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UTILIZING STANDARDIZED PROTOCOLS FOR MONITORING VASCULAR PLANTS OF FEDERAL CONCERN: A STUDY WITH CASTANEA PUMILA VAR. OZARKENSIS

SUBMITTED BY

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SUBMITTED TO

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March 2004

The Principal Investigator of this project was Amy K. Buthod of the Oklahoma Biological Survey. Dr. Bruce W. Hoagland was Co-investigator. This was a cooperative project supported by the Oklahoma Biological Survey and the United States Fish and Wildlife Service.

I would like to acknowledge the Robert Bebb Herbarium (OKL) at the Oklahoma Biological Survey/University of Oklahoma for providing access to herbarium specimens. I wish to thank Dr. Bruce W. Hoagland of the Oklahoma Biological Survey for his assistance in all aspects of this work. I would also like to thank the Nature Conservancy and Mr. Chris Wilson for providing access to the J. T. Nickel Family Nature and Wildlife Preserve and the United States Fish and Wildlife Service and Mr. Steve Hensley for providing access to the Ozark Plateau National Wildlife Refuge.

Any voucher specimens associated with this study are deposited at the Robert Bebb Herbarium.

The following report summarizes part one of a two-part study of *Castanea pumila* var. *ozarkensis*. Part one (funded 9/1/2002-12/1/2003) concentrated on trees in the Ozarks. The second part (funded 1/12/04-12/31/04) will examine populations in the Ouachitas. A comparison of the two groups will appear in the second report.

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I. Species information—*Castanea pumila* var. *ozarkensis*

A. Nomenclature, classification, and taxonomic information

1. Scientific name

Castanea pumila (L.) P. Mill. var. *ozarkensis* (Ashe) Tucker

2. Valid synonyms

Castanea alabamensis Ashe
Castanea ozarkensis Ashe
Castanea ozarkensis Ashe var. *arkansana* (Ashe) Ashe

3. Classification

Kingdom—Plantae (plants)
Subkingdom—Tracheobionta (vascular plants)
Superdivision—Spermatophyta (seed plants)
Division—Magnoliophyta (flowering plants)
Class—Magnoliopsida (Dicotyledons)
Subclass—Hamamelidae
Order—Fagales
Family—Fagaceae (beech family)
Genus—*Castanea* P. Mill. (chestnut)
Species—*Castanea pumila* (L.) P. Mill. (chinquapin)
Variety—*Castanea pumila* (L.) P. Mill. var. *ozarkensis* (Ashe) Tucker (Ozark chinquapin)

4. Full bibliographic citation for all binomials

Gary E. Tucker, in *Proceedings of the Arkansas Academy of Science* 29: 68 (1975).

5. Type specimen

W. W. Ashe, s.n., from Searcy County, Arkansas, September 17, 1923, University of North Carolina (NCU) accession number 64311. Ashe did not designate type specimens in his original description of *Castanea ozarkensis*. This lectotype was selected by Tucker.

6. Common name

Ozark chinquapin

7. USDA code

CAPUO

8. History of knowledge of the taxon

Castanea pumila var. *ozarkensis* was originally described by Ashe in 1923 as a new species (*C. ozarkensis*). A second Ozarkian species, *C. arkansana*, was described by Ashe at the same time based on differences in leaf pubescence. It was later reduced it to a variety of *ozarkensis* and then to synonymy *with ozarkensis*. *C. ozarkensis* was reduced to a variety of *C. pumila* in the 1970's after a review of herbarium specimens uncovered the extreme intergradations of morphological characters that occur throughout the *C. pumila* group. Another species, *C. alabamensis*, was reduced to synonymy with *C. pumila* var. *ozarkensis* in the 1990's by Kartesz.

9. Current alternative taxonomic treatment

There is currently no alternative taxonomic treatment for *Castanea pumila* var. *ozarkensis*.

B. Present legal or other conservation status

1. Federal

Castanea pumila var. *ozarkensis* currently has no federal status. Prior to 1996 it was a category 2 (C2) candidate for listing.

> C2="A likely candidate for federal listing as endangered or threatened, but it is necessary to obtain further information regarding possible threats" (Department of the Interior, 1993).

2. State

The status of *C. pumila* var. *ozarkensis* in states reported to have populations of the plant is as follows: Oklahoma, none; Alabama, none; Arkansas, INV; Louisiana, none; Mississippi, none; Missouri, none.

