

## STUDIES IN THE QUERCUS UNDULATA COMPLEX. V. THE TYPE OF QUERCUS UNDULATA<sup>1</sup>

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### A B S T R A C T

The original material of *Quercus undulata* Torr. was collected by Edwin James on Major Long's expedition to the Rockies in 1820. The type locality was stated by Torrey as "sources of the Canadian and the Rocky Mountains." Evidence is here adduced that the type locality is on Ute Creek, a tributary of the Canadian River, in northeastern New Mexico. The site was found to harbor *Q. gambelii*, *Q. grisea*, and numerous intermediate hybrid forms. Certain of the latter match the type of *Q. undulata* quite closely. The type sheet includes three elements—a branchlet regarded as the type, a twig of *Q. grisea*, and an isolated acorn of *Q. havardii*. Torrey's new species was illustrated by a figure which does not closely resemble the type, but which is more similar to *Q. havardii*. The acorn of *Q. havardii* on the type sheet must have been collected in the Texas Panhandle or western Oklahoma, where Long's party would have encountered this species. In my opinion, Torrey's figure could have been drawn from a specimen collected there, which, except for the isolated acorn, has since been lost.

*QUERCUS UNDULATA* Torrey (*sensu lato*) has been interpreted as a complex derived from hybridization between *Q. gambelii* and six other species of the southern Rockies and the Southwest (Tucker, 1961). This interpretation provides a broad, overall view of the complex, and subsequent analyses and discussions (Tucker et al., 1961; Tucker, 1963a, 1970) have provided an explanation of the evolution of the various components of the complex. The interests of formal taxonomy and nomenclature, however, have yet to be considered. A formal classification of the elements in the complex is planned for the final paper in this series. In that, the numerous binomials that have been applied to different forms in the complex will, hopefully, be accounted for.

The type of *Q. undulata* is, of course, central to the nomenclature of the complex, and merits special consideration, not only for this reason, but also because the material on the type sheet is to some extent controversial in that it contains three different elements, probably no two of them con-

specific. Furthermore, Torrey's (1828) statement of the type locality is quite indefinite ("Sources of the Canadian and the Rocky Mountains"), although this was not unusual at that early period in the exploration of the West. The purposes of this paper, therefore, are (1) to establish the type locality as accurately as possible, and (2) to offer some comments regarding the three diverse components on the type sheet.

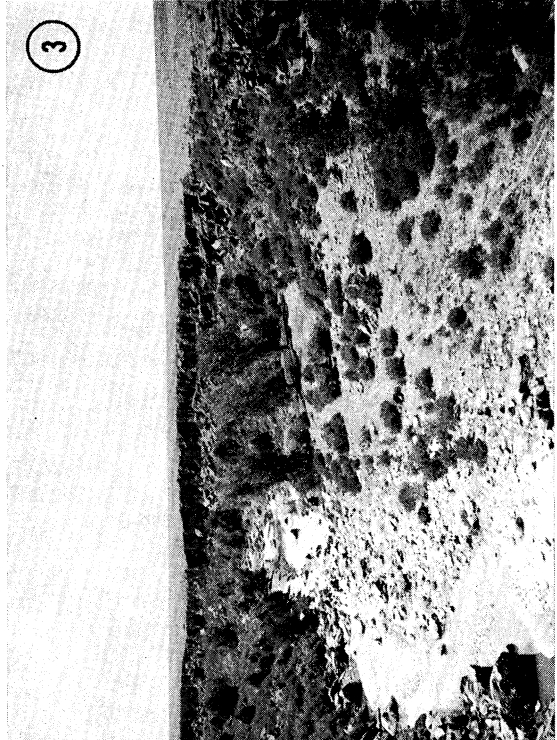
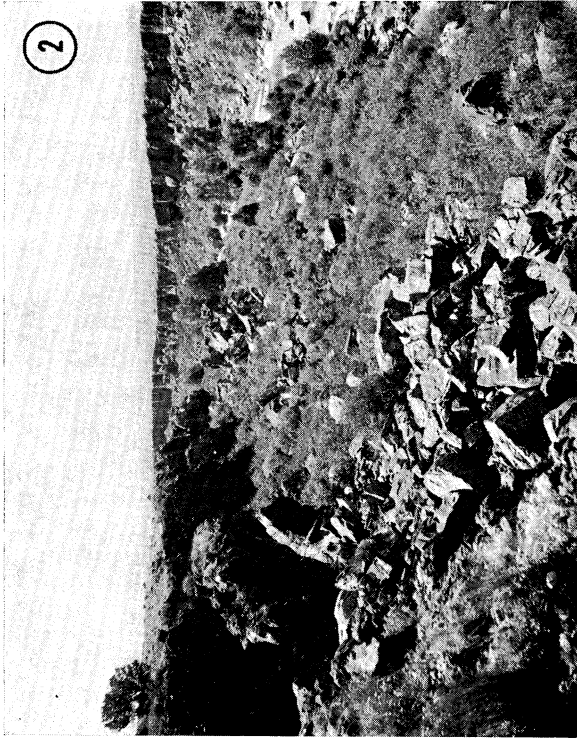
There seems to be little doubt that the type locality is in northeastern New Mexico. However, it would be helpful to know the exact location because the most complicated patterns of hybridization in the whole *Q. undulata* complex occur in this area; and these can vary from one location to another. Also, the type shows scant evidence of the influence of *Q. gambelii* (aside from characters of foliar trichomes). Thus, knowing the type locality and the character of the populations there permits a better understanding of the type itself.

