen on the basis of suitable habitat, were investigated by means of snap-trapping in the winter and spring of 1959, spring of 1960, and winter and spring of 1961. Variation in specimens obtained by me and in other specimens in the Museum of Natural History, The University of Kansas, was analyzed. Captive mice from Cherokee County, Kansas, were observed almost daily from March 27, 1960, to June 1, 1961. Captive mice from Chautauqua and Cowley counties were studied briefly. Contents of 38 stomachs of brush mice were analyzed, and diet-preferences of the captive mice were studied. Data from live-trapping and from snap-trapping are combined and provide some knowledge of size and fluctuation of populations in the species.

Examination of the accumulated specimens and the captive mice reveals the occurrence in southern Kansas of an unnamed subspecies, which may be named and described as follows:

### *Peromyscus boylii cansensis* new subspecies

*Type*.—Male, adult, skin and skull; No. 81830, K. U.; from 4 mi. E Sedan, Chautauqua County, Kansas; obtained on December 30, 1959, by C. A. Long, original No. 456.

*Range*.—Known from 3 mi. W Cedar Vale, in Cowley County, Kansas, and from the type locality.

*Diagnosis*.—Size medium (see Table 1 beyond); underparts white; upper parts Ochraceous-Tawny laterally, becoming intermixed with black and approaching Mummy Brown dorsally (capitalized color terms after Ridgway, 1912); eye nonprotuberant; tail short but well-haired distally and usually less than half total length; nasals long; cranium large.

*Comparisons*.—From *P. b. attwateri*, the subspecies geographically nearest *cansensis*, the latter can be easily distinguished by the less protuberant eyes and relatively shorter tail (91 per cent of length of head and body; in topotypes of *P. b. attwateri* from Kerr County, Texas, 104 per cent; in specimens of *P. b. attwateri* from Cherokee County, Kansas, 103 per cent). *P. b. cansensis* is darker than *P. b. attwateri* and darker than *P. b. rowleyi*, the palest subspecies of brush mouse, which occurs to the westward. The skull and nasals (see Table 1) in adults of *P. b. attwateri* from Cherokee County average shorter than in *cansensis*.

[Pg 102]

*Specimens examined*.—Total, 26. Cowley Co.: 3 mi. W Cedar Vale, 16. Chautauqua Co.: type locality, 10.

**TABLE 1. AVERAGE AND EXTREME MEASUREMENTS OF SPECIMENS OF *P. B. CANSENSIS*, OF *P. B. ATTWATERI* FROM CHEROKEE COUNTY, KANSAS, AND OF TOPOTYPES OF *P. B. ATTWATERI* LISTED BY OSGOOD, 1909.**

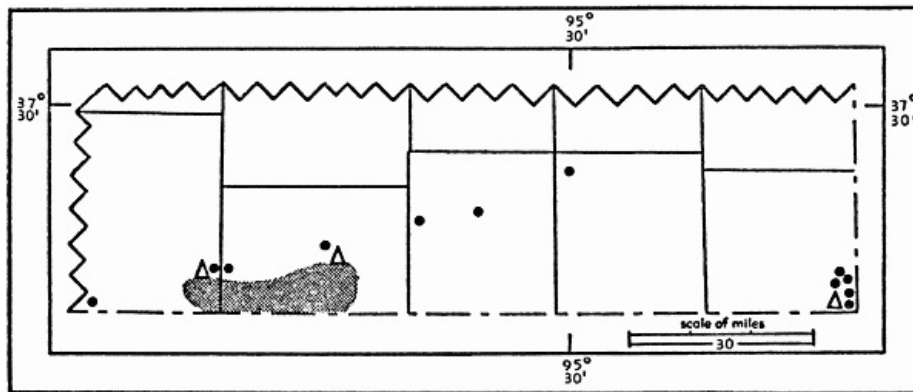
	<i>P. b. cansensis</i>			<i>P. b. attwateri</i>	
	Three miles west of Cedar Vale	Type locality	Both localities	Two miles south of Galena	Type locality <sup>[A]</sup>
No. specimens	11	7	18	20	10
Total length	180.5 170-199	176.7 166-188	179.1 .....	186.2 170-210	196.0 .....
Tail-vertebrae	85.5 72-101	85.0 75-93	85.3 .....	94.5 83-104	100.0 .....
Hind foot	23.1 22-24	23.6 22-25	23.3 .....	23.8 22-25	21.0 .....
Ear from notch	18.2 17-19	19.1 18-21	18.5 .....	18.4 14-21	..... .....
Greatest length of skull	27.9 26.8-29.0	28.3 27.9-28.9	28.1 .....	27.8 26.6-29.1	..... .....
Length of nasals	10.4 9.9-10.8	10.2 9.5-10.7	10.3 .....	9.9 9.1-10.4	..... .....
Zygomatic breadth	14.3 13.9-15.0	13.5 13.0-13.9	13.9 .....	13.8 13.3-14.4	..... .....