> INV=Inventory Element. "The Arkansas Natural Heritage Commission is currently conducting active inventory work on these elements. Available data suggests these elements are of conservation concern" (Arkansas Natural Heritage Commission, 2001).

C. Global and state rankings

1. Global

Castanea pumila var. *ozarkensis* has a global ranking of G5T3.

> G5="Demonstrably secure globally though it may be quite rare in parts of its range, especially at the periphery" (Oklahoma Natural Heritage Inventory, 2001).

C. pumila is a widespread species, but the varietal form (*ozarkensis*) is "restricted to a narrow range largely within the Ozark Highlands, where it is threatened by chestnut blight (NatureServe, 2002)." The "T" rank refers to subspecies, varieties, and populations.

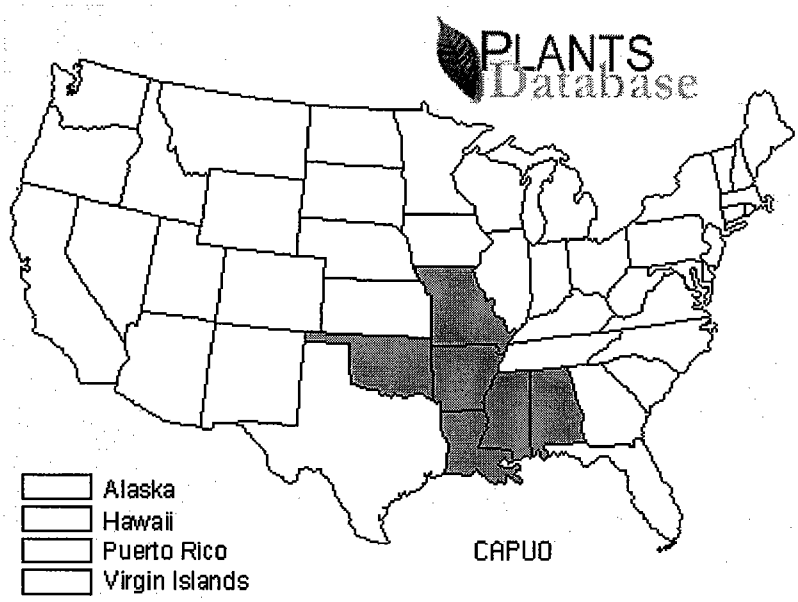
2. State

Oklahoma, S2; Alabama, SH; Arkansas, S3S4; Louisiana, S1; Mississippi, not ranked; Missouri, S2.

> S1="Critically imperiled in Oklahoma because of extreme rarity...or because of some factor of its biology making it especially vulnerable to extinction" (Oklahoma Natural Heritage Inventory, 2001).
>
> S2="Imperiled...because of extreme rarity (six to 20 occurrences or few remaining individuals or acres) or because of other factors making it very vulnerable to extinction throughout its range" (Oklahoma Natural Heritage Inventory, 2001).
>
> S3="Rare or local...(though it may be abundant at some of its locations); in the range of 21-100 occurrences" (Oklahoma Natural Heritage Inventory, 2001).
>
> S4="Apparently secure" (Oklahoma Natural Heritage Inventory, 2001).
>
> SH="Historically known, but possibly extirpated; not seen in the last 15 years" (Oklahoma Natural Heritage Inventory, 2001).

D. Geographical distribution

Ozark chinquapin is found in the Ozark Plateau region, typically at elevations from 150.0-850.0 m. Populations occur in Alabama, Arkansas, Louisiana, Mississippi, Missouri, and Oklahoma. In Oklahoma, the plant is reported from Adair, Cherokee, Choctaw, Delaware, Latimer, Leflore, Mayes, and McCurtain counties.



Distribution of *Castanea pumila var. ozarkensis* (USDA, 2004).

E. General habitat description

Castanea pumila var. *ozarkensis* grows in upland oak-hickory forests and oak-pine forests. The plant typically is found on dry acidic soils on ridges and ravine slopes. Historically, Ozark chinquapin may have been common in thin woodlands and woodland margins. Foresters have reported that the chinquapin will appear in areas that have been newly cleared, leading scientists to conclude that the plant gets established and survives as a long-lived seedling until the canopy opens up enough for growth and reproduction (Paillet, 2002).