**THE TYPE LOCALITY**—The type material was collected by Edwin James in the summer of 1820, when he served as botanist and geologist with Major S. H. Long's expedition to the Rocky Mountains. James kept a diary during the expedition, and from this published a journal in 1823, first in Philadelphia, then—in the same year, and with occasional minor changes—in London. Several others also contributed to this account, notably Major Long and Thomas Say, the zoologist of the expedition. Portions of their itinerary along the Rockies are rather sketchy and indefinite, and historians have often been quite critical: "The route from the time the party left the South Platte until they arrived at the Canadian is extremely difficult to follow except along the

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Arkansas. It would be scarcely possible to find in any narrative of Western history so careless an itinerary, and in a scientific report like that of Dr. James it is quite inexcusable" (Chittenden, 1902, V.2, p. 578). Similar sentiments (although somewhat less harsh) have been echoed by others (Thwaites, 1905; Gilbert, 1933; Goetzmann, 1959).

Botanists concerned with the type localities of plants first described from this region have sometimes overlooked James' collections (e.g., Standley, 1910a, 1910b). Others have doubtless experienced frustration at the inadequacy or confusion in James' recorded type localities (Pennell, 1920, p. 348, *Penstemon alpinus* Torr.; p. 364, *P. ambiguus* Torr.). A few have helped in small ways to clarify Long's itinerary or James' type localities (Osterhout, 1920).

In fairness to Long and his party, however, it should be noted that at least their journey between the Arkansas and the Canadian Rivers was well out on the high plains to the east of the mountains, where conspicuous landmarks are few. Most later writers, furthermore, seem to have ignored James' very extensive geological observations, and, to present-day geologists who know the region well, these often provide very clear and dependable clues to Long's route. Indeed, using this geological, and other evidence, it has been possible to work out their line of march in some detail from the Arkansas River to the Canadian (Tucker, 1963b). The places where they would have encountered oaks are relatively few, for the vegetation of this country is grassland, devoid of trees or shrubby vegetation except along stream courses or on rocky slopes of isolated mesas. By piecing together items of evidence from James' diary and account, and checking the more significant ones by personal observation in the field, I have made an educated guess as to the type locality of *Q. undulata* (Fig. 1).

Clearly, the initial problem is to determine how the phrase, "sources of the Canadian" should be interpreted. Taken at face value, one would assume that this signified a location somewhere on the headwaters of the Canadian River proper. Muller's statement implying a knowledge of the type locality (1944, p. 446)—which he assumed to be on Raton Mesa—was based on the assumption that Long's party had followed the old Indian trail (later to become part of the well-known Santa Fe Trail) over Raton Pass (personal communication). Had Long's party followed this route southward they would, indeed, have traversed the upper Canadian. From James' account of the

expedition, however, one is led to a different conclusion, namely, that Major Long's route was actually out on the plains some 40–50 miles to the east of where the Canadian rises in the mountains west of present-day Raton, New Mexico.

Major Long had been charged, among other things, with locating and exploring the headwaters of the Red River of Louisiana. Accordingly, on July 24, 1820, his party left the Arkansas River near the location of present-day Rocky Ford, Otero County, Colorado, and headed southward, unaware that they were too far to the west to strike the Red River. On July 30 they came upon a stream which they took to be a source of the Red River, and over the next several days they followed it down to the Canadian, supposing the latter to be the main Red River:

"Having arrived at that part of the country which has by common consent been represented to contain the sources of the Red River of Louisiana, we were induced, by the general inclination of the surface of the country and the direction of this creek, to consider it as one of those sources; and accordingly resolved to descend along its course . . ." (James, 1823).

Following the Canadian back to its confluence with the Arkansas, they ultimately came to realize their mistake.

