Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 56 October, 1954 No. 670

SOME BOTANICAL STUDIES IN THE BLACK MESA REGION OF OKLAHOMA

C. M. Rogers

A LAVA-CAPPED PLATEAU, about forty-five miles in length and varying from one to six miles wide, with the long axis lying generally from northwest to southeast, extends from southeastern Colorado through the northeastern corner of New Mexico into the tip of the Oklahoma panhandle. Most of this plateau lies in Colorado and New Mexico, where it is usually called the Mesa de Maya, while the easternmost part, which extends a short distance into Cimarron County, Oklahoma, is more commonly known as the Black Mesa.

For many years the Black Mesa region has been recognized as one of Oklahoma's most interesting botanically; yet, until recently, because of its distance from a center of education, very few details of the vegetation were known and herbarium material was practically non-existent. The author first visited the area in 1944, when he was a student new to Oklahoma, and with little knowledge as to which species were widespread or plentiful in the state. Yet in the one brief forenoon spent there, eleven species which reach their easternmost limit in Oklahoma in the Black Mesa region were collected, of which seven were then unknown in the state. There appeared to be ample reason why further study might be profitably undertaken. Intermittently, therefore, during the summers of 1947 to 1949 additional field work was conducted. A general account of the whole Mesa de Maya region may be found in an earlier paper (Rogers, 1953). The Oklahoma part is described briefly in the paragraphs that follow.

In the extreme northwestern corner of Cimarron County, the cutting action of the Cimarron River and its tributaries has resulted in the formation of many canyons and mesas, including the Black Mesa. It is this area, perhaps one hundred square miles in Oklahoma, that is referred to as the "Black Mesa region." Peninsula-like, the Black Mesa projects across the New Mexico boundary into the heart of this region, at a point about four or five miles south of the Colorado state line. It extends about three miles into Oklahoma and is approximately one mile wide here. The Black Mesa is the most conspicuous element of the region. Because of the layer of basalt which covers it to a depth of sixty to seventy feet or more here, the Mesa stands above the surrounding plains. On top of the Mesa is the highest elevation in Oklahoma, nearly five thousand feet.

The probable source of the lava is Piney Mountain or the Bar Seven-L Buttes, as it is locally known, a small hill near the center of the Mesa de Maya, about thirty miles westward in Colorado. Underlying the lava is the Dakota sandstone formation which, like the basalt, erodes vertically and results in steep talus-strewn slopes which rather abruptly merge with the plains below. The Cimarron River lies at the base of the south slope of the Mesa and Carrizo Creek, a tributary of the Cimarron, is on the north side. These two streams join at the eastern tip of the Black Mesa, about six hundred feet below its summit.

The nearly flat top of the Black Mesa is covered with a layer of soil varying from a few inches to several feet in depth, mostly clay containing pieces of weathered basalt, and apparently derived from the decomposition *in situ* of the lava. The upper slopes of the Mesa are strewn with blocks of basalt of all sizes, while downward transportation of detritus has produced outcrops of bare rock in many places, and considerable deposition of clay, sand, and gravel in others. The gentler lower slopes tend to have a more stable soil. The surrounding high plains are covered with soils derived from direct weathering of sandstone formations or from inwash of sands and gravels from the Rocky Mountains in recent geologic times.

Rainfall, based on a thirty year record kept at Kenton, one and one-half miles south of the Mesa, is about eighteen inches annually. Data from other nearby weather stations indicate

that from fifteen to twenty inches is the average annual precipitation over most of this region. Much of the rain comes as thundershowers, accompanied by large runoff. In this area, near the center of the dust bowl, the limited moisture available to the plants is probably the principal factor determining the type of vegetation that exists.

The Black Mesa region has three rather distinct vegetational types, the riparian, the prairie, and the foothill communities. Since the first two are widespread in Oklahoma, collections of plants in these communities add comparatively little to the total knowledge of the flora of the state. The stream-side plants here are principally *Populus deltoides*, *Salix exigua*, and *S. amygdaloides*. Though the Cimarron River and Carrizo Creek usually contain some water, most of the streams are dry except immediately following a rain and there is little chance for a hydrophytic vegetation to develop other than in a few pools, man-made ponds, seepage areas on the mesa sides, or other places where moisture can collect. There species of *Typha*, *Scirpus*, *Echinochloa*, and other wide ranging plants may be found.