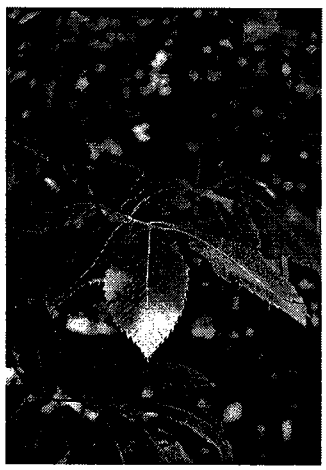
F. Morphology, life history, and related species

Castanea pumila var. *ozarkensis* is a perennial tree or shrub. Because of the effects of the fungal disease chestnut blight (*Cryphonectria parasitica,* formerly *Endothia parasitica*), Ozark chinquapin typically grows in small groups that are stump sprouts from the root collar of an older blighted tree. Plants are usually less than 5.0 m in height, but can be as tall as 10.0 m. Crown width can be up to 6.0 m. The bark of the Ozark chinquapin is gray to grayish brown in color, with hairless, gray-colored branchlets. Leaves are 13.0-20.0 cm in length, broadly lanceolate to oblong, and coarsely toothed. Upper leaf surfaces are glabrous and greenish-yellow. There may or may not be pubescence on the under side. Petioles are glabrous. Flowers are white, imperfect, apetalous, and scented. The inflorescence is a dense catkin 5.0-20.0 mm in length. Inflorescences are exclusively male-flowered or may have a few female flowers near the base. Fruits are produced in burs with hairy spines. Nuts are small, round, and brown.

Ozark chinquapin flowers from May through June and produces fruits from June through September. The plant is monoecious, but cross-pollination may be required for the production of viable seed (Elias, 1971). The plant is primarily wind pollinated.

In the field, Ozark chinquapin could be mistaken for chinquapin oak (*Quercus muhlenbergii*), but the latter has leaves with rounded teeth and buds clustered at the stem's apex. *Castanea pumila* var. *pumila* (Allegheny chinquapin) has much smaller leaves than var. *ozarkensis*, grows in sandy soil, and is rare in the Ozark Plateau region. The two varieties may also differ in flavonoid content (Dane et al., 1999). *Castanea dentata*, the American chestnut, is found in the eastern United States and has broader leaves with smaller teeth and smaller burrs.

G. Photos



Castanea pumila var. *ozarkensis* leaves (Photo by Bruce Hoagland)

Dead *C. pumila* var. *ozarkensis* stems (Photo by Bruce Hoagland)

C. pumila var. *ozarkensis* burrs and inflorescences (Photo by Bruce Hoagland)

II. Field Work

A. Experimental methods

Nine sites with dead or alive Ozark chinquapins present were selected. Plots of 30.0 by 30.0 meters were established at each site. Permanent photo points were selected and marked, and photos were taken at these points. UTM information was recorded using a Garmin II GPS unit. A rough sketch was made of each plot. Canopy cover was recorded at the center and at each corner of the plot using a densitometer. Soil depth was measured. All associated species within the plot were noted.

Three types of Ozark chinquapin individuals were encountered at the sites. The majority were root sprouts from "clumps" that included dead stems. The diameter of each "clump" was measured, as well as the diameter of each living sprout within a clump. A second type of individual noted was a dead crown without living sprouts, and these diameters were also recorded. Individuals not related to clumps were also present in some of the plots, and these were counted and measured. The presence of buds, flowers, or fruits was noted. When available, seeds were collected from stems of varying diameters. Experiments to determine germination rates are currently taking place.

B. Sites

Site name: C3
Date observed: May 14, 2003
Surveyors: Amy Buthod and Bruce Hoagland
Location: The Nature Conservancy's J. T. Nickel Family Nature Preserve, 15S 335959 3990875
Percent coverage by Ozark chinquapin: <5.0%
Clumps with root sprouts: 14
Average diameter of clump: 24.4 cm

Clumps without root sprouts: 4
Average diameter of clump: 22.0 cm
Number of individuals: 3
Densiometer: 34% open
Soil depth: <10.0 cm
Community type: *Sassafras albidum/Quercus velutina* forest
Associated species: *Carya alba, Cornus florida, Q. marilandica, Q. alba, Vaccinium arboreum, Rhododendron oblongifolium*
Evidence of reproduction: none
General comments: This site was recently burned.