The view prevalent among historical writers, almost without exception, has been that the stream which the party followed down to the Canadian was Major Long's Creek, a tributary that enters the Canadian over 30 miles east of the present Texas-New Mexico state boundary. A number of James' observations, however, leave little doubt that their route was, instead, down Ute Creek, a tributary farther west that enters the Canadian near Logan, New Mexico (see Tucker, 1963b). One important point is the fact that James observed, on both sides of the stream, cliffs of columnar basalt which "falls readily into large prismatic masses . . . For this reason the valley is much obstructed by fallen masses retaining their angular form . . ." (James, 1823). These features are to be seen at present on upper Ute Creek (Fig. 2, 3). There is no basalt, however, nor any other volcanic formation, along Major Long's Creek, according to three geological experts for this region: Brewster Baldwin, Elmer H. Baltz, and William R. Muehlberger (personal communication; see also, Baldwin and Muehlberger, 1959, plate 1c). These distinctive low cliffs of basalt on Ute Creek are in an area three to four miles down-

Fig. 1-3. Ute Creek, New Mexico.—Fig. 1. The type locality of *Quercus undulata*. Valley of Ute Creek (left to right, middle foreground) from south rim of canyon; looking into side canyon (northeast 40, of northwest quarter, Sec. 13, T 22 N, R 29 E, Harding Co.; see Fig. 6).—Fig. 2. Upper Ute Creek in the area where Major Long's party first came upon it; angular masses of basalt fallen from the canyon walls are a common feature here, as noted in Edwin James' Account (western half of Sec. 31, T 24 N, R 29 E, southwestern Union Co.).—Fig. 3. Upper Ute Creek in the high plains of northeastern New Mexico. (Panoramic view, looking downstream; east canyon wall in left foreground, west canyon wall in middle distance; same general location as Fig. 2.)

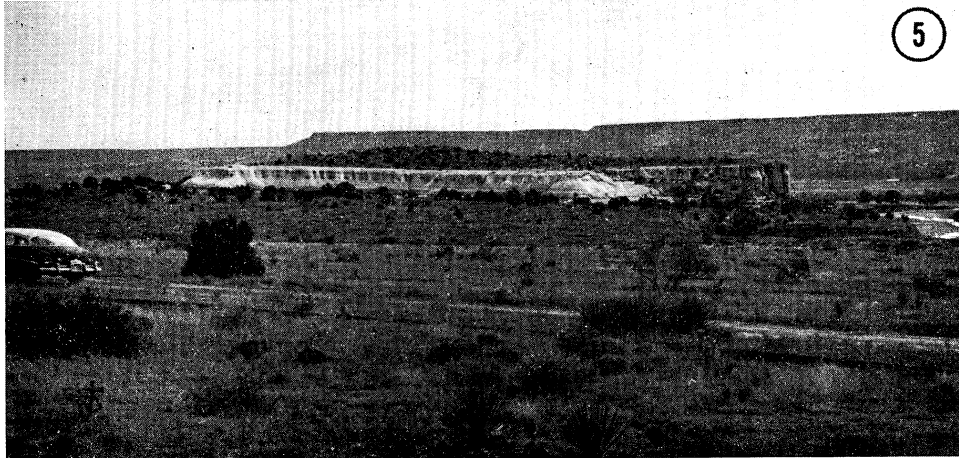
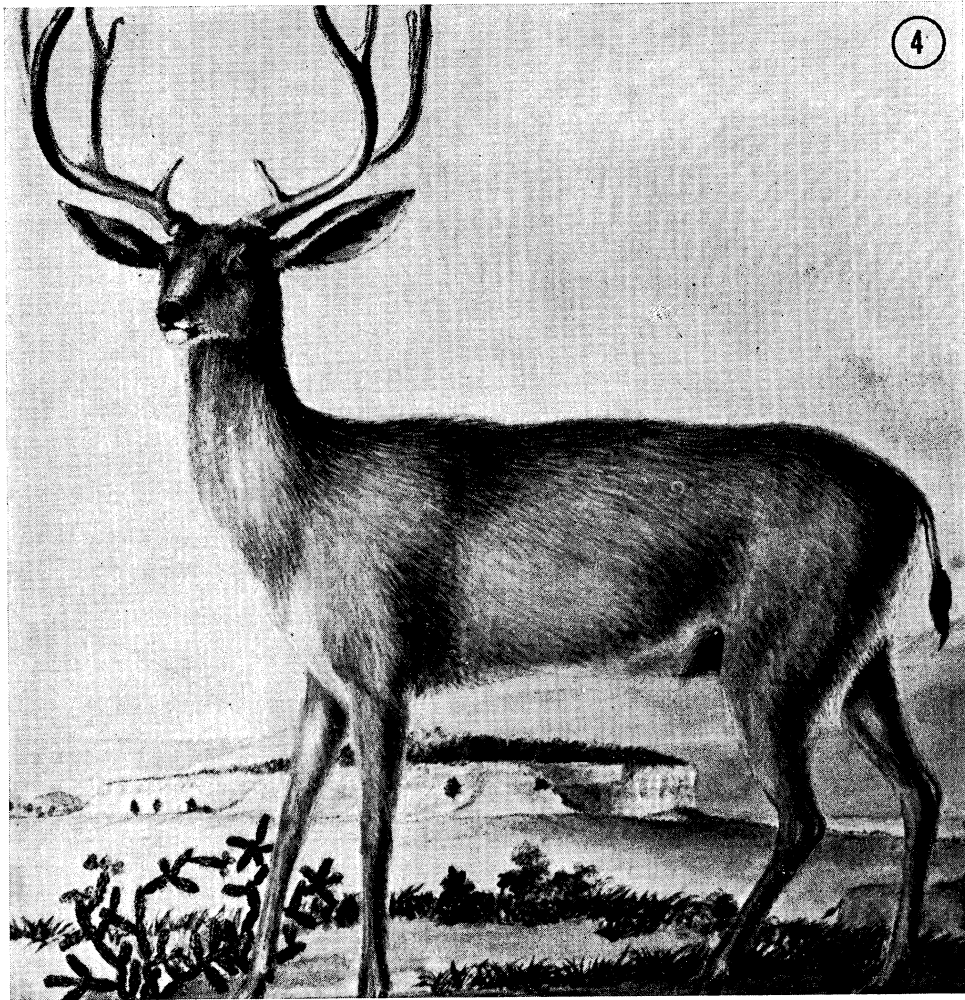


