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COMMENTS ON DISTRIBUTION AND NATURAL HISTORY OF POCKET GOPHERS ON THE ROLLING PLAINS OF WEST-CENTRAL TEXAS

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The Rolling Plains of Texas constitute a significant physiographic area, one that extends from the eastern escarpment of the Llano Estacado eastward, generally between the Red and Colorado rivers, to the place it meets the Cross Timbers and Prairies District (McMahon *et al.*, 1984). It merges with the latter, almost imperceptibly, at the border of the prairie lands adjacent to West Cross Timbers. Thus, although difficult to locate precisely on the ground, the eastern border of the Rolling Plains approximates the 99th meridian. Ecologically, the region more or less conforms with the Mesquite Plains Biotic District of the Kansan Biotic Province (Blair, 1954).

Dalquest and Horner (1984) accounted for mammalian species inhabiting the northeastern and north-central parts of the Rolling Plains in Texas, but the southern part of the district has received little attention from a mammalogical perspective. The survey of mammals of Coke County by Simpson and Maxwell (1989) and the study of gopher distribution in several counties by Thornton and Creel (1975) are among the exceptions to this generalization. See also Davis (1974) and Hall (1981) for overall distributional patterns.

Our object was to document the species of pocket gophers occurring in a 15-county area (see Figs. 1-2) in the southern part of the Rolling Plains and the immediately adjacent parts of the Llano Estacado, and to examine factors relating to their distribution. At the onset of our study, there was the possibility that three genera of geomyids might be en-

countered. A few reports of the plains pocket gopher, *Geomys bursarius*, already were on record (Davis, 1974; Thornton and Creel, 1975). *Cratogeomys castanops*, the yellow-faced pocket gopher, was known from the Llano Estacado along the western border of our study area and also to the south (Hollander, 1990), but not from east of the Llano escarpment at that latitude. And finally, *Thomomys bottae*, one of the smooth-toothed pocket gophers, has been reported from the Edwards Plateau to the south (as near as northwestern Tom Green County—see Hollander *et al.*, 1987). As it turned out, two of the three species are found on the southern part of the Rolling Plains.

METHODS AND ACKNOWLEDGMENTS

Beginning in the summer of 1990 and continuing to February of 1992, we drove literally hundreds of miles along roadways in the 15 counties that comprised our primary area of study. We also investigated sites in counties adjacent to our area, especially to the east and south. As we drove, we mapped location of pocket gopher mounds, pausing to set Macabee or Victor traps in areas of special interest. As have others, we found locating burrow systems much easier in winter and early spring, when most vegetation is dead or dormant, than at other times of the year.

We searched along both federal and state highways as well as Texas farm-to-market roads in quest of gophers, and occasionally along unimproved county roads. Highway rights-of-way frequently are the only localized places where pocket gophers occur, the surrounding areas being devoted to agricultural production and thus unsuited for all but ephemeral pocket gopher habitation. On the other hand, rights-of-way also could serve as corridors of dispersal for gophers, especially when suitable "fill" is hauled in to establish the road bed. To what extent road-building activities benefit pocket gophers has not been studied in detail. Certainly rights-of-way provide havens for them, but this simply may result in larger or somewhat more continuously distributed populations than otherwise would be the case. There is no evidence of which we are aware of any significant distributional shifts by gophers in which roadways were used as a means of dispersal, although Moulton *et al.* (1983) documented local movements by *Geomys bursarius* along roadsides in southeastern Colorado.

Specimens were prepared as standard museum skins accompanied by skulls. Frozen tissues were saved from some. All specimens and

tissues are housed in The Museum at Texas Tech University. Measurements used in the following accounts are in millimeters and weights are in grams.

There is a soil survey for each of the 15 counties in which we searched for pocket gophers, published by the Soil Conservation Service of the U.S. Department of Agriculture. We used these extensively, not only to plot the soil types in which gophers were taken, but also in planning field work. We found them quite helpful.