Site name: C4
Date observed: May 14, 2003
Surveyors: Amy Buthod and Bruce Hoagland
Location: The Nature Conservancy's J. T. Nickel Family Nature Preserve, 15S 335684 3990808
Percent coverage by Ozark chinquapin: <5.0%
Clumps with root sprouts: 0
Average diameter of clump: 0.0 cm
Clumps without root sprouts: 23
Average diameter of clump: 20.7 cm
Number of individuals: 1
Densiometer: 30% open
Soil depth: <10.0 cm
Community type: *Quercus velutina* forest
Associated species: *Sassafras albidum, Cornus florida, Q. alba, Vaccinium pallidum, Rhus copallinum*
Evidence of reproduction: none
General comments: This site was recently burned.

Site name: C5
Date observed: May 14, 2003
Surveyors: Amy Buthod and Bruce Hoagland
Location: The Nature Conservancy's J. T. Nickel Family Nature Preserve, 15S 335593 3991518
Percent coverage by Ozark chinquapin: <5.0%
Clumps with root sprouts: 5
Average diameter of clump: 26.2 cm
Clumps without root sprouts: 13
Average diameter of clump: 24.9 cm
Number of individuals: 7
Densiometer: 5% open
Soil depth: <10.0 cm
Community type: *Quercus velutina* forest
Associated species: *Sassafras albidum, Cornus florida, Q. alba, Nyssa sylvatica, Vaccinium pallidum*

Evidence of reproduction: none

Site name: C6
Date observed: May 15, 2003
Surveyors: Amy Buthod and Bruce Hoagland
Location: The Nature Conservancy's J. T. Nickel Family Nature Preserve, 15S 335654 3991598
Percent coverage by Ozark chinquapin: <5.0%
Clumps with root sprouts: 5
Average diameter of clump: 22.0 cm
Clumps without root sprouts: 5
Average diameter of clump: 31.6 cm
Number of individuals: 5
Densiometer: 6% open
Soil depth: <10.0 cm
Community type: *Quercus velutina/Q. marilandica* forest
Associated species: *Sassafras albidum*, *Robinia pseudoacacia, Q. stellata, Q. shumardii, Amelanchier arborea, Carya alba, C. texana, Vaccinium pallidum*
Evidence of reproduction: none

Site name: C7
Date observed: June 16, 2003
Surveyors: Amy Buthod and Bruce Hoagland
Location: The Nature Conservancy's J. T. Nickel Family Nature Preserve, 15S 338394 3991930
Percent coverage by Ozark chinquapin: <5.0%
Clumps with root sprouts: 16
Average diameter of clump: 16.1 cm
Clumps without root sprouts: 0
Average diameter of clump: 0.0 cm
Number of individuals: 10
Densiometer: 82% open
Soil depth: <10.0 cm
Community type: *Cornus florida/Acer rubrum* forest
Associated species: *Sassafras albidum*, *Prunus serotina, Quercus velutina, Q. marilandica*
Evidence of reproduction: 3 clumps with root sprouts with stems bearing fruit

Site name: C11
Date observed: July 31, 2003
Surveyors: Amy Buthod, Bruce Hoagland, and Christy Batterson
Location: The Nature Conservancy's J. T. Nickel Family Nature Preserve, 15S 337126 3991738
Percent coverage by Ozark chinquapin: <5.0%
Clumps with root sprouts: 27

Average diameter of clump: 17.7 cm
Clumps without root sprouts: 1
Average diameter of clump: 18.0 cm
Number of individuals: 0
Densiometer: 67% open
Soil depth: <10.0 cm
Community type: *Quercus velutina/Sassafras albidum* forest
Associated species: *Q. alba, Q. marilandica, Rhus glabra*
Evidence of reproduction: 12 clumps with root sprouts with stems bearing fruit
General comments: This site is in an area that was treated with the herbicide tebuthiuron (Spike).

Site name: C12
Date observed: September 24, 2003
Surveyors: Amy Buthod, Bruce Hoagland, and Steve Hensley
Location: Ozark Plateau National Wildlife Refuge, 15S 348749 3954744
Percent coverage by Ozark chinquapin: <5.0%
Clumps with root sprouts: 13
Average diameter of clump: 6.0 cm
Clumps without root sprouts: 0
Average diameter of clump: 0.0 cm
Number of individuals: 7
Densiometer: 5.2% open
Soil depth: ca. 10.0 cm
Community type: *Quercus velutina/Cornus florida* forest
Associated species: *Q. alba, Sassafras albidum, Carya texana, Vitis vulpina*
Evidence of reproduction: none