Fig. 4-5.—Fig. 4. The butte sketched by Titian Ramsay Peale (as a background feature in a drawing of a black tail deer).—Fig. 5. The butte which Peale sketched, as it appears now, in the valley of Ute Creek, in the south half of the northwest quarter of Sec. 28, T 21 N, R 30 E, Harding Co., New Mexico. (These same illustrations constitute Fig. 3 in: Tucker, 1963, *N. Mex. Hist. Rev.* 38: 185-219).

stream from the present crossing of U.S. Highway 56, in southwestern Union County, New Mexico. Another important point is the fact that several days later James observed four "immense circular elevations" rising from the floor of the valley farther downstream. It happens that there are four conspicuous buttes in the broad valley floor of Ute Creek a few miles west of present-day Bueyeros. None of the geologists I consulted knew of any other valley in all that region in which four buttes occur within a space of two or three miles. Furthermore, James mentioned that the artist of the expedition, Titian Ramsay Peale, had made a drawing of one of them. After an extensive search by correspondence, I was able to locate Peale's sketch at the library of the American Philosophical Society in Philadelphia; and, by obtaining a photograph of it, I was readily able to identify, in the field, the particular butte Peale had sketched (Fig. 4, 5).

Taking Torrey's phrase, "sources of the Canadian," to apply to Ute Creek, therefore, rather than to the headwaters of the Canadian proper, the type locality of *Q. undulata* can be postulated with a high degree of probability. One of their several camps on Ute Creek would seem to be a likely possibility—a good deal of James' plant collecting was probably done around their camps, as noted by Ewan (1942). Oaks are mentioned only once during their several days on Ute Creek. In fact, in the entire 12-day journey from the Arkansas to the Canadian, oaks are mentioned only twice—in the account for July 28 (when the party camped in the valley of the Cimarron River, two days before striking Ute Creek), and in James' diary entry for August 1, while they were camped on Ute Creek.

Their camp on the Cimarron on July 28 can be ruled out for several reasons. First, as noted above, Torrey's phrase "sources of the Canadian" probably applies to Ute Creek rather than the Cimarron. Secondly, from the circumstances under which they encamped, it seems unlikely that James would have collected the oaks: "Having crossed the creek with some difficulty, we halted on its bank to set up our tent, and prepare ourselves for a thunder shower, which was already commencing. After the rain, the sky became clear, and the sun, which was near setting, gilded with its radiance the dripping foliage of a cluster of oaks and poplars, which stood near our tent." (James, 1823). Finally, no plants are mentioned at all in James' diary entry for that day. Although this is negative evidence, it would suggest that he had not collected any, for on other occasions he listed (and often described in detail) the plants he collected during the day.

The camp where the party spent the nights of July 31 and August 1 (the latter day spent as a day of rest) is very probably the type locality of *Quercus undulata*. The day of rest would have afforded time to collect, and indeed, James does

list a number of plants in his diary entry of that date. Oaks are mentioned, also, in a general description of the valley here: "It is comparatively well covered with grass and herbaceous plants but has little timber. Among the shrubby and thinly scattered trees are oaks, willow, cotton wood, mulberry, and a shrub with spiny trunk and branches and pinnated leaves resembling the honey locust—and some others." From James' observations on the geology and topography of the site, this camp would have been in the northern part of Sec. 13, T 22 N, R 29 E (Fig. 6).