The prairie grassland, found on the plains around the Mesa and on the level top, where mature soils have developed, must be considered the climax vegetation under the climatic conditions which now exist. The principal species are *Bouteloua gracilis*, *B. hirsuta*, and *Buchloe dactyloides*, with many other, mainly perennial, grasses and forbs. A dozen or fifteen species, such as *Muhlenbergia torreyi*, *Oryzopsis hymenoides*, *Verbena ambrosifolia*, and *Chrysothamnus nauseosus*, are restricted in their eastern distribution to the high plains and hence "enter" Oklahoma here. Otherwise, most of the plants of this community are also well known eastward throughout the state.

The Rocky Mountain foothill community is the one which is of particular interest to the author and others, for one can not help but be impressed by the abrupt change in the vegetation as the Black Mesa is approached from the nearly unbroken stretches of grassland to the east. The dominant plants are shrubs and small trees, mainly *Pinus edulis*, *Juniperus monosperma*, and *Quercus undulata*, with which are associated a variety of herbaceous species. The community is restricted to

the canyon and mesa sides where erosion, deposition, accumulation of moisture, shading, and associated factors produce a variety of conditions not duplicated in the plains region of Oklahoma. From sixty-five to seventy species, consequently, including all of the dominant plants in this community, are unknown eastward in the state. There are also many species for which Black Mesa collections are noteworthy within-the-state range extensions, principally species of the Wichita and Arbuckle Mountain areas.

The vegetation on the mesa sides shows much variation, both in density of growth and in kinds of plants. Some spots may be completely or nearly bare, while nearby is a growth of shrubs so dense as to be nearly impenetrable. Intermittently along the slopes, where a mature or stable soil has developed, prairie plants have invaded, as have some weedy plants whose distribution is not bounded by either foothills or plains. *Andropogon furcatus, A. saccharoides, A. scoparius,* and *Panicum virgatum,* abundant on the eastern plains, are more common on the mesa slopes than on the surrounding dry prairie.

The common woody or semi-woody plants on the Black Mesa, in addition to the species mentioned, are *Yucca glauca, Celtis reticulata, Ribes cereum, Cercocarpus montanus, Physocarpus monogynus, Prunus virginiana, Rubus deliciosa, Dalea formosa, Mimosa borealis, Ptelea trifoliata, Rhus trilobata, Forsellesia planitierum, Vitis longii,* several Opuntias, mainly *O. imbricata, Brickellia brachyphylla, B. californica,* and *Pericome glandulosa.* A few individuals of *Pinus ponderosa,* wide ranging at low altitudes in the Rocky Mountains, are also found near the Black Mesa. In rocky crevices are such ferns as *Cheilanthes eatoni, C. feei, Notholaena sinuata, N. standleyi, Pellaea atropurpurea,* and *Woodsia oregana,* as well as *Selaginella densa,* while a few of the other herbaceous plants which are characteristic of or restricted to this habitat, filling in under and between the woody species, are the grasses *Bromus anomalus* var *lanatipes, Oryzopsis micrantha, Setaria macrostachya, Stipa neomexicana, S. scribneri,* and *Trichachne californica,* and also the following herbs, *Paronychia sessiliflora, Lesquerella ovalifolia, Psoralea tenuiflora, Asclepias macrotis, Mentzelia oligosperma, Gilia laxiflora, Onosmodium occidentale, Cryptantha thyrsiflora, Erigeron nudiflorus,* and *Zinnia grandiflora.*

While most of the species characteristic of the Mesa slopes are eastern outliers of the Rocky Mountain foothills, a few appear to be more appropriately considered a part of the flora which lies to the south and west of the Black Mesa. Some of these are *Aristida arizonica*, *A. divaricata*, *Muhlenbergia arenicola*, *M. porteri*, *Enneapogon desvauxii*, *Allionia incarnata*, *Mimosa borealis*, *Ditaxis laevis*, *Asclepias involucrata*, *A. macrotis*, and *Verbena plicata*, all of which appear to reach the northeastern edge of their range here. In some instances the Black Mesa collections are many miles from the nearest known station. Further field work may close the gaps in the ranges of these species, but the Black Mesa region, for the present, must be considered a relict area for certain southwestern plants.

During the past few years from thirty-five to forty species from the Black Mesa region have been added to the known flora of the state (see chiefly Waterfall 1949, 1950a, 1950b). Some species, which appear not to be included in Waterfall's recent (1952) list of the plants of the state, were collected by the author on or about the Black Mesa. Among them are the following. The numbers cited are in each case the author's. Voucher specimens are in the herbarium of the University of Michigan.

Selaginella densa Rydb. This plant is fairly frequent on the rocky slopes of the Black Mesa, where *4767* was collected on July 9, 1947. The species has been reported from Baca County, Colorado, just north of Cimarron County, but apparently has not been recorded for Oklahoma.