[A] From Turtle Creek, Kerr County, Texas, after Osgood (1909:148).

### *Distribution of Peromyscus boylii in Kansas*

The subspecies *Peromyscus boylii attwateri* is known in the state only from Cherokee County, the southeasternmost county in the state. Probably the only locality where the brush mouse occurs in that county is on the systems of cliffs along Shoal Creek, southward from Galena, to the eastward of Baxter Springs. This is the extent of the known range, and in my opinion the probable range, of *P. b. attwateri* in the state (see Fig. 1). Cockrum (1952:fig. 49) by mistake mapped the species

Osgood (1909:149) recorded the subspecies *P. b. attwateri* from Cedar Vale, Chautauqua County, Kansas, but the specimen from there must now be assigned to *cansensis* on geographic grounds. Probably the specimen was not obtained from Cedar Vale itself for the habitat is not suitable there. Numerous specimens are known from 3 mi. W Cedar Vale, in Cowley County, Kansas, all of which are assigned to *cansensis*. Osgood's recorded locality is situated between this locality and the type locality of *cansensis*, which is 4 mi. E Sedan, Chautauqua County, Kansas. The distribution of *cansensis* also is shown in Fig. 1.



**FIG. 1. Distribution of the brush mouse in Kansas. The southernmost row of counties includes from left to right Cowley, Chautauqua, Montgomery, Labette, and Cherokee. Black dots represent trapping localities from which brush mice were not obtained. Triangles represent localities from which brush mice were obtained. The stippled area contains suitable habitat for the brush mouse, but was not investigated. The easternmost triangle represents a place 2 mi. S Galena, Cherokee Co., Kansas, from which *P. b. attwateri* is known. The westernmost triangle represents a place 3 mi. W Cedar Vale, in Cowley Co., Kansas, from which *P. b. cansensis* is known. The triangle of intermediate position represents the type locality of *P. b. cansensis*, a place 4 mi. E Sedan, Chautauqua Co., Kansas. Many of the trapping localities have been investigated more than once.**

The probable geographic range of *P. boylii* is based on trapping data (see Fig. 1). The brush mouse is confined to systems of wooded cliffs in Kansas. The two subspecies seem to be separated by more than 80 miles of grasslands. Blair (1959) has postulated that in the northeastern part of its range *P. b. attwateri* is represented by disjunct, relict populations formed by diminishing montane or cool, moist environmental conditions. He has implied that the critical climatic change occurred during post-Wisconsin times, and that the isolation of these populations occurred so recently that no morphological differentiation has resulted in them. Inasmuch as the species is widely distributed in México, the southwestern United States, and in California, and has been recorded from the Pleistocene of California (Hay, 1927:323), it is reasonable to suppose that the species immigrated into Kansas from the southwest and that the immigration was in a generally northward or eastward direction. If long tail and large eyes are specializations for a scansorial mode of life (discussed below), then *P. b. cansensis* must be considered more primitive than *P. b. attwateri* for the eyes are less protuberant and the tail is shorter in *P. b. cansensis* than in the latter. I suggest that *P. b. cansensis* occurred in what is now known as Kansas before *P. b. attwateri* entered this area by way of the Ozark Mountains. The occurrence of a mouse of "the truei or boylei group" (Hibbard, 1955:213) in southwestern Kansas in the Jinglebob interglacial fauna of the Pleistocene adds little to support the thesis outlined above, but is not inconsistent with the thesis. Incidentally, the geographic distribution of *P. boylii* may differ somewhat from that shown by Blair (1959:fig. 5); whereas he has mapped the distribution of *P. boylii* to show disjunctivity in *P. b. attwateri* and homogeneity in the distribution of other subspecies of the brush mouse to the westward and southward, disjunctivity actually occurs frequently also in the western and southern subspecies.