**THE TYPE SPECIMEN**—There are three elements on the type sheet of *Q. undulata* (Fig. 7): (1) the branchlet regarded as the type, (2) a second, smaller twig, which was annotated as *Q. grisea* Liebm. by E. O. Wooton and by P. A. Rydberg, and (3) a large detached acorn, lacking a cup, annotated as *Q. havardii* Rydb. (in Rydberg's handwriting). Of the two twigs, there is no serious question as to which should be considered the type. Torrey's original description clearly applies to the larger branchlet rather than the smaller: "Leaves . . . an inch and a half or two inches long, . . . margin much undulated and repandly dentate; . . . upper [surface] shining, . . ." I concur in the determination of the smaller twig as *Q. grisea* Liebm.

Torrey's new species was illustrated with a drawing (Torrey, 1828; Fig. 8) which is distinctly different, however, from either of the twigs on the type sheet, as noted by some earlier botanists (Watson, 1874; Britton, as quoted by Greene, 1890). The isolated acorn, and Torrey's figure, introduce an element of mystery into the case. Many years after he described *Quercus undulata*, Torrey wrote the following comment on the type sheet: "The large acorn came with the other, but it is doubtful whether it is not from another oak—J. T. 1866." Rydberg's annotation (as *Q. havardii*), in my opinion, is correct. The size, color and shape, (insofar as the latter can be inferred from its present partly broken state), and the conspicuously thin and rather fragile acorn shell, are characteristic of this species. When Rydberg studied it, some 70 years ago, it could well have been in better condition. Under his description of *Q. havardii* as a new species, Rydberg commented (1901): "An acorn of this species was collected by Dr. James and mixed in with the type of *Q. undulata*. Dr. Torrey figures it with that species, but seems to have doubted its belonging there from the beginning; his notes to that effect are on the type sheet."

Torrey's figure, also, is a better representation of *Q. havardii* than of *Q. undulata*, granted the multiplicity of forms shown by the latter. The large acorns, the comparatively *straight* branchlets, at least the main one being erect, with some of the laterals showing a slight upward curvature, are all common features of *Q. havardii* (compare Fig.