Site name: C13
Date observed: September 25, 2003
Surveyors: Amy Buthod and Bruce Hoagland
Location: The Nature Conservancy's J. T. Nickel Family Nature Preserve, 15S 337603 3992286
Percent coverage by Ozark chinquapin: <5.0%
Clumps with root sprouts: 12
Average diameter of clump: 11.4 cm
Clumps without root sprouts: 0
Average diameter of clump: 0.0 cm
Number of individuals: 0
Densiometer: 8.4% open
Soil depth: <10.0 cm
Community type: *Quercus velutina/Q. marilandica* forest
Associated species: *Carya texana, Sassafras albidum, Vaccinium arboretum, Rhus glabra*
Evidence of reproduction: 9 clumps with root sprouts with stems bearing fruit

Site name: C14
Date observed: September 25, 2003
Surveyors: Amy Buthod and Bruce Hoagland
Location: The Nature Conservancy's J. T. Nickel Family Nature Preserve, 15S 337289 3992730
Percent coverage by Ozark chinquapin: <5.0%
Clumps with root sprouts: 7
Average diameter of clump: 18.4 cm
Clumps without root sprouts: 0
Average diameter of clump: 0.0 cm
Number of individuals: 0
Densiometer: 61% open
Soil depth: <10.0 cm
Community type: *Quercus velutina* forest
Associated species: *Carya texana*, *Q. stellata, Diospyros virginiana, Rhus glabra*
Evidence of reproduction: 6 clumps with root sprouts with stems bearing fruit
General comments: This site is in an area that was treated with the herbicide tebuthiuron (Spike).

C. Historical sites

Herbarium records, the Oklahoma Natural Heritage Inventory database, and personal accounts were consulted in order to attempt to locate historical populations of Ozark chinquapin. Six locations in Adair and Delaware counties were visited. Many of these historical sites were on private land or on unsuitable habitat (pasture). Others had inadequate directional information.

III. Current assessment of *Castanea pumila* var. *ozarkensis* in the Oklahoma Ozarks

In terms of management, current populations of Ozark chinquapin should be maintained. Experiments relating to canopy cover and sprout formation have suggested that the plant responds positively to the removal of some cover (NatureServe, 2002). Future burning activities are planned for some of the sites on the Nickel Preserve.

Chestnut blight continues to threaten populations of *Castanea pumila* var. *ozarkensis*. Other threats include timber-harvesting activities that may injure the root crowns of old trees, thereby hindering root sprouting. Loss of the natural fire regime may also limit reproduction, as the plant tends to reproduce in areas with open canopies (Paillet, 2002).

IV. Information Sources

A. Literature

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B. Herbarium collections

The following is a list of herbarium specimens consulted for this project. All collections are from the Robert Bebb Herbarium (OKL) at the Oklahoma Biological Survey and Department of Botany and Microbiology, the University of Oklahoma, Norman, Oklahoma.

Accession Number	Collector	Coll. No	Coll. Date	County	Location
OKL15741	P. Kirtley	18	Monday, November 18, 1935	Cherokee	Tahlequah; 3.5 mi E of Tahlequah
OKL15740	E. L. Little, Jr.	532	Sunday, August 26, 1928	Cherokee	Tahlequah; near Tahlequah
OKL15735	E. L. Little, Jr.	531	Sunday, August 26, 1928	Cherokee	Tahlequah; near Tahlequah
OKL15736	C. S. Wallis	8055	Friday, May 16, 1958	Adair	Stilwell; 3 mi N of Stilwell on US 59
OKL14890	C. H. Perino & G. L. Pierson	181	Saturday, April 27, 1968	Adair	Hwy jct; 1 mi W from intersection OK 51 & US 59 on OK 51
OKL15738	M. Hopkins	3134	Saturday, May 07, 1938	Cherokee	Tahlequah; 8 mi N of Tahlequah
OKL201661	R. J. Tyrl & J. J. Crokett	1626	Tuesday, May 16, 1978	Cherokee	Tenkiller Reservoir; adjacent to Carters Landing Recreation Area, Tenkiller Reservoir
OKL28019	P. Buck	1026	Saturday, June 03, 1978	Adair	Watts; 1.6 mi W of Hwy 59 on S side of creek about 1.8 mi S of Watts