We are indebted to S. D. Brown, L. L. Choate, A. F. Laemmerzahl, R. W. Manning, and F. D. Yancey for assistance in the field. Clyde Hendrick, Dean of the Graduate School at Texas Tech University, and Gary Edson, Director of The Museum, provided financial aid for travel. Additionally, one of us (Goetze) held a Graduate School Research Assistantship in the summer of 1990 when the project was initiated. R. D. Bradley and R. J. Baker provided karyotypic data and R. M. Timm identified lice.

RESULTS

Cratogeomys castanops

The yellow-faced pocket gopher is widely distributed on the Llano Estacado (Hollander, 1990). In the 15-county area, it occupies sandy to clayey loams, frequently with conspicuous calcareous content, in the west in Borden, Dawson, Howard, and Lynn counties, and east of the Llano in Borden, Howard and Scurry counties (Fig. 1). Gophers from atop the High Plains are assignable to the subspecies *C. c. perplanus*, whereas those to the east of the escarpment are referable to the race *C. c. dalquesti*.

On the Llano, most land turned for agriculture is devoted to growing cotton. Not only does this result in narrow rights-of-way (no fencing) along many farm-to-market and county roads, but such a monoculture does not allow much utilization of agricultural lands by pocket gophers. Consequently, *Cratogeomys* (and northwardly *Geomys*) frequently are concentrated along state and federal highways. On the Rolling Plains to the east of the Llano in Borden, Howard, and Scurry counties, a significant amount of mesquite grassland, utilized for range cattle, still prevails, but *C. castanops* seems nonetheless to be concentrated along roadways. It must penetrate the grassland areas as well, although we have seen little evidence of this. Nor have we found at any place the situation described by Moulton *et al.* (1983) in Colorado

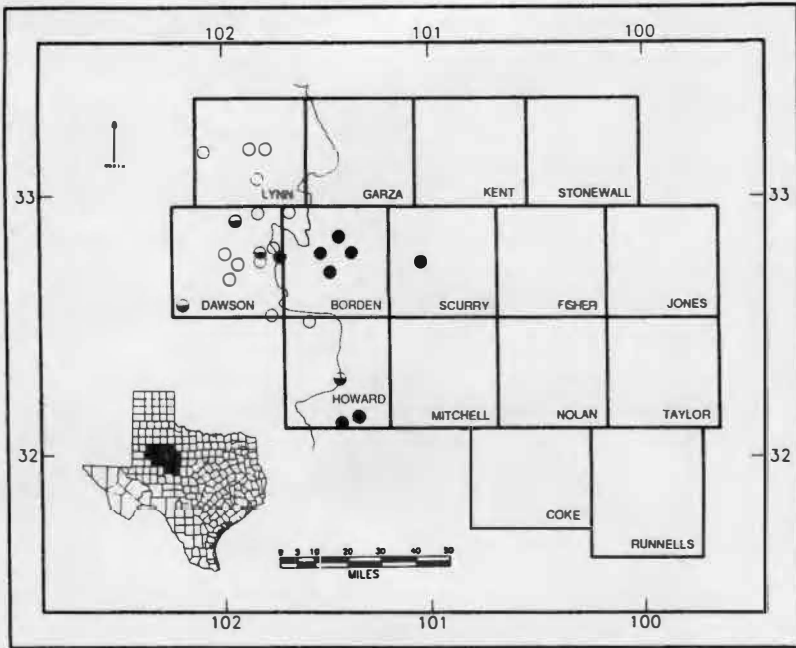


FIG. 1.—Records of *Cratogeomys castanops*. Solid symbols represent specimens of *C. c. dalquesti*; open symbols represent specimens of *C. c. perplanus*, whereas half-solid symbols represent reports in the literature of that subspecies. The north-south line through the western counties represents the approximate border between the High Plains (Llano Estacado) and Rolling Plains.

where *Geomys* was found in bar ditches along roadways and *Cratogeomys* was taken nearby in native rangeland. In fact, we found no place in the 15-county area where the local distribution of the two species came into close proximity, as is known elsewhere within their ranges. *Geomys* prefers deep, sandy soils, evidently excluding *Cratogeomys* from such areas. The latter normally occupies harder, more calcereous soils of clay or clay-loam, but is found in sandy areas in the absence of plains pocket gophers. In our study area, for example, *Geomys* is found in northeastern Lynn County but *Cratogeomys* abounds to the south and west, and *Geomys* occurs to the north, south, and east of Snyder, Scurry County, with *Cratogeomys* found to the west of Snyder.