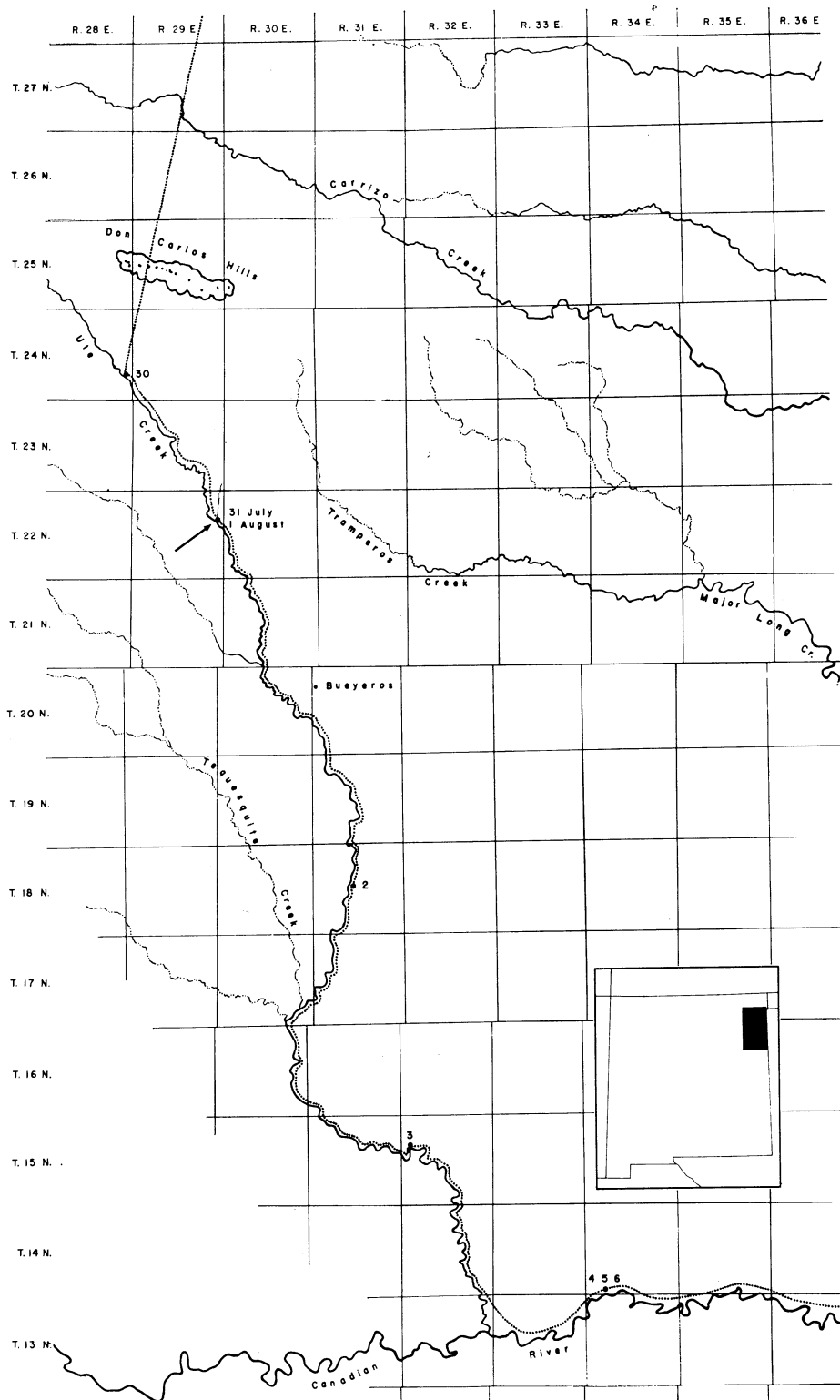


Fig. 6. Major Long's route to the Canadian River via Ute Creek, northeastern New Mexico; arrow indicates type locality of *Quercus undulata*. (This is adapted from Fig. 1 in: Tucker, 1963, N. Mex. Hist. Rev. 38: 185-219.)

8 and 9-11). Although the leaf form in Torrey's figure is not too frequently encountered, *Q. havardii* is so very polymorphic in this respect (see Muller, 1951, p. 53) that his figure can be matched

fairly well in any sizeable series of *Q. havardii* specimens.

It is inconceivable to me that Torrey's figure was drawn from the type of *Q. undulata* (Fig. 12).