Accession Number	Collector	Coll. No	Coll. Date	County	Location
OKL64298	E. L. Little, Jr.	36615	Saturday, April 25, 1981	Delaware	Flint; Dripping Springs 2.5 mi E of Flint
OKL30200	T. A. Zanoni	3361	Sunday, September 04, 1977	Delaware	Kansas; Dripping Springs, Rt. 33 E of Kansas
OKL29651	J. Crockett & P. Buck	1060	Monday, June 19, 1978	Adair	Caney Creek; 3 mi W of 51-59 junction, Caney Creek
OKL15737	F. J. Gibbs	s.n.	Thursday, May 29, 1930	unknown	unknown
OKL15742	M. Hopkins & M. Van Valkenburgh	3592	Sunday, October 09, 1938	Delaware	Jay; 10 mi S of Jay
OKL64297	E. L. Little, Jr.	36616	Saturday, April 25, 1981	Delaware	Flint; Dripping Springs 2.5 mi E of Flint
OKL57088	P. G. Risser	2-1	Thursday, May 11, 1978	Cherokee	Tahlequah; W side of Hwy 10 NE of Tahlequah; 11.3 mi N junction Hwys 10 and 62
OKL182407	B. B. Amos	4487	Thursday, May 11, 1978	Comanche	Wichita Mountains Wildlife Refuge; Lost Lake, below dam, Wichita Mountains Wildlife Refuge
OKL30202	J. Crockett & P. Buck	1060	Monday, June 19, 1978	Adair	Caney Creek; 3 mi W of 51/59 junction on S side of Caney Creek
OKL280020	P. Buck	1027	Saturday, June 03, 1978	Adair	Watts; 3.3 mi S of Watts on Hwy 59
OKL15733	U. T. Waterfall	6988	Sunday, June 08, 1947	Delaware	Dripping Springs; 3 mi E & 2 mi N of Dripping Springs
OKL15739	C. Prier	s.n.	Sunday, May 10, 1925	Cherokee	Tahlequah
OKL30206	J. Crockett & P. Buck	1057	Monday, June 19, 1978	Cherokee	Elton; 0.3 mi W (on 51) of 51/62 junction at Elton
OKL29649	P. Buck	1057	Monday, June 19, 1978	Cherokee	Elton; 0.3 mi W (on 51) of 51/62 junction at Elton
OKL52958	E. L. Little, Jr.	36208	Wednesday, May 21, 1980	Adair	Cookson Hills Game Refuge; SW Adair County, Cookson Hills Game Refuge
OKL15734	E. L. Rice	s.n.	Monday, June 17, 1957	Adair	Piney; 2 mi S of Piney
OKL29645	P. Buck	1025	Saturday, June 03, 1978	Mayes	Locust Grove; 1.1 mi E of Locust Grove on Hwy 33 at Pipe Springs
OKL15744	T. A. Tripp	148	Friday, May 04, 1928	Delaware	Dripping Springs
OKL15750	O. M. Clark	2885	Saturday, June 14, 1930	Latimer	N Laura
OKL15748	O. W. Blakley	3448	Thursday, July 15, 1915	LeFlore	Page; near Page, Rich Mountain

Accession Number	Collector	Coll. No	Coll. Date	County	Location
OKL57047	P. G. Risser	1-1	Thursday, May 11, 1978	Cherokee	Tahlequah; 3.7 mi N on Hwy from junction Hwy 51 & 10 at Tahlequah, W side of road
OKL15747	G. W. Stevens	2663	Friday, September 08, 1933	LeFlore	Page; near Page, Rich Mountain
OKL55848	H. F. Duckett	215	Monday, August 14, 1933	LeFlore	unknown
OKL15751	R. Pearce	1452	Saturday, July 18, 1964	McCurtain	Sherwood; State Game Preserve 5 mi E of Sherwood
OKL15746	D. Demaree	4519	Sunday, October 09, 1927	Rogers	Ramona; vicinity of Ramona, 26 mi N of Tulsa
OKL15749	A. & R. Nelson & G. J. Goodman	5598	Sunday, April 21, 1946	McCurtain	Broken Bow; Ouachita Mountains, 15 mi N of Broken Bow
OKL15745	C. Sooter	1316R		Mayes	Pryor Creek; Pryor Creek bottom
OKL15743	M. Hopkins	3249	Saturday, May 07, 1938	Delaware	Dripping Springs
OKL219852	unknown	303	Friday, May 06, 1949	Delaware	Grove; Camp Garland, Grove
OKL221159	A. Buthod & B. Hoagland	AB-4022	Wednesday, June 18, 2003	Cherokee	J. T. Nickel Family Nature Preserve; The Nature Conservancy's J. T. Nickel Family Nature Preserve

D. Knowledgeable persons

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