Soils in areas inhabited by *C. c. perplanus* in southern Lynn, Dawson, adjacent Borden, and northern Howard counties are composed primarily of Amarillo series elements. These are soils of the Llano Estacado

that developed in loamy alluvium and eolian materials, usually formed over caliche.

Cratogeomys castanops dalquesti from Borden, Dawson, and Scurry counties, to the east of the Llano Estacado, represent a northward extension of the known range of this subspecies. Animals from Borden County were found in Olton-Rowena-Rotan association soils, which are deep and have a clay-loam surface over clay. Soils of this association were formed from loamy outwash and eolian materials. A specimen from Scurry County was taken in a soil zone of the Olton clay-loam series, whereas those from southern Howard County inhabited Portales clay-loam soils.

According to Hollander (1990), *C. c. dalquesti* differs from *C. c. perplanus* in being smaller cranially, slightly darker in color, and in having a broader and uniquely shaped lacrimal bone. Nine adult females of *perplanus* from Borden, Dawson, and Lynn counties had the following external measurements (average followed by extremes): total length, 286.1 (273-309); length of tail, 75.1 (66-86); length of hind foot, 37.8 (36-42); length of ear, 7.5 (6-8). Eight of these animals (all nonpregnant) weighed an average of 307.6 (287.6-332.5). Measurements of two adult females of *C. c. dalquesti* from southern Borden County were 272, 268; 80, 64; 39, 37.5; 7, 7. Weights were 275.0 and 270.0, respectively. Cranial measurements are listed in Table 1.

The yellow-faced pocket gopher is reproductively active the year around in western Texas and adjacent New Mexico (Davidow-Henry *et al.*, 1989). From our study area, we have records of gravid females collected in February (two fetuses x 27 in crown-rump length), May (two x 30 and three x 42), and November (two x 38). A lactating female was obtained in April and another with swollen uteri in January. A May-taken adult male had testes that measured 25 x 9. Lack of additional reproductive data is due, in part at least, to the effects of seasonal sampling.

Geomys bursarius

Sandy soils, specifically fine sandy loams, are favored by *Geomys bursarius major*, which evidently excludes *C. castanops* from such habitats. Within the range of the plains pocket gopher in our study area, this species inhabits Miles fine sandy loam in all but Coke, Jones, Nolan, and Runnels counties. This soil was formed in sandy outwash or old alluvium. The surface layer is a brownish and fine sandy loam

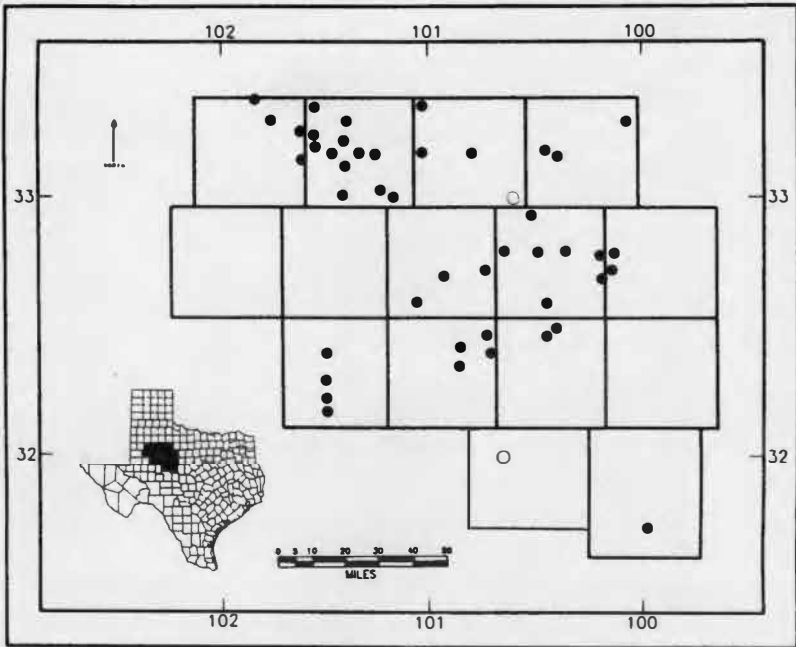


FIG. 2.—Records of *Geomys bursarius major*. Solid symbols represent specimens examined, whereas open symbols represent records from the literature. See Figure 1 for names of counties.

