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A NEW SUBSPECIES OF GEOMYS BURSARIUS (MAMMALIA: GEOMYIDAE) FROM TEXAS AND NEW MEXICO

Robert J. Baker and Hugh H. Genoways

As part of a study of the systematics and ecology of pocket gophers occurring on the high plains of Texas and eastern New Mexico, numerous populations of the plains pocket gopher, *Geomys bursarius*, were examined karyotypically. Four chromosomal races were described from this area by Baker *et al.* (1973). Additional studies lead us to believe that two of these races represent an undescribed subspecies of the plains pocket gopher. In addition to karyological evidence, specimens of this subspecies are morphologically distinct from those of all contiguous populations of *Geomys bursarius major*, the race to which they previously were assigned. How a widespread subspecies of pocket gopher could have gone undetected until now is not easily explainable. It is noteworthy, however, that Bailey (1905) did assign the first known specimen of this subspecies to *Geomys arenarius*, which the new subspecies does resemble superficially.

Geomys bursarius knoxjonesi, new subspecies

Holotype.—Adult female, skin, skull, and body skeleton, no. 19872, The Museum, Texas Tech University (TTU); from 4.1 mi. N, 5.1 mi. E Kermit, Winkler Co., Texas; obtained on 27 January 1974 by Stephen L. Williams; original no. 1303; karyotype no. TK 5074.

Distribution.—Presently known from southern Cochran, Yoakum, Terry, Gaines, northwestern Martin, Andrews, Winkler, and Ward counties in western Texas, and Chavez, Eddy, and Lea counties in southeastern New Mexico (Fig. 1). This subspecies generally is restricted to deep, sandy soils of aeolian origin within this region.

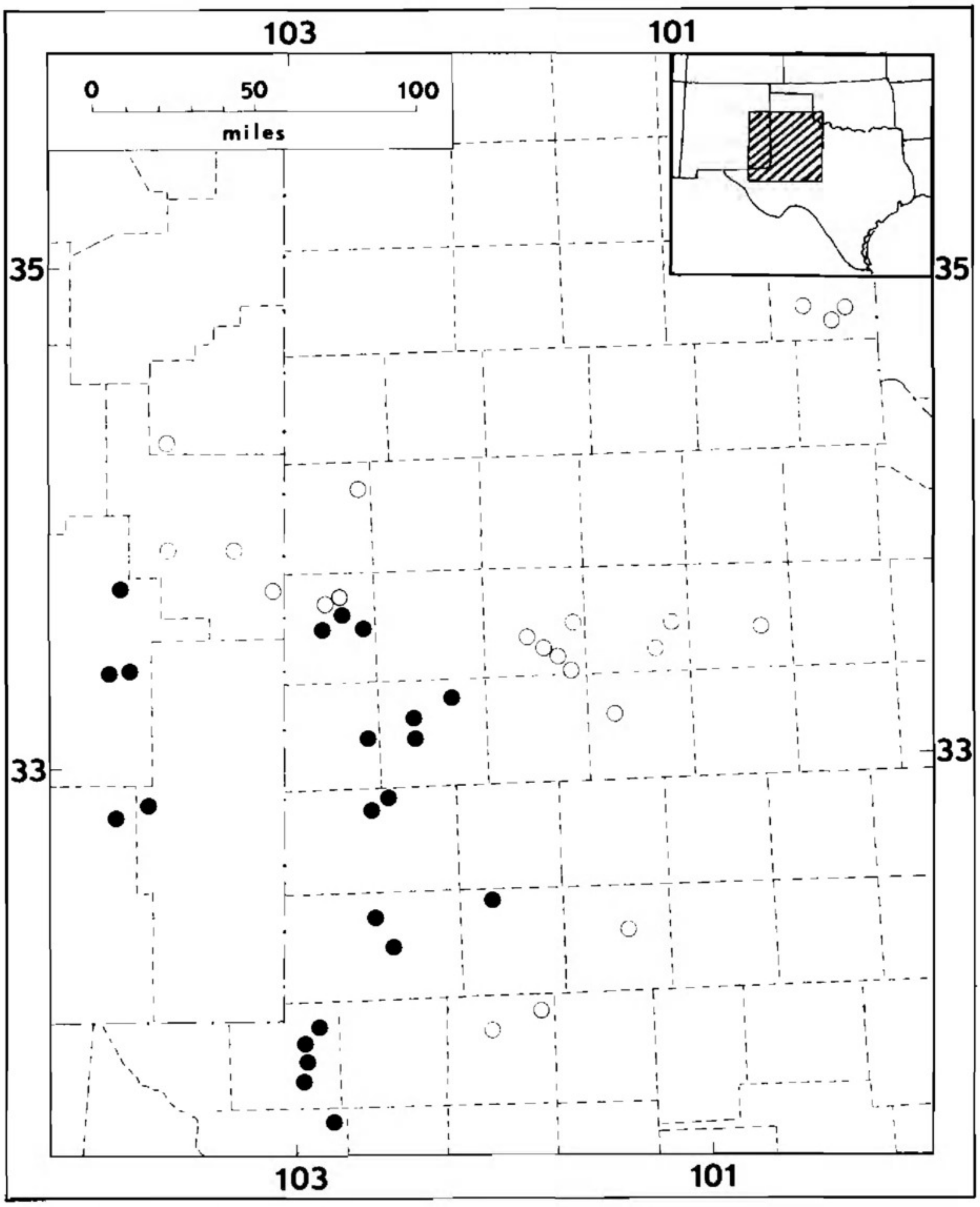

FIG. 1.—Map of West Texas and eastern New Mexico showing the geographic distribution of *Geomys bursarius knoxjonesi* (closed circles) and adjacent samples of *Geomys bursarius major* (open circles) used in this study.