### Ecology

In Kansas the brush mouse is confined to systems of cliffs, the faces of which range in height to at least 40 feet. The highest cliffs—some approximately 100 feet—on which brush mice are known to occur in Kansas are along Shoal Creek, Cherokee County. The brush mouse is found on low bluffs that are parts of higher systems, but in Cherokee County the mouse was not obtained from low bluffs separated by even a few miles from the cliff-system along Shoal Creek. As implied above the brush mouse is adapted for a scansorial mode of life; but other mice and rats inhabit the rocky crevices of low bluffs. Whereas the brush mouse is well adapted for living on high cliffs it seems that the other rodents are better adapted for life on low cliffs. *Sigmodon hispidus* was obtained from the low, limestone cliffs mentioned previously. From most low bluffs in southeastern Kansas (and on some high bluffs outside the geographic range of *cansensis*) *Peromyscus leucopus* was obtained. In Cowley County the brush mouse was abundant when *P.*

*leucopus* was not and *vice versa* during this study. *Sigmodon hispidus* did not associate with the brush mouse in any area, although *S. hispidus* was often trapped in grassy areas adjacent to cliffs and on the grassy crests of the hills. Except at the locality in Cherokee County, the pack rat, *Neotoma floridana*, was found in association with the brush mouse. *Microtus ochrogaster* was the most abundant rodent in adjacent southwestern Missouri (Jackson, 1907) before *Sigmodon* thoroughly infiltrated this area and southeastern Kansas. Activities of other rodents may have confined the brush mouse ecologically to cliffs. Although the grasslands are a barrier to further intrusion by the brush mouse into Kansas, one cannot assume that they alone confined the brush mouse to cliffs. Such an assumption would not explain its absence on systems of cliffs similar to and near other systems of cliffs on which it is found in the non-grassy Ozarkian habitats of Arkansas, as was noticed by Black (1937). Such an assumption would not indicate why the size of the cliff-systems is correlated with the absence or presence of the brush mouse on the northeastern margin of its geographic range.

Parasites found on *P. b. attwateri* include three individuals of the laelapid mite, *Haemolaelaps glasgowi*. Two of these mites were removed from a live mouse. Two larval Ixodid ticks, *Ixodes* possibly *cookei*, were removed from the pinnae of the ears of a specimen of *cansensis* from the type locality, 4 mi. E Sedan, Chautauqua County. Four larval Ixodid ticks, *Dermacentor* possibly *variabilis*, were removed from the pinnae of the ears of a live specimen of *cansensis* from 3 mi. W Cedar Vale, in Cowley County.

**TABLE 2. STOMACH CONTENTS OF 38 BRUSH MICE FROM SOUTHEASTERN KANSAS IN WINTER AND SPRING.**

Localities and number of stomachs	Month	Empty	Acorn pulp	Seeds
2 mi. S Galena				
10	May, 1959	2	6	2
11	December, 1959	1	10	0
3	March, 1960	1	2	0
4 mi. E Sedan				
3	December, 1959	3	0	0
2	April, 1961	1	1	0
3 mi. W Cedar Vale				
6	December, 1959	1	3	2
3	December, 1960	0	3 <sup>[B]</sup>	0

[B] Judged to be acorn pulp or hickory nut pulp.

Black (1937:195) and Cockrum (1952:180-181) reported stomach contents of *P. b. attwateri* from Cherokee County containing acorn pulp, seeds, and insects. Analysis of 38 stomachs of the brush mouse (Table 2) show acorns to be the most commonly used food in winter and spring. Seed coats were only rarely found, and insects were absent. Two captive females preferred acorns. Live beetles and grasshoppers of numerous kinds were decapitated and their inner parts eaten. Seeds (wheat, corn, and oats) were also eaten. Inasmuch as acorns appear to be the chief food, it is not surprising that the brush mouse is usually found on cliffs that support stands of blackjack oak (*Quercus marilandica*). Other oaks are present, but I have no evidence that the brush mouse eats their acorns. A. Metcalf told me that he observed in December, 1960, a released brush mouse interrupt its movement toward a hole in a cliff-face along Cedar Creek, Cowley County, in order to pick up an acorn (judged to be from the blackjack oak) in daylight. The mouse carried the acorn into the hole in the cliff. I have observed that captive brush mice eat acorns of the blackjack oak but not some other kinds of acorns.

*Behavior*

The chief differences observed between the brush mouse and other species of the genus *Peromyscus* in Kansas can be summarized as follows: the brush mouse is a superior and more cautious climber; seldom jumps from high places when under stress; is capable of finding its way better in partial darkness; has a stronger preference for acorns; and sometimes buries or hides seeds or acorns. These are all behavioral adaptations that seem in harmony with its mode of life.

Buck, Tolman, and Tolman (1925) showed the balancing function of the tail in *Mus musculus*. Climbers (for example, squirrels) often possess long, well-haired tails. It is reasonable to suggest (as did Hall, 1955:134) that the long, tufted tail is an adaptation for a scansorial existence. Little observation is necessary to observe how such a tail is used in balancing. Furthermore, it is used as a prop when the mouse is climbing a vertical surface. Dalquest (1955:144) mentioned tree-climbing in *P. boylii* from San Luis Potosí, México. It may occur in *P. b. attwateri* or in *P. b. cansensis* also, but there is no evidence as yet to prove it.