that averages 10 inches in thickness and was developed over a layer of friable, sandy clay-loam, which is, on average, 70 inches thick. Specimens from Jones County were collected from a small pocket of Winters fine sandy loam located at the western edge of that county, whereas those from Nolan County inhabited a different fine sandy loam classified in the Paducah-Woodward series.

No gophers were taken in Taylor County, where most soils are calcareous clays and clayey loams that are shallow and stony, clearly unsuitable for *G. bursarius*. This is true also of all but extreme western Jones County, most of Fisher and Nolan counties, southern Mitchell County, and Stonewall County from Aspermont eastward. Some of these areas are dominated by rough, broken land that is characterized by steep slopes and shallow, rocky, and erodible soils.

In Runnels County, at the southeastern edge of our study area, there is an isolated population of *G. bursarius* to the south of the Colorado River just southwest of Ballinger. Gophers were first taken in this area in 1971, when Thornton and Creel (1975: 274) trapped specimens "in

areas of deep sand" above the floodplain of the river along U. S. Highway 67. We returned to this place in 1991 and found *G. bursarius* mounds common along the divided highway and its access roads, and to either side of the access roads, from approximately two to four miles southwest of Ballinger. Insofar as we could tell, gophers inhabited an area a few hundred yards to either side of the access roads, perhaps as much as a mile to the north. Rangeland and several small vineyards were adjacent to the highway. One farmer-rancher, who has lived in the immediate area since 1952, reported that the animals were common there when he purchased his present property. The localized sandy soil is Tivoli-Brownfield, which has a surface layer of fine, pale brown sand that is 20 to 40 inches deep, deposited over a reddish, sandy-clayey loam that may be as deep as 50 inches. *Geomys bursarius* seems to be excluded from other areas in Runnels County due to the shallow, rocky nature of soils both north and south of Ballinger, nor did we find gophers in counties to the east of Runnels.

To the southwest of Ballinger, the distribution of *G. bursarius* stopped abruptly when Tivoli-Brownfield sand gave way to Acuff loam. To the north, in good years, the distribution of these gophers evidently extends all the way to the Colorado River and perhaps beyond, because in February of 1986 one of us (Jones) noted active mounds along State Highway 158 on the northwestern outskirts of Ballinger. These were completely gone a month later when a field party returned to trap there, demonstrating once again the rapidity by which a local area can be inhabited by gophers and then abandoned. Along U. S. Highway 67, Tivoli-Brownfield sands are surrounded in part by sandy loams of the Miles series, soils in which *Geomys* also sometimes is found.

The presence of plains pocket gophers south of the Colorado River in Runnels County immediately raises the question of their relationship to gophers referred to as *Geomys texensis* that occur in a similar situation about 100 miles southeastward. However, our specimens closely resemble those of *G. b. major* listed herein in external and cranial morphology. Furthermore, they have the karyotypic characteristics of *major* (as do specimens from farther north in Fisher County) as opposed to *texensis* (see Block and Zimmerman, 1991), and were parasitized by a louse, *Geomydoecus oklahomensis*, that is typical of *major* and its allies rather than *G. heaneyi*, which parasitizes *texensis* (Timm and Price, 1980). Nor are the specimens from near Ballinger in

any way reminiscent in external, cranial, or karyotypic characters of *Geomys knoxjonesi*, which occurs on the southwestern part of the Llano Estacado and in adjacent areas some 150 miles or so to the west.

Average (and extreme) external measurements of eight adult females from Runnels County followed by those of eight from Garza County are: total length, 245.9 (238-256), 247.5 (235-260); length of tail, 74.2 (71-78), 69.2 (58-79); length of hind foot, 30.7 (30-32), 30.0 (29-31); length of ear, 6.0 (5-7), 5.9 (5-8). Seven nonpregnant females from Runnels County averaged 181.0 (155-205) in weight, whereas seven from Garza County averaged 183.1 (160-210). For cranial measurements, see Table 1.