Description.—Size small, both externally and cranially (Table 1), particularly evident in measurements of cranial length (Fig. 2); length of tail proportionally long as compared with the length of head and body. Coloration pale; upper parts buffy-brown, paler on sides and venter; some areas on venter covered with almost pure white hair; feet white.

Karyotypic features.—The diploid number is 70 (Fig. 3) and the fundamental number (*FN*, number of arms of autosomal complement)

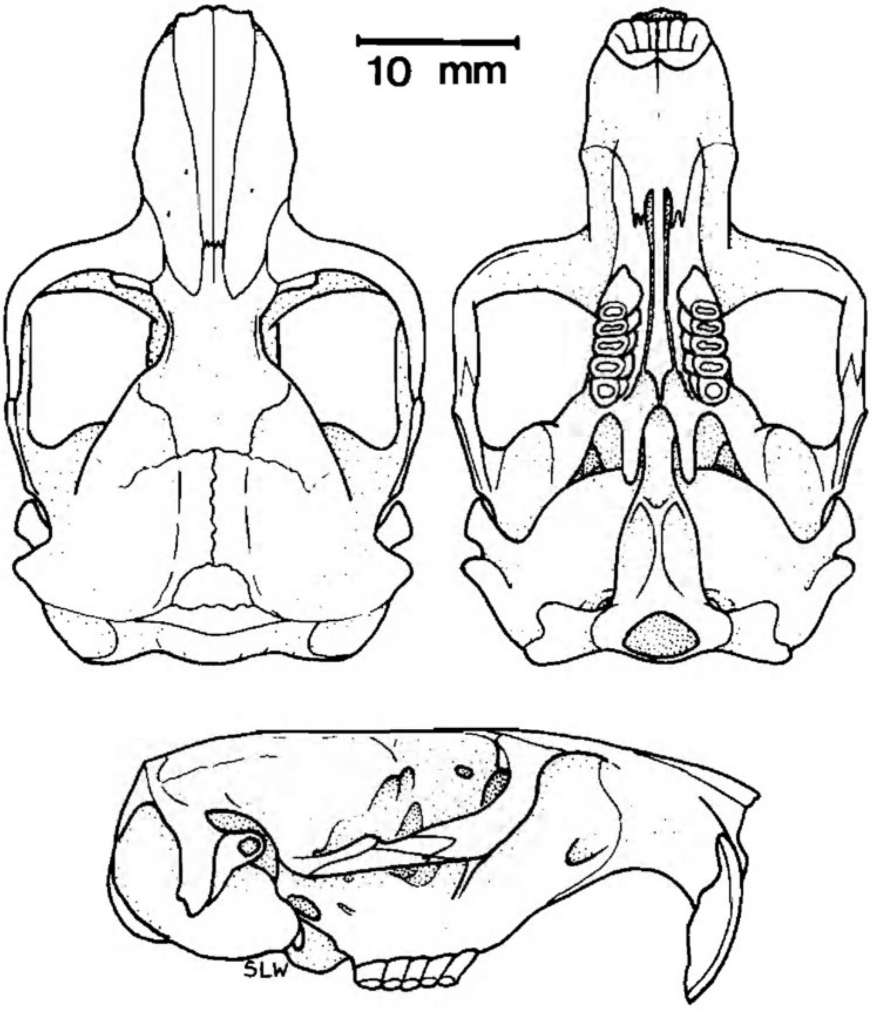

FIG. 2.—Dorsal, ventral, and lateral views of the cranium of the adult female holotype, TTU 19872, of *Geomys bursarius knoxjonesi.*

is 68 in Texas populations and 70 in New Mexico samples. The X chromosome is the largest element. The Y is believed to be a medium or small-sized acrocentric. New Mexico samples have a small pair of biarmed elements, whereas karyotypes from individuals from Texas are composed entirely of acrocentrics. The three smallest pairs of elements have secondary constrictions. Texas populations consist of chromosomal race *A* and the New Mexico population represent chromosomal race *B* of Baker *et al.* (1973). A variant karyotype ($2N=69$, $FN=68$) was described by Baker *et al.* (1973) for a specimen assigned to *G. b. knoxjonesi.*

Measurements.—Measurements of three samples of *G. b. knoxjonesi* are given in Table 1. External and cranial measurements (in millimeters) of the holotype (TTU 19872) are as follows: total length, 238; length of tail, 83; length of hind foot, 30; length of ear, 6; greatest length of skull, 40.1; condylobasal length, 38.5; zygomatic breadth, 24.7; least interorbital breadth, 5.4; mastoid breadth, 23.3; length of

TABLE 1.—*External and cranial measurements of seven samples of* Geomys bursarius.

Sex and statistics	Total length	Length of tail	Length of hind foot	Greatest length of skull	Condylobasal length	Zygomatic breadth	Interorbital breadth	Mastoid breadth	Length of nasals	Length of rostrum	Length of maxillary toothrow	Palatofrontal depth
					Winkler and Ward counties, Texas							
Males (12)												
Mean	255.5	89.8	31.2	44.1	42.6	27.0	6.0	25.0	15.5	18.4	8.5	16.3
1 SE	±6.37	±2.48	±0.68	±0.47	±0.48	±0.55	±0.07	±0.34	±0.21	±0.25	±0.13	±0.21
Minimum	206.0	77.0	28.0	40.9	39.5	23.8	5.6	23.0	14.4	17.1	7.5	15.3
Maximum	282.0	104.0	35.0	46.0	44.1	29.3	6.4	26.5	16.7	19.6	9.0	17.5
CV	8.6	9.6	7.6	3.7	3.9	7.1	4.1	4.7	4.8	4.8	5.2	4.5
Females (17)												
Mean	232.6	80.6	28.4	40.1	38.9	23.9	5.9	22.6	13.8	16.4	8.1	14.6
1SE	±3.21	±1.99	±0.44	±0.28	±0.30	±0.22	±0.06	±0.18	±0.13	±0.16	±0.12	±0.13
Minimum	209.0	65.0	25.0	38.0	36.9	22.6	5.5	21.4	12.7	14.7	6.8	13.7
Maximum	255.0	94.0	31.0	43.0	41.7	25.8	6.2	23.8	14.7	17.3	8.9	15.5
CV	5.7	10.2	6.4	2.9	3.2	3.8	4.1	3.3	3.9	4.1	6.0	3.6