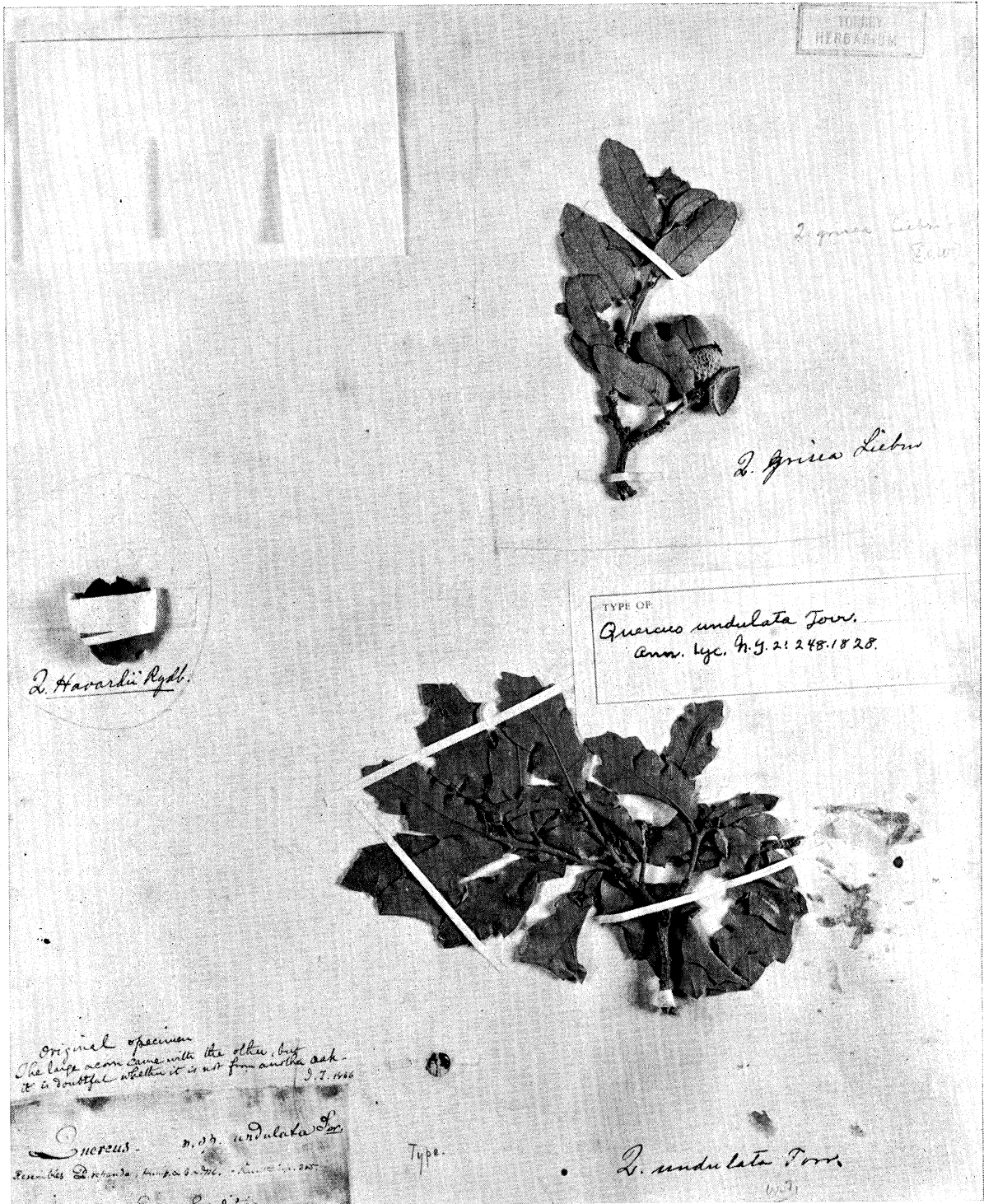
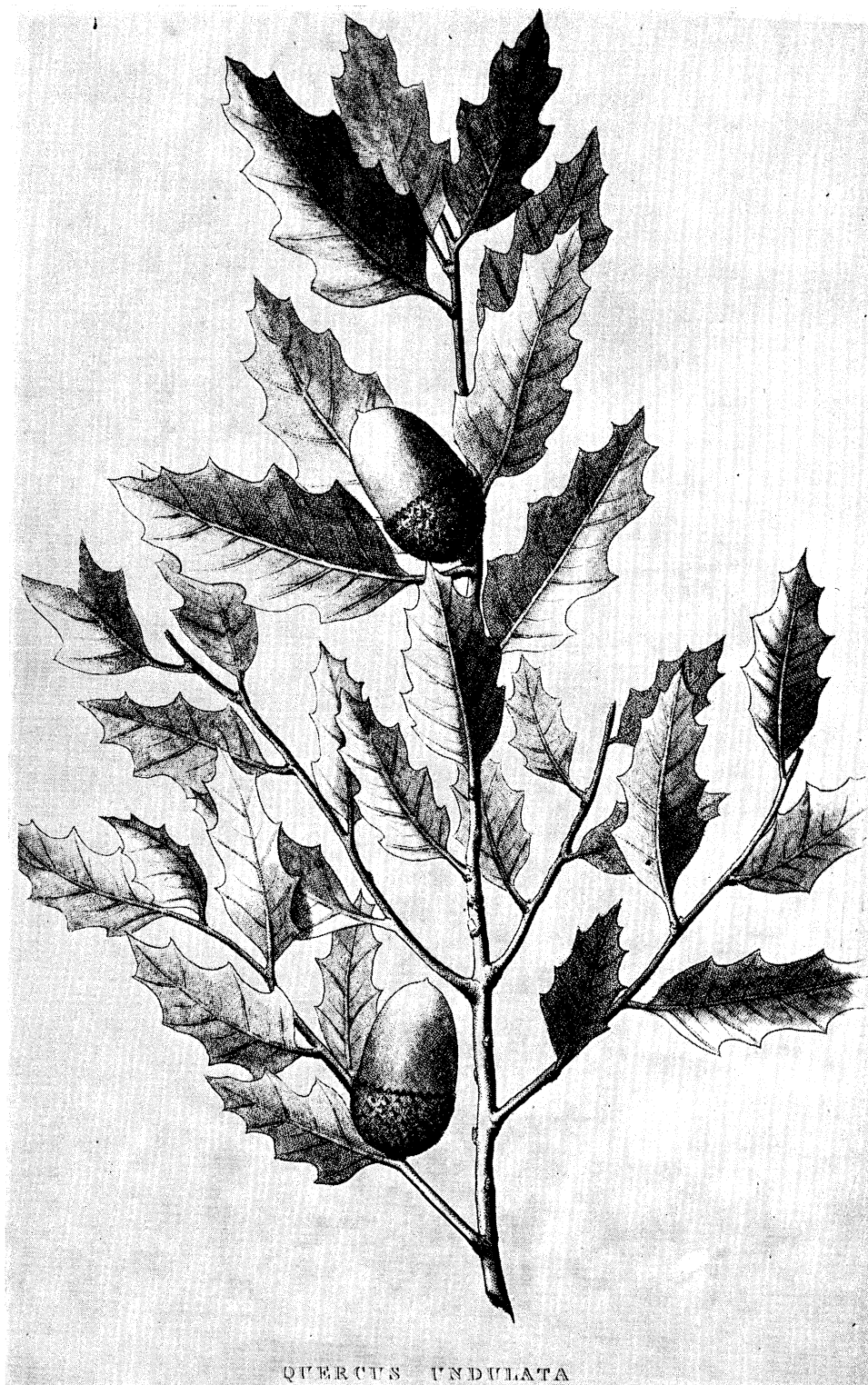


Fig. 7. The type sheet of *Quercus undulata*, from the Torrey Herbarium, New York Botanical Garden.



QUERCUS UNDLATA

Fig. 8. The figure which accompanied Torrey's original description of *Quercus undulata*. (Tab. IV, Ann. Lyc. Nat. Hist. N. Y. 2: 248, 1828).