Aristida arizonica Vasey. This grass ranges from southern Colorado to southern Texas and Arizona. Chase, in Hitchcock's Manual of Grasses (ed. 2. 1950) and Waterfall, in his catalogue, fail to record this species from Oklahoma, although Featherly (Manual of the Grasses of Oklahoma: 43. 1946) states that it has been collected in Roger Mills County. Specimens from the Black Mesa, with spikelets very near the minimum size for this species, are *5061*, collected on the slope of the Black Mesa, 3 miles north of Kenton, July 28, 1947, and *6454*, from one mile southwest of Kenton, September 9, 1948.

Aristida divaricata H. & B. This grass is omitted from Waterfall's Catalogue, but is recorded for western Oklahoma by both Featherly (*op. cit.:* 41) and Chase (*op. cit.:* 472). An additional record is *6909*, August 1, 1949, from 5 miles east of Kenton.

Enneapogon desvauxii Beauv. This grass, better known as *Pappophorum wrightii*, appears to be quite uncommon in the Black Mesa region. Only a few plants were seen, from which *6460*, on a rocky slope 1 mile southwest of Kenton, September 9, 1948, and *6922*, on the side of

the Black Mesa, north of Kenton, were taken. The distribution of this plant has been known from Utah to Texas and southward, so that the Oklahoma stations are at the northeastern edge of its range.

Leptochloa dubia (HBK) Nees. A northward extension of range within the state is represented by *6411*, from the side of the Black Mesa, north of Kenton, September 7, 1948. Chase (*op. cit.:* 492) includes the state within the range, and Featherly (*op. cit.:* 28) records it from Comanche and Murray Counties.

Poa fendleriana (Steud.) Vasey. This grass, widely distributed in the foothill and mesa regions of the Rocky Mountains, has been reported by Rydberg (Flora of Colorado: 46–47. 1906), including *P. longipedunculata* and *P. brevipaniculata*, and by Harrington (Manual of the Plants of Colorado: 58. 1954) from a number of localities in southeastern Colorado, so that this extension eastward into Oklahoma is not unexpected. It is represented here by *5608*, collected on a rocky hillside 3 miles east of Kenton, April 24, 1948.

Setaria macrostachya HBK. This species has been reported by Featherly (*op. cit.:* 90) from Payne County. A suitable habitat is unlikely there and since Waterfall omits this grass from his catalogue, the report may be erroneous. The plant is frequent on the mesa sides, *4785* having been collected on the slope of the Black Mesa north of Kenton, July 10, 1947. Other collections are recorded by Harrington (*op. cit.*: 112) from Baca County, Colorado, adjacent Cimarron County on the north.

Brayulinea densa (H. & B.) Small. This unexpected find was collected as *5935*, June 10, 1948, and again as *6910*, August 1, 1949, about 3 miles east of Kenton. Kearney and Peebles (Arizona Flora: 268. 1951) give the range as western Texas to Arizona and southward, indicating that the Black Mesa collections extend this some distance northward. A number of plants were found, all restricted to a small grassland area where the dominant plant was the mesquite, *Prosopis juliflora* var. *glandulosa*, also a southwestern plant reaching the limit of its range here in the Black Mesa region.

Fallugia paradoxa (D. Don.) Endl. This rosaceous shrub was collected as *5931*, June 10, 1948, near the former U. S. Highway 64 at the Old Santa Fe Trail marker, between Boise City and Kenton. Only a plant or two were seen, and can scarcely be said to have been established in the area. Perhaps until additional evidence is secured that it is maintaining itself, this species should not be admitted to the state flora. This station is not too far east of the present known limit of the species in New Mexico and it is likely that more plants may be found within the state.

Astragalus hallii A. Gray. One of the duplicates of *5691*, collected along the upper slopes of the Black Mesa, north of Kenton, May 16, 1948, was determined to be this species by C. L. Porter. On the basis of this determination the species is included in the state flora. Other collections of this species in southeastern Colorado fill in the gap between the Black Mesa and the Rocky Mountains, from which it has long been known.

ASTRAGALUS LOTIFLORUS Hook. Stemen and Myers (Oklahoma Flora: 247–248. 1937) list this species from the "plains" of Oklahoma, although Waterfall omits it from his catalogue. Two collections from near the highway between Boise City and Kenton, *5605* about 10 miles southeast of Kenton, and *5719*, about 8 miles east of Kenton, both determined by C. L. Porter, reinstate this species in the flora of the state.