TABLE 1.—*Continued.*

	Andrews, southern Cochran, Gaines, and Terry counties, Texas											
Males (10)												
Mean	251.6	83.0	29.7	44.8	43.6	29.6	6.2	25.7	16.2	18.7	8.3	16.5
1SE	±5.72	±1.69	±0.58	±0.53	±0.53	±1.00	±0.05	±0.36	±0.39	±0.29	±0.11	±0.19
Minimum	231.0	74.0	28.0	42.0	40.9	26.5	5.9	23.7	14.4	17.6	7.9	15.5
Maximum	280.0	94.0	34.0	46.9	45.7	37.8	6.5	27.7	18.1	20.2	9.0	17.4
CV	7.2	6.5	6.2	3.7	3.8	10.7	2.7	4.4	7.6	4.9	4.3	3.7
Females (16)												
Mean	219.4	73.4	26.6	39.4	37.5	23.9	5.9	22.4	13.4	16.0	7.8	14.6
1SE	±2.00	±2.00	±0.43	±0.25	±0.64	±0.17	±0.08	±0.13	±0.16	±0.43	±0.09	±0.09
Minimum	203.0	57.0	23.0	37.6	36.0	22.5	5.4	21.7	12.5	14.8	7.0	14.0
Maximum	234.0	87.0	29.0	41.8	39.8	25.2	6.6	23.2	14.5	17.7	8.4	15.3
CV	3.6	10.9	6.4	2.5	6.9	2.9	5.5	2.4	4.7	4.3	4.6	2.4
	Collingworth County, Texas											
Males (13)												
Mean	255.8	80.5	31.8	48.0	46.6	29.5	6.6	27.7	17.3	20.5	8.6	17.0
1SE	±3.08	±1.68	±0.71	±0.31	±0.34	±0.39	±0.10	±0.65	±0.19	±0.16	±0.21	±0.16
Minimum	235.0	73.0	30.0	45.9	45.1	27.0	6.1	26.3	16.4	19.2	6.6	16.1
Maximum	273.0	91.0	38.0	49.6	48.6	31.2	7.3	28.8	18.6	21.5	9.4	17.9
CV	4.3	7.5	8.1	2.3	2.6	4.8	5.6	2.8	3.9	2.8	8.8	3.4
Females (19)												
Mean	232.3	70.2	29.8	42.4	41.4	25.0	6.3	23.8	14.6	17.6	8.0	15.3
1SE	±2.64	±1.20	±0.57	±0.38	±0.26	±0.34	±0.05	±0.27	±0.18	±1.19	±0.08	±0.14
Minimum	214.0	60.0	26.0	38.7	40.1	22.4	5.9	21.6	13.0	16.0	7.6	14.5
Maximum	253.0	81.0	37.0	46.0	43.1	28.7	6.8	26.6	15.9	19.2	8.8	17.0
CV	4.9	7.5	8.3	4.0	2.2	5.9	3.6	4.9	5.3	4.6	4.6	4.1

TABLE 1.—*Continued.*

	Bailey and northern Cochran counties, Texas, and Curry and Roosevelt counties, New Mexico											
Males (6)												
Mean	259.6	81.2	31.2	48.2	46.9	29.1	6.4	27.9	17.1	20.9	8.8	17.1
1SE	±8.22	±4.64	±0.60	±1.41	±1.27	±1.10	±0.13	±1.08	±0.77	±0.67	±0.21	±0.54
Minimum	234.0	68.0	29.0	42.1	41.6	25.0	6.0	24.0	14.6	18.1	8.2	15.7
Maximum	284.0	94.0	33.0	51.6	50.0	32.3	6.8	31.1	19.5	22.5	9.6	18.9
CV	7.8	14.0	4.7	7.1	6.6	9.3	4.9	9.5	11.1	7.9	5.8	7.8
Females (8)												
Mean	233.4	77.6	28.0	42.0	41.0	25.0	6.1	24.3	14.2	17.5	8.2	15.2
1SE	±2.53	±2.10	±0.46	±0.71	±0.76	±0.40	±0.10	±0.51	±0.34	±0.40	±0.15	±0.20
Minimum	221.0	71.0	26.0	39.3	38.4	23.3	5.8	22.3	12.8	16.1	7.7	14.5
Maximum	245.0	88.0	30.0	44.8	44.2	26.6	6.6	26.5	15.2	19.0	9.1	15.9
CV	3.1	7.7	4.7	4.8	5.3	4.6	4.7	5.9	6.8	6.4	5.3	3.7
	Chavez, Eddy, and Lea counties, New Mexico											
TTU 17570 ♂	243.0	81.0	30.0	42.3	40.2	25.3	5.4	23.0	14.4	17.8	7.9	15.0
TTU 17566 ♂	225.0	85.0	29.0	41.3	40.4	26.0	5.3	23.7	14.0	17.4	7.7	15.3
Females (6)												
Mean	225.3	79.3	28.0	38.8	37.7	23.3	5.9	21.8	13.2	15.8	8.1	14.6
1SE	±4.40	±2.69	±0.51	±0.18	±0.18	±0.30	±0.09	±0.17	±0.16	±0.15	±0.14	±0.14
Minimum	210.0	72.0	26.0	38.2	37.0	22.4	5.5	21.5	12.8	15.2	7.4	14.0
Maximum	241.0	89.0	29.0	39.3	38.4	24.2	6.1	22.5	13.8	16.3	8.4	15.0
CV	4.8	8.3	4.5	2.5	1.2	3.1	3.9	1.9	2.9	2.4	4.4	2.4