As for the locality in Coke County, Thornton and Creel (1975) collected two *G. bursarius* in sandy soil along the Colorado River in 1971—at Willcoxson Ranch, 10 mi. NW Robert Lee (Simpson and Maxwell, 1989). We have been unable to determine on which side of the Colorado these specimens were taken, but we presume on the north because Tivoli-Brownfield sandy soil prevailed there as it does today. The dam of E. V. Spence Reservoir, northwest of Robert Lee, was closed in 1969, but the lake filled slowly and, in fact, is not yet completely filled. It is possible that areas in which *G. bursarius* once occurred now have been inundated by the rising water level. There are, nonetheless, several extant, albeit small, areas of Tivoli-Brownfield sand on the north side of the Colorado where plains pocket gophers still may occur. We searched for them in vain, however, in northwestern Coke County along FM 2059 and State Highways 158 and 208.

A gopher from northeastern Stonewall County was obtained along the Salt Fork of the Brazos River. Soil in this area is alluvial, fine sandy loam and loamy fine sand, both favorable to habitation by *Geomys*. Gophers from northeastern Stonewall County inhabited soils classified as Lincoln series loamy fine sands.

To the west, we took no *G. bursarius* in Borden or Dawson counties, only *Cratogeomys*, and the latter occupies all but the northeastern fourth of Lynn County as well. Calcareous soils prevail in these areas—soils in which *Geomys* does not occur. Thus, *G. bursarius* is distributed on the southern Rolling Plains as an ever narrowing wedge from the north, culminating in the isolated populations in Coke and Runnels counties.

We have records of pregnant females from the months of January, February, March, and November; seven carried an average of 3.8 (two

TABLE 1.—Cranial measurements of selected specimens of two species of pocket gophers from the Texas Rolling Plains and adjacent areas, illustrating size relationships among populations. All specimens are adults (age classes 4 and 5 as defined by Hollander, 1990:14). Measurements were taken to the nearest hundredth of a millimeter, using Fowler digital calipers, then rounded to the nearest tenth of a millimeter.

Catalogue number or number of specimens averaged, and sex	Condylobasal length	Zygomatic breadth	Mastoid breadth	Length of rostrum	Breadth of rostrum	Postorbital constriction	Palatofrontal depth	Length of max. toothrow
<i>Geomys bursarius major</i> , Garza-Kent counties, Texas								
Average 9 (F)	41.91	25.74	24.08	18.19	10.10	6.18	15.67	8.42
Minimum	41.0	25.1	23.0	17.5	9.5	5.8	15.3	8.0
Maximum	43.1	26.6	24.9	19.0	11.2	6.7	16.2	9.2
Jones-Fisher-Stonewall counties, Texas								
TTU 59172, F	42.0	25.7	23.6	18.5	10.0	5.8	15.9	8.6
TTU 50179, F	44.5	—	26.0	18.9	10.8	6.8	17.0	8.6
TTU 59188, F	42.3	26.4	25.0	18.7	10.1	5.8	16.0	8.8
Runnels County, Texas								
TTU 59192, F	42.2	26.8	25.7	18.8	10.2	6.7	15.7	8.1
TTU 59194, F	42.7	—	25.1	19.2	10.1	6.9	15.3	8.5
TTU 59195, F	43.4	—	24.6	18.8	10.5	6.5	15.7	8.4
TTU 59196, F	43.8	27.8	25.5	19.8	10.8	7.3	16.1	8.7
<i>Cratogeomys castanops perplanus</i> , Dawson County, Texas								
TTU 25268, M	59.9	41.1	35.6	27.4	13.9	7.5	24.1	11.2
TTU 25278, M	61.3	44.3	35.2	27.5	14.3	7.3	24.1	11.3
TTU 25270, F	53.1	34.2	29.7	23.5	12.0	6.6	20.8	9.7
TTU 25291, F	53.4	34.0	31.2	22.7	12.0	6.9	20.5	9.7
TTU 26034, F	53.4	33.9	30.5	23.2	11.3	6.8	20.0	10.5
<i>Cratogeomys castanops dalquesti</i> , Borden County, Texas								
TTU 59139, M	58.2	39.8	32.4	25.6	12.9	7.0	22.5	10.8
TTU 60396, M	58.7	39.4	33.5	26.8	13.9	6.7	23.2	10.7
TTU 60405, M	58.2	39.1	34.5	26.1	12.9	7.0	21.9	9.9
TTU 59169, F	52.7	33.2	29.8	23.5	11.0	7.0	20.3	9.5
TTU 59393, F	50.5	32.7	28.6	22.4	10.9	6.7	19.8	9.0
TTU 60404, F	52.2	34.6	29.8	24.9	11.2	7.3	20.2	10.5