DITAXIS LAEVIS (Torr.) Heller. This southern species has been previously reported only as far north as western Texas and southern New Mexico. The present specimens were collected as *4751* on the slope of the Black Mesa north of Kenton on July 9, 1947. These as well as other specimens of this species which were examined resemble *D. humilis* in characters other than pubescence and Pax (in Engler, Das Pflanzenreich, 57 (IV, 147, VI): 75. 1912) indicates that this is the main difference between them. If true it is very doubtful whether the plant deserves specific rank. *D. humilis* is also found in the Black Mesa region and is the more common of the two species.

CORYPHANTHA DESERTI Britt. & Rose. This western species of cactus is represented in the flora of Oklahoma by *5992½*, collected atop the Black Mesa north of Kenton, June 13, 1948. This, a living plant, was sent to E. U. Clover, who determined it to be this species.

OENOTHERA ENGELMANNI (Small) Munz. Munz (Amer. Journ. Bot. **18:** 316. 1931) cites specimens of this species from Texas and New Mexico, while Harrington (*op. cit.*: 396–397) records it from southeastern Colorado also. A short extension eastward is *4684*, collected in the prairie about 14 miles west of Boise City, somewhat outside the Black Mesa region, but near enough to warrant mention here.

ASCLEPIAS INVOLUCRATA Engelm. This southwestern species was collected as *1068*, during the author's first trip to the Black Mesa, June 5, 1944, on the high plains 18 miles northwest of Boise Vity. Since that time, the plant has been collected twice in nearby southeastern Colorado. One of these specimens was verified as this species by R. E. Woodson. The plant is nowhere common, but is found almost throughout the grassland area in the Black Mesa region.

CRYPTANTHA THYRSIFLORA (Greene) Payson. This perennial is a conspicuous and frequent herb on and about the Black Mesa and may inadvertently have been omitted from earlier lists. It is represented by several collections, the first of which, *2083*, was collected on the Black Mesa, June 5, 1944.

ANTENNARIA PARVIFOLIA Nutt. Plants keying to this species were observed in several localities in the Mesa de Maya region, but in only one area in Oklahoma, about 8 miles east and 7 miles north of Kenton, near the Oklahoma-Colorado state boundary, where it was frequent in protected places on rocky slopes. There, *6189* was collected on July 6, 1948, quite past the flowering stage.

CIRSIUM UNDULATUM (Nutt.) Spreng. This species has been reported several times from Oklahoma. Material keying to *C. undulatum* was

found throughout the Mesa de Maya Region, of which *4826* was collected atop the Black Mesa north of Kenton on July 11, 1947.

Erigeron flagellaris A. Gray. Though recorded for Colorado and New Mexico, as well as other Rocky Mountain states, Oklahoma has not been included in the range of this species. Only a few plants were found, these near the Cimarron River north of Kenton where *5704*, verified by S. F. Blake, was collected May 16, 1948. These probably developed from seeds brought down by the river from further west where the species is more common.

Of the nearly six hundred species collected by the writer over the whole Mesa de Maya, approximately five hundred were found, or could be found in Oklahoma. The remaining one hundred, still unknown in the state, came from adjacent New Mexico and/or Colorado. Of these some grow near the western end of the Mesa de Maya, thirty miles or more from the Oklahoma state line and up to 1800 feet higher in elevation, and can scarcely be expected within the state. A number, however, were collected within twenty miles of the state line, in habitats almost identical to those existing on and about the Black Mesa. These should be looked for within the state. Among the more interesting of these species are *Notholaena fendleri, Muhlenbergia arenacea, Stipa viridula, Ribes leptanthum, Opuntia phaeacantha, O. rhodantha, O. schweriniana, Oenothera flava, Swertia coloradensis, Asclepias uncialis, Lobelia cardinalis, Artemisia frigida, Brickellia grandiflora,* and *Pericome caudata.*

There are still many kinds of plants to be collected in the Black Mesa region. Each collecting trip yields additional species. The area, though small, is varied, and every newly explored canyon or mesa may and frequently does contain plants which are not known to exist in the state.

Department of Biology, Wayne University, Detroit, Michigan.

Literature Cited

Rogers, C. M. 1953. The Vegetation of the Mesa de Maya Region of Colorado, New Mexico, and Oklahoma. Lloydia **16**: 257–290.

Waterfall, U. T. 1949. Some Results of a Summer's Botanizing in Oklahoma. Rhodora **51**: 18–28.

———. 1950a. Some Additions to the Oklahoma Flora. Rhodora **52**: 19–24, 35–41.

———. 1950b. Some Results of a Third Summer's Botanizing in Oklahoma. Rhodora **52**: 165–175.

———. 1952. A Catalogue of the Flora of Oklahoma.