TABLE 1.—*Continued.*

	Crosby, Dickens, Garza, and Lubbock counties, Texas											
Males (8)												
Mean	269.0	84.0	30.6	47.8	46.9	30.5	6.6	27.5	17.1	20.6	8.9	17.7
1SE	±4.78	±2.28	±0.82	±0.53	±1.07	±0.91	±0.08	±0.65	±0.65	±0.60	±0.19	±0.41
Minimum	243.0	76.0	27.0	44.1	42.9	27.3	6.2	24.9	14.6	18.2	7.8	16.0
Maximum	290.0	95.0	34.0	52.9	50.7	32.9	7.0	29.7	20.4	23.1	9.7	19.0
CV	5.0	7.7	7.6	7.3	6.5	8.5	3.6	6.6	10.7	8.2	6.1	6.6
Females (13)												
Mean	236.8	69.0	28.2	42.4	41.4	25.7	6.4	24.1	14.7	17.6	8.2	15.7
1SE	±4.40	±1.83	±0.51	±0.25	±0.26	±0.24	±0.08	±0.16	±0.17	±0.20	±0.11	±0.09
Minimum	215.0	55.0	24.0	41.4	40.1	24.6	5.9	23.2	13.8	16.7	7.4	15.2
Maximum	274.0	81.0	30.0	44.1	43.1	27.8	7.1	25.0	15.8	19.0	9.1	16.3
CV	6.8	9.6	6.5	2.2	2.2	3.4	4.7	2.3	4.3	4.2	4.8	2.1
	Morton County, Kansas											
Males (4)												
Mean	265.5	81.8	34.3	48.8	47.2	29.8	6.1	27.7	16.7	21.0	8.6	17.4
1SE	±7.71	±5.01	±1.49	±0.78	±0.93	±0.45	±0.13	±0.25	±0.15	±0.36	±0.21	±0.34
Minimum	250.0	68.0	30.0	46.6	44.8	28.9	5.6	27.2	16.4	20.2	8.2	16.4
Maximum	285.0	92.0	37.0	50.0	49.0	31.0	6.8	28.2	17.1	21.9	9.3	17.9
CV	5.8	12.2	8.7	3.2	4.0	3.0	8.7	1.8	1.8	3.4	5.8	4.0
KU 5014 ♀	234.0	72.0	28.0	41.7	40.5	24.1	6.0	23.1	14.7	17.2	8.0	15.2

FIG. 3.—Karyotype of the adult female holotype, TTU 19872, of *Geomys bursarius knoxjonesi.*

nasals, 14.0; length of rostrum, 16.5; length of maxillary toothrow, 8.0; palatofrontal depth, 14.7.

Comparisons.—Populations of *Geomys bursarius knoxjonesi* are in contact only with populations of *G. b. major* and, therefore, need extensive comparison only with this taxon. Individuals of *Geomys bursarius knoxjonesi* are significantly smaller in size than those of *G. b. major* in several cranial measurements. *G. b. knoxjonesi* averages smaller than *major* in most other characteristics (see Table 1, Figs. 4-5, and discussion below) and has a proportionally longer tail. In coloration, *knoxjonesi* is noticeably paler than *major*, being a buffy brown rather than a darker (more chocolate) brown on the upper parts. It is of interest to note that Bailey (1905:130) reported the first specimen of *knoxjonesi* from near Monahans, Texas, as *Geomys arenarius.* These two taxa do resemble each other in external coloration.

The karyotype of the Texas populations of *G. b. knoxjonesi* is distinguished from that of adjacent populations of *G. b. major* by comparing fundamental numbers (70 or 72 in *major*, as opposed to 68 in Texas populations of *knoxjonesi*). New Mexican populations of *knoxjonesi* have a fundamental number of 70, their karyotype having a pair of small biarmed elements. No pair of small biarmed elements has been found in the karyotype of any population of *G. b. major* having a karyotype with a fundamental number of 70.

The relationship and distinction of the four karyotypic races (*A* and *B* in *knoxjonesi* and *C* and *D* in *major*) found in *Geomys bursarius* in western Texas and adjacent New Mexico is complicated by polymorphisms, and these were discussed in detail by Baker *et al.* (1973). Their paper should be consulted for additional information.

Another subspecies that approaches *knoxjonesi* in the northeastern part of its geographic range is *G. b. jugossicularis*. Morphologically, samples of *knoxjonesi* differ from those of *jugossicularis* in many of the same characteristics in which they differ from *major*. *G. b. knoxjonesi* is smaller in size and has a proportionally longer tail. Based on coloration, samples of *knoxjonesi* are not separable from our sample of *jugossicularis* from Kansas.

The karyotype of *G. b. jugossicularis* was reported by Hart (1971) to have a $2N=72$ and $FN=72$, identical to that recorded for some populations of *G. b. major* that we have examined, but the diploid and fundamental values are greater by two than any recorded for *G. b. knoxjonesi*.

As will be seen in the discussion below, the subspecies of *Geomys bursarius* that are most closely related to *G. b. knoxjonesi* are *G. b. llanensis* and *G. b. texensis*. These two subspecies are geographically separated from *knoxjonesi* by intervening populations of *major*. The main differences among these taxa are the generally narrower skulls of *texensis* and *llanensis*, particularly evident in interorbital breadth (5.7 and 5.7, respectively, for females and 5.7 and 5.8 for males), and the proportionally shorter tails of *texensis* and *llanensis* (40.4 and 38.8 per cent of head and body length, respectively, for females and 38.7 and 36.8 per cent for males).

The karyotype of *knoxjonesi* is indistinguishable from that of *texensis* and *llanensis*.