to five) fetuses. Females taken in December and April evinced no reproductive activity. Males with scrotal testes were captured in January (20 x 13, 17 x 12, 24 x 14, and 20 in length), February (25 x 14, and 20 x 14), March (20 x 15), April (22 x 14), May (15 x 8), and November (20 x 11).

SPECIMENS EXAMINED

We examined 65 *Cratogeomys castanops* and 116 *Geomys bursarius* from the 15-county study area, more than half of which were collected by us. The others had been deposited previously in the collection of mammals at The Museum of Texas Tech University or were found among pocket gophers housed in the collection at Midwestern State University (MWSU). Additionally, we have listed specimens reported in the literature from localities not otherwise represented, along with a citation to the appropriate publication.

Localities of record are shown on Figure 1 (*Cratogeomys*) and Figure 2 (*Geomys*). Some localities are not plotted because undue crowding of symbols would have resulted; these are listed in italic type below. For the same reason, a few symbols are slightly offset on the maps.

Cratogeomys castanops dalquesti Hollander, 1990

Specimens examined (10).—BORDEN Co.: 10.5 mi. N Gail, 1; 7.5 mi. W Gail, 1; 5 mi. E Gail, 1; 5.5 mi. E Gail, 2; 4 mi. S, 1.5 mi. W Gail, 1. DAWSON Co.: 2 mi. S, 13 mi. E Lamesa, 1. HOWARD Co.: 11.2 mi. S Big Spring, 1 (MWSU); 13 mi. SSE Big Spring, 1 (MWSU). SCURRY Co.: 5 mi. W Union, 1.

Cratogeomys castanops perplanus Nelson and Goldman, 1934

Specimens examined (55).—BORDEN Co.: 11 mi. N, 13.5 mi. W Gail, 2; DAWSON Co.: 2 mi. S, 1 mi. W O'Donnell, 2; 4 mi. S, 4 mi. E O'Donnell, 1; 5 mi. S, 1 mi. E O'Donnell, 2; Lamesa, 1 (MWSU); 2.2 mi. S, 0.3 mi. E Lamesa, 2; 2.3 mi. S Lamesa, 7; 2.8 mi. S, 0.6 mi. E Lamesa, 2; 2.9 mi. S Lamesa, 4; 3.3 mi. S, 4 mi. E Lamesa, 5; 4.6 mi. S, 4.3 mi. E Lamesa, 1; 5 mi. ENE Key, 1; 4 mi. WSW Key, 1; 5 mi. S, 4.5 mi. E Lamesa, 5; 5.2 mi. S, 5 mi. E Lamesa, 1; 6 mi. S, 5.7 mi. E Lamesa, 4; 6.8 mi. S, 1.3 mi. E Lamesa, 5; 1 mi. NNW Ackerly, 1. HOWARD Co.: 1.5 mi. WSW Vealmoor, 1. LYNN Co.: 1 mi. E West Point, 1; Tahoka, 1 (MWSU); 2.5 mi. E Tahoka, 1; 4 mi. E Tahoka, 1; 10 mi. S, 2 mi. E Tahoka, 3.

Additional records (Hollander, 1990: 54).—DAWSON Co.: 11.1 mi. N, 3 mi. E Lamesa; 11.1 mi. N, 4.3 mi. E Lamesa; 10 mi. E Lamesa; 22 mi. SW Lamesa. HOWARD Co.: Big Spring. LYNN Co.: 3 mi. S Tahoka.