The brush mouse can seldom be induced to jump from heights of two feet or more. Rather it tends to scamper downward or to remain in place. It often swings itself over an edge, holding to it by its hind feet, and sometimes to it lightly with its tail, and reduces a short jump by almost the length of its body. Such caution seems to be an adaptation in a mouse that lives as a climber.

[Pg 107]

Many animals of cavernous habitats have small eyes (see Dobzhansky, 1951:284). Some nocturnal animals (for example, owls) have large eyes. The brush mouse has large, protuberant eyes; it lives in the deep crevices and fissures of the cliffs on which it is found, but it is not strictly a cave-dwelling animal. Perhaps large eyes aid the brush mouse in performing activities in the partial darkness of a deep crevice or hole in a cliff. Brush mice experimentally placed in what appeared to be total darkness fed, built houses of cotton, and ran and climbed in the usual manner.

On several occasions the captive brush mice hid surplus seeds and on other occasions hid acorns by burying them and sometimes by placing them in a small jar. The mice never carried the surplus food into their house.

Black (1937:195) has claimed that the brush mouse builds a nest similar to that of the nest of the pack rat, *Neotoma floridana*. Hall (1955:134) doubts this to be the case. Dalquest (1953:144) described a nest of *P. boylii* from San Luis Potosí as seven inches in diameter, made of leaves, and found in a hollow tree. Drake (1958:110) noted that *P. b. rowleyi* lives in holes and crevices in rocky bluffs in Durango, México. I have found this to be the case for *P. b. attwateri*, as did A. Metcalf (unpublished) for *P. b. cansensis*. Nests of sticks and leaves were taken apart by Metcalf, and all sign indicated only the presence of the pack rat. I have observed that there are no such houses on the cliffs along Shoal Creek, Cherokee County, and that no pack rats have been obtained from there (pack rats have not been reported from Cherokee County). Blair (1938) found two brush mice (*P. b. attwateri*) in the house of a pack rat in Oklahoma. Nests of the brush mice that occur in Kansas have not been found.

A lactating, pregnant female (KU 81833) of *P. b. attwateri*, containing three embryos, was obtained on December 24, 1959, and shows that this subspecies breeds in winter. Accumulated records for the subspecies indicates year-round breeding (see Cockrum, 1952:181). Another female obtained on March 27, 1960, was probably lactating.

Pregnant females of *P. b. cansensis* (KU 84892, 84895, and 84890) were obtained from the type locality on April 1-2, 1961, containing 3, 4, and 5 embryos respectively. This indicates, perhaps, increased breeding in spring; five was the highest number of embryos found in brush mice in Kansas.

[Pg 108]

#### *Population Studies*

In the period of my study the populations of brush mice became smaller, perhaps owing to the severe winter of 1959-1960. In Cowley County, *P. leucopus* is now abundant and *P. boylii* rare where in December of 1959, the opposite was true. It is also possible, of course, that trapping has depleted the populations.

#### Conclusions

1. A new subspecies of brush mouse is named and described from southern Kansas.
2. The new subspecies has smaller eyes and a shorter tail and may be more primitive than *P. b. attwateri*.
3. No significant sexual dimorphism was noted in *P. boylii*.
4. In Kansas, *P. b. attwateri* is known only from a single locality; *P. b. cansensis* is known from only two localities, both in Kansas.
5. The cliff-dwelling habit of *P. boylii* probably isolates populations from one another.
6. The grasslands constitute a barrier for the brush mouse.
7. In Kansas, *P. b. cansensis* probably is an older population than *P. b. attwateri*.
8. In Kansas the brush mouse is confined to systems of cliffs that are wooded and that are at least 40 feet in height.
9. The brush mouse may be confined to cliffs in part by activities of other rodents.
10. The brush mouse commonly associates with the pack rat.
11. Laelapid mites have been found on specimens of *P. b. attwateri*.
12. Larval ixodid ticks were found on specimens of *P. b. cansensis*.
13. Acorns seem to be the chief food of the brush mouse; insects and seeds are also commonly eaten.
14. The brush mouse is adapted for climbing and probably for a partly subterranean life.

15. *P. b. attwateri* breeds in winter, as well as in other parts of the year.

[Pg 109]

16. *P. b. cansensis* is known to breed in early April.

17. The highest number of embryos obtained from a brush mouse in Kansas is five.

### Acknowledgments

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### Transcriber's Note

The following error is noted, but left as printed:

Page 105, "the must abundant rodent" should be "the most abundant rodent"

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