Remarks.—Both univariate and multivariate statistical analyses were used to study the relationships among populations of *Geomys bursarius* in Texas and adjacent regions. Samples used in the univariate analyses include three populations of *G. b. knoxjonesi*, three of *G. b. major* from near, or adjacent to, the geographical range of *knoxjonesi*, and one of *G. b. jugossicularis* (Table 1). Males and females were treated separately because of the high degree of secondary sexual dimorphism in this species. For the univariate analyses, single classification analysis of the variance (ANOVA) and sums of squares simultaneous testing procedure (SS-STP) were used in a manner similar to that employed by Genoways (1973).

Skull measurements were used as defined by Russell (1968) and Genoways (1973). All comparisons were made using adults (as indicated by the completed ossification of the basisphenoid and basioccipital bones).

The univariate analyses revealed that samples of *knoxjonesi* were significantly different from samples of *major* and *jugossicularis* in several characteristics. This was particularly true for females. In males, the same trends as for females are present, but the picture is not as clear. This probably results from the smaller sample size and generally higher individual variation in males.

In only two characteristics (total length and length of maxillary toothrow) were the means for samples of males not significantly different (ANOVA). In the remaining 10 characters, several patterns of nonsignificant subsets of means were revealed (SS-STP). For two characteristics (condylobasal length and length of rostrum), the samples were divided into two nonoverlapping subsets—one containing samples of *major* and *jugossicularis*; the other, samples of *knoxjonesi*. The samples of *knoxjonesi* were significantly smaller than those of the other two subspecies. Subsets containing samples of *knoxjonesi* and *major* overlapped only at the sample from Lubbock County and vicinity for greatest length of skull. Again, the means for *knoxjonesi* were significantly smaller. The other seven characteristics exhibit patterns of two or three broadly overlapping subsets. For three of these characteristics (mastoid breadth, length of nasals, and palatofrontal depth), however, samples of *knoxjonesi* had the smallest mean values. One characteristic in which *knoxjonesi* did not average smaller than *major* and *jugossicularis* was in length of tail. It appears that *knoxjonesi* has a proportionally longer tail in comparison with length of head and body than do *major* and *jugossicularis* (average percentage for *knoxjonesi* samples is 54.2, 49.2, and 55.0, as compared with 45.4, 45.9, 45.5, and 44.5 for *major* and *jugossicularis*).

Only in length of maxillary toothrow were the sample means of females not significantly different. In three characteristics (greatest length of skull, mastoid breadth, and length of rostrum), the three female samples of *knoxjonesi* formed a subset that did not overlap the subset formed by the samples of *major* and *jugossicularis*. Samples of *knoxjonesi* also are significantly smaller than all samples of *major* and *jugossicularis*, with the exception of the sample from Bailey and northern Cochran counties, Texas, and Curry and Roosevelt counties, New Mexico, which is intermediate in four characteristics (condylobasal length, interorbital breadth, length of nasals, and palatofrontal depth). This sample of *G. b. major* is intermediate between typical *major* and *knoxjonesi*, these four characteristics being in subsets with each taxon. As in males, females of *knoxjonesi* have a proportionally longer tail (53.0, 50.1, and 54.3) than do those of *major* and *jugossicularis* (41.1, 43.3, and 44.4). The one sample of *major* that approaches *knoxjonesi* in this characteristic is the one from Bailey and Cochran counties, Texas, and Curry and Roosevelt counties, New Mexico, in which the ratio of the length of tail to head and body length is 49.8.

Based on the univariate analyses, it appears that *G. b. knoxjonesi* is a distinctly smaller subspecies than either *G. b. major* or *G. b. jugossicularis* and is more distinct from both than either is from the other. These differences are more marked in females than in males, but the same trends are present in both sexes. In females, an intermediate sample between the geographic ranges of *knoxjonesi* and *major* (Bailey and Cochran counties, Texas, and Curry and Roosevelt counties, New Mexico) is morphologically intermediate in several characteristics, although significantly different from *knoxjonesi* in several others. This intermediate tendency was not evident in males. Another characteristic of samples of *knoxjonesi* is that they possess relatively long tails in comparison with the length of head and body.

In the multivariate analyses that were conducted, the OTUs were sample means. Phenetic distance coefficients were derived from standardized characteristic values; these were clustered using UPGMA (unweighted pair-group method using arithmetic averages), and a phenogram was generated. Also, the first three principal components were extracted from a matrix of correlation among the 12 characters. A projection matrix for the first three dimensions was generated and used for plotting OTUs onto these principal components (see Genoways, 1973, for additional discussion of these techniques). In addition to the samples used in the univariate analyses, samples of the following subspecies were used in the multivariate analyses (see also specimens examined): *pratincola*, *ammophilus*, *attwateri*, *brazensis*, *dutcheri*, *texensis*, and *llanensis*. Additionally, several individuals from near the range of *knoxjonesi*, for which no chromosomal data were available, were tested to determine their morphometric relationships. These specimens originated from the following localities: 2.9 mi. S Patricia, Martin County, Texas (one female); 4.5 mi. SSW Morton, Cochran County, Texas (one male); 1 mi. SE Santa Rosa,