Geomys bursarius major Davis, 1940

Specimens examined (116).—FISHER Co.: 6 mi. NW Rotan, 1; 12.5 mi. W Roby, 1; 5 mi. W Roby, 1; 10 mi. E Roby, 1 (MWSU); 6 mi. S, 1 mi. E McCaulley, 2; 3 mi. E Sylvester, 1; 2 mi. S, 3.5 mi. E Sylvester, 2; 9.5 mi. N Sweetwater, 1. GARZA Co.: 5.5 mi. SE Southland, 1; 10 mi. N Post, 1; 8 mi. N, 8.5 mi. W Post, 1; 7 mi. N Post, 7; 5 mi. N, 6.5 mi. W Post, 1; 4.5 mi. NW Post, 1; 3 mi. NW Post, 3; 2 mi. E Post, 2; 11.5 mi. E Post, 2; 0.5 mi. S, 8.5 mi. W Post, 1; 0.5 mi. S, 3 mi. W Post, 1; 5.5 mi. S, 0.5 mi. W Post, 1; 0.5 mi. N, 1.5 mi. E Justiceburg, 1; 0.3 mi. N, 0.5 mi. E Justiceburg, 1; 4 mi. E Justiceburg, 2; 0.25 mi. SE Justiceburg Post Office, 1; 13.5 mi. S, 1 mi. W Post, 1; 14 mi. S, 1 mi. E Post, 1; 6 mi. SE Justiceburg, 1. HOWARD Co.: 9 mi. N Big Spring, 1; 2 mi. N Big Spring, 1; 2.1 mi. NE Big Spring, 2; Big Spring, 2; 5.6 mi. S Big Spring, 1 (MWSU); 7.6 mi. S Big Spring, 1 (MWSU); 8.7 mi. S Big Spring, 1 (MWSU); 9.2 mi. S Big Spring, 1 (MWSU). JONES Co.: 4.5 mi. S, 2 mi. E Hamlin, 1; 9 mi. S, 0.5 mi. W Hamlin, 2. KENT Co.: 2 mi. N, 26 mi. W Girard, 2; 26 mi. W Girard, 1; 1 mi. N, 15.5 mi. W Clairemont, 1; 2 mi. W Clairemont, 1; 1.9 mi. E Clairemont, 1. LYNN Co.: 14 mi. N Tahoka, 2; 10.5 mi. N Grassland, 1; 8 mi. N, 1.5 mi. E Grassland, 1; 2 mi. S, 2 mi. W Wilson, 1; 12 mi. E Tahoka, 1; 1 mi. E Grassland, 1; MITCHELL Co.: 3 mi. N, 0.3 mi. E Colorado City, 9; 4 mi. N Loraine, 3; 4 mi. S, 0.5 mi. E Loraine, 1; 5 mi. S, 2 mi. E Colorado City, 1. NOLAN Co.: 3 mi. E Sweetwater, 3; 4 mi. E Sweetwater, 1; 2 mi. S Sweetwater, 1; 3 mi. S Sweetwater, 1. RUNNELS Co.: 3 mi. SW Ballinger, 14. SCURRY Co.: 4 mi. E Snyder, 1; 1 mi. S, 4 mi. E Snyder, 1; 2 mi. S, 1 mi. E Snyder, 1; 4 mi. SW Snyder, 1 (MWSU); 4 mi. S Snyder, 1; 5 mi. N, 4 mi. E Hermleigh, 1; 1 mi. N, 4 mi. W Ira, 4. STONEWALL Co.: 10 mi. W Rochester, 1 (MWSU); 2.5 mi. N, 7 mi. W Peacock, 1; 2 mi. N, 1 mi. W Peacock, 1; 0.5 mi. S, 0.5 mi. E Peacock, 3.

Additional records.—COKE Co.: 10 mi. NW Robert Lee (Thornton and Creel, 1975: 274). HOWARD Co.: 2 mi. N, 3 mi. E Big Spring (Baker et al., 1973: 769). KENT Co.: 14.5 mi. NW Rotan (Baker et al., 1973: 769). RUNNELS Co.: 2 mi. S[W] Ballinger (Thornton and Creel, 1975: 274).

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