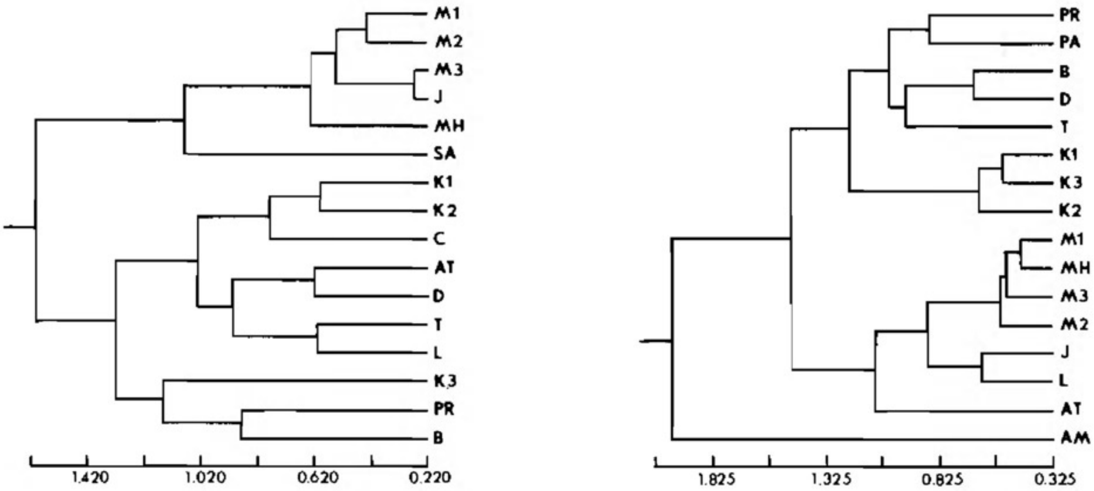

FIG. 4.—Phenograms of samples of *Geomys bursarius* (males left, females right) computed from distance matrices based on standardized characters and clustered by unweighted pair-group method using arithmetic averages (UPGMA). The cophenetic correlation coefficient for males is 66.2 per cent; for females, 79.5. Symbols used are as follows: Kl, *G. b. knoxjonesi* from Winkler and Ward counties, Texas; K2, *G. b. knoxjonesi* from Andrews, southern Cochran, Gaines, and Terry counties, Texas; K3, *G. b. knoxjonesi* from Chavez, Eddy, and Lea counties, New Mexico; Ml, *G. b. major* from Crosby, Dickens, Garza, and Lubbock counties, Texas; M2, *G b. major* from Collingsworth County, Texas; M3, *G. b. major* from Bailey and northern Cochran counties, Texas, and Curry and Roosevelt counties, New Mexico; J, *G. b. jugossicularis*; AM, *G. b. ammophilus*; AT, *G. b. attwateri*; B, *G. b. brazensis*; D, *G. b. dutcheri*; L, *G. b. llanensis*; PR, *G. b. pratincola*; T, *G. b. texensis*; C, single male from 4.5 mi. SSW Morton, Cochran Co., Texas; MH, sample from Midland and Howard counties, Texas; PA, single female from 2.9 mi. S Patricia, in Martin County, Texas; SA, single male from 1 mi. SE Santa Rosa, Guadalupe County, New Mexico.

Guadalupe County, New Mexico (one male); Midland and Howard counties, Texas (one male, seven females).

The phenogram (Fig. 4) resulting from clustering of phenetic distance coefficients for females is divided into three major groups. One sample is composed solely of *G. b. ammophilus.* The second group includes the three samples of *G. b. major*, a sample from Midland and Howard counties (which would be assigned to *major* based on these data), and samples of *jugossicularis*, *llanensis*, and *attwateri.* Within the third group, the three samples of *knoxjonesi* form a distinct cluster from samples of *pratincola*, *brazensis*, *dutcheri*, and *texensis.* The specimen from near Patricia is within this group. Based on this analysis, it appears that *knoxjonesi* has a greater morphological similarity to subspecies of *Geomys bursarius* from central and eastern Texas than to geographically contiguous samples of *G. b. major* and *G. b. jugossicularis.*

In the phenogram (Fig. 4) for males, two major clusters are present. The upper cluster contains the three samples of *major* and one of *jugossicularis.* Also in this group are the sample from Midland and Howard counties, Texas, and the individual from Santa Rosa, New Mexico. Within the other cluster, three subclusters are evident. The upper of these contains the two Texas samples of *knoxjonesi* and the single specimen from south of Morton, Texas. The second subcluster contains samples of the subspecies *attwateri, dutcheri, texensis,* and *llanensis.* The last subcluster contains the New Mexican sample of *knoxjonesi* and samples of *pratincola* and *brazensis.* Males, as do females, of *knoxjonesi* have a greater morphometric similarity to those from samples of *Geomys bursarius* from eastern Texas than they do to males in contiguous populations.

The OTUs projected onto the first three principal components are shown in Fig. 5. For males, these two components account for 82.5 per cent of the total phenetic variation (71.2 for I and 11.3 for II) and for females 79.3 per cent (60.9 for I and 18.4 for II). Results of the factor analyses are shown in Table 2. For both sexes, size is the major influence in component I. Males and females both show high positive weighting for interorbital breadth and length of maxillary toothrow and high negative weighting for length of tail in component II. Highest weighting is for length of tail in component III in males. Females have a high negative value for length of tail and a high positive one for length of rostrum in the third component.

In the plots, samples of *knoxjonesi* form a cluster separated from others. The cluster is much tighter in females than in males. In both sexes, *knoxjonesi* is separated from *major* in both the first and second components. The sample of *jugossicularis* is separated from *knoxjonesi* in the first component. The main separation of other samples is in the second component. The sample of *attwateri* also may be separated in the first component, at least in females. The sample of *llanensis* appears morphologically nearest to *G. b. knoxjonesi* in the plot of females, whereas *llanensis* and *texensis* are nearest for males.

The multivariate analyses clearly indicate that *G. b. knoxjonesi* is morphologically distinct from contiguous populations of *G. b. major.* In fact, *knoxjonesi* shows greater distinctness from *major* than do any of the other taxa included in this study; it evidently has affinities, both morphologically and karyotypically, with populations of *G. bursarius* from central and eastern Texas. It would appear to be more closely related to *G. b. llanensis* and *G. b. texensis* than to other races to the east.

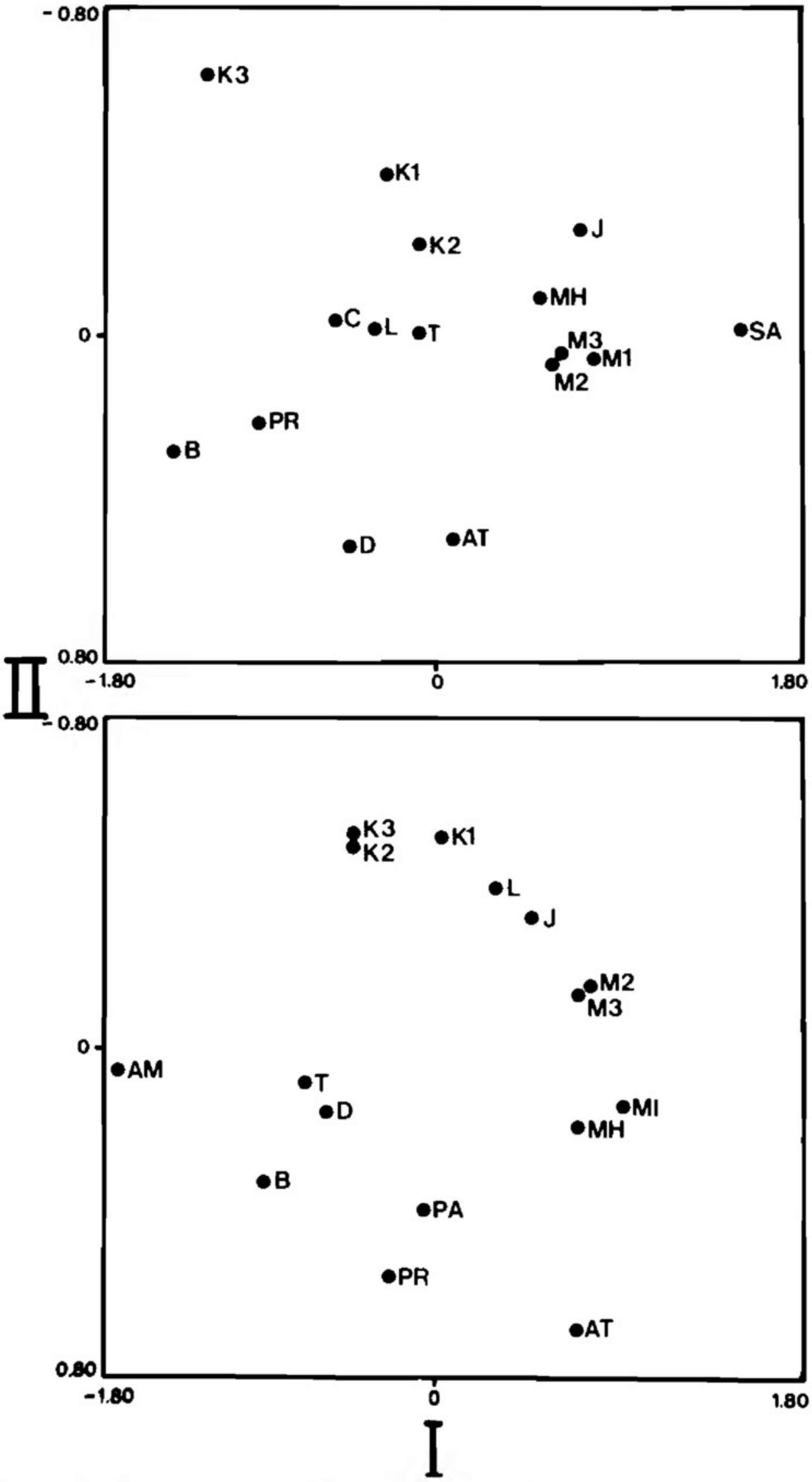

FIG. 5.—Two dimensional projections of the first two principal components illustrating the phenetic position of samples of *Geomys bursarius* (males, upper; females, lower). See Fig. 4 for key to symbols.

Significance of karyotypic variation.—The karyotype serves to identify populations at the subspecies level, but the actual role of this

TABLE 2.—*Factor matrix from correlation among the 12 characters of* Geomys bursarius *studied.*

Character	Males			Females		
	Component I	Component II	Component III	Component I	Component II	Component III
Total length	0.906	−0.211	0.044	0.903	−0.291	−0.157
Length of tail	0.410	−0.599	0.654	0.478	−0.647	−0.508
Length of hind foot	0.765	−0.286	−0.402	0.604	−0.596	0.032
Greatest length of skull	0.982	−0.014	−0.123	0.977	0.042	0.134
Condylobasal length	0.984	−0.028	−0.105	0.959	0.083	0.145
Zygomatic breadth	0.938	−0.085	0.164	0.889	0.292	−0.204
Interorbital breadth	0.441	0.688	0.483	0.134	0.753	−0.335
Mastoid breadth	0.925	−0.141	0.140	0.907	0.031	−0.201
Length of nasals	0.936	0.161	−0.170	0.919	−0.141	0.281
Length of rostrum	0.910	0.206	−0.275	0.721	0.334	0.501
Length of maxillary toothrow	0.706	0.532	0.134	0.303	0.743	−0.241
Palatofrontal depth	0.949	−0.115	0.044	0.969	0.088	−0.043

karyotypic variation in speciation in the plains pocket gopher is unknown. It is possible that karyotypic variation may result in reduced fertility in F_1 hybrids between *knoxjonesi* and *major*, but this has not been investigated. It should be pointed out that even if the present karyotypic variation that distinguishes these taxa does not result in reduced fertility, the mechanism for such is available. Because chromosomal characteristics are inherited in a Mendelian manner, and chromosomal rearrangements are believed to occur at a low rate, the karyotypic variation is an important marker of evolutionary divergence. However, the significance of this divergence to karyotypically characterized taxa must be investigated in each case.

The chromosomal variation within *knoxjonesi* is not believed to be a significant factor in reducing fertility between respective populations. The small second arm on the small biarmed elements may have resulted from a pericentric inversion, but in light of the karyotype of the population from Maljamar and Loco Hills, New Mexico, the second arms may be heterochromatic (Baker *et al.*, 1973). If these arms are heterochromatic, there should be no meiotic problems resulting from the karyotypic differences.

It is apparent from the foregoing analyses and discussion that *Geomys bursarius knoxjonesi* is a distinctive subspecies of the plains pocket gopher, inhabiting the deep aeolian sands of West Texas and southeastern New Mexico. *G. b. knoxjonesi* is geographically in contact only with the subspecies *major*. However, our analyses have shown that *knoxjonesi* differs as much or more from *major* as it does from any of the other taxa of *Geomys bursarius* included in this study. The highest degree of similarity shown by *knoxjonesi* is with *texensis* and *llanensis*. Whether or not this indicates past genetic affinity can only be a matter of conjecture at the present time. However, it is interesting to note that all three of these taxa represent peripheral populations of the plains pocket gopher. The possibility does exist that *llanensis*, *texensis*, and *knoxjonesi* were previously in contact and that the intervening area was invaded subsequently by *major* at the expense of the other subspecies. On the other hand, these peripheral populations may represent convergent evolution in the occupancy of similar marginal areas. Whatever the answer, these populations presently represent geographically isolated genetic pools.

There is a question in our minds at present as to whether *knoxjonesi* and *major* actually interbreed along their zone of contact. Although some populations from one area were morphologically intermediate in some characteristics, we have not been able to obtain karyological hybrids. This relationship will be the subject of continuing study of pocket gophers in this area.

Etymology.—The subspecific name is a patronym honoring Dr. J. Knox Jones, Jr., in recognition of his contributions to the study of Recent mammals and his leadership in the American Society of Mammalogists.

Specimens examined.—Included in the following list are all known specimens of *Geomys bursarius knoxjonesi* plus those specimens of other taxa actually used for comparative purposes. Localities of *G. b. knoxjonesi* and *G. b. major* set in italics are those that were omitted from Fig. 1 to prevent undue crowding of symbols. Specimens housed in The Museum of Texas Tech University carry no institutional designation. Other institutions from which specimens were examined are as follows: Museum of Natural History, The University of Kansas (KU); Texas Cooperative Wildlife Collection, Texas A&M University (TCWC); National Museum of Natural History (USNM).

Geomys bursarius knoxjonesi.—NEW MEXICO: Chavez Co.: 0.75 mi. N, 9.1 mi. W Caprock, 4; 0.7 mi. N, 12.6 mi. W Caprock, 1; *0.7 mi. N, 9.1 mi. W Caprock*, 2; 7.2 mi. N, 11.3 mi. E Elkins, 2. Eddy Co.: *1.6 mi. N, 9.5 mi. E Loco Hills*, 1; 5.7 mi. E Loco Hills, 3. Lea Co.: 0.6 mi. S, 2.5 mi. W Maljamar, 2. TEXAS: Andrews Co.: 10 mi. NW Andrews, 1; 0.5 mi. N Andrews, 1. Cochran Co.: 1 mi. W Lehman, 1; 4.5 mi. SSW Morton, 1; *3.4 mi. N, 3.3 mi. W Whiteface, 2; 3.2 mi. N, 3.0 mi. W Whiteface*, 1; *1.0 mi. N, 0.9 mi. W Whiteface*, 4; 1 mi. N, 0.5 mi. W Whiteface, 2. Gaines Co.: 1 mi. SE Seagraves, 1; 5 mi. SE Seagraves 1. Martin Co.: 2.9 mi. S Patricia, 1. Terry Co.: 6 mi. W Brownfield, 6; 4 mi. N Gomez, 23; 1.7 mi. S, 0.5 mi. W Meadow, 2. Ward Co.: 3.5 mi. E Monahans, 9. Winkler Co.: 11 mi. NE Kermit, 2; *10 mi. NE Kermit*, 4; 4.1 mi. N, 5.1 mi. E Kermit, 37; *3.6 mi. E Kermit*, 1; 5 mi. E Kermit, 2; 6.5 mi. SE Kermit, 1. Yoakum Co.: 7.3 mi. E Plains, 1.

Geomys bursarius ammophilus.—TEXAS: Victoria Co.: Victoria, 1 (USNM).

Geomys bursarius attwateri.—TEXAS: Aransas Co.: 10 mi. SE Austwell, 8 (TCWC); 8 mi. SW Rockport, 5 (TCWC).

Geomys bursarius brazensis.—TEXAS: Wood Co.: Mineola, 9.

Geomys bursarius dutcheri.—OKLAHOMA: Muskogee Co.: Ft. Gibson, 10 (USNM).

Geomys bursarius jugossicularis.—KANSAS: Morton Co.: 12 mi. N Elkhart, 2(KU); no specific locality, 3 (KU).

Geomys bursarius llanensis.—TEXAS: Llano Co.: 51.6 mi. W Austin, 1; Castell, 1; 7 mi. E Llano, 4 (TCWC); 3 mi. S Llano, 2 (TCWC); 9 mi. N Jct. Texas 20 and Texas 16, on Texas 16, 1.

Geomys bursarius major.—NEW MEXICO: Curry Co.: 4 mi. S Melrose, 2. Guadalupe Co.: *1 mi. SE Santa Rosa*, 1. Roosevelt Co.: 1.5 mi. W Dora, 1; 1 mi. E Elida, 1; *2.8 mi. E Elida*, 4; 1.8 mi. S, 1.1 mi. E Lingo, 3. TEXAS: Bailey Co.: 2 mi. SE Muleshoe, 1. Cochran Co.: 5 mi. W Morton, 1; 1 mi. W Morton, 1. Collingsworth Co.: 2.1 mi. W, 9.1 mi. W Wellington, 9; 1.5 mi. N, 2 mi. E Wellington, 1; *0.5 mi. N Wellington*, 3; *0.2 mi. W Wellington*, 3; 0.1 mi. W