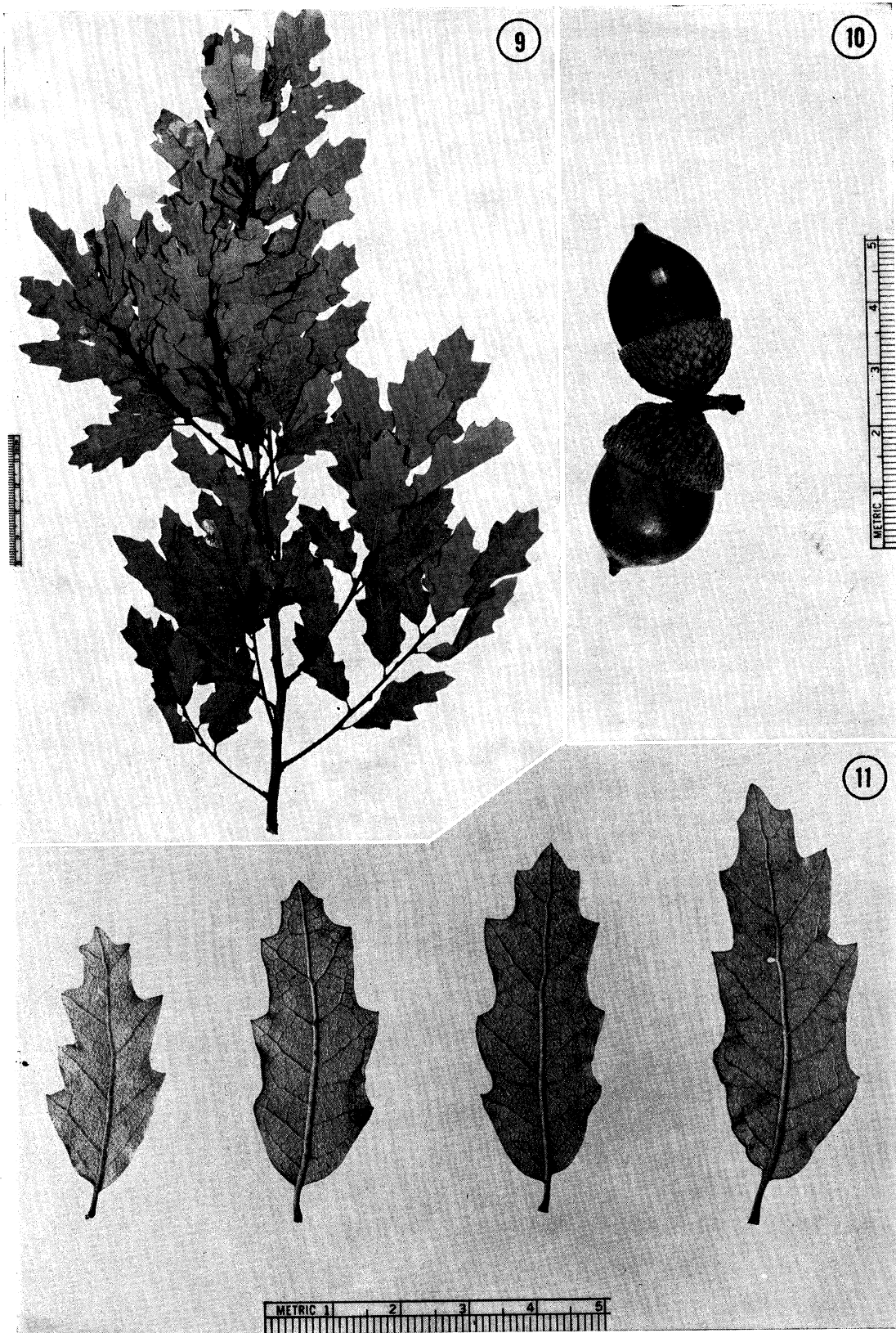


Fig. 9-11. *Quercus havardii* Rydb.—Fig. 9. Branchlet—*Tucker 2971-4* (Crane Co., Tex.).—Fig. 10. Acorns—*Cavognaro 166* (Chaves Co., N. Mex.).—Fig. 11. Leaves—*Tucker 2961-20* (De Baca Co., N. Mex.).

Originally there were at least two acorns on the latter—both quite small. Sereno Watson described the type in a letter to Engelmann dated Nov. 2, 1874: "The James specimens are two upon the same sheet, neither of which is represented by the

plate except as regards the character of the foliage of the larger specimen, which is closely copied [I disagree on this latter point]. There are two acorns upon this specimen, both badly shrunk, one 4 lines long, the other 6 long and 4 broad. . . . There



Fig. 12. The holotype of *Quercus undulata* Torr. [The holotype has clearly had a long history of attrition. As described by Watson in 1874, it bore two acorns; in the photograph in Trelease's monograph (1924), one acorn is in evidence; as received by the present writer, there were none.]

is besides glued down apart another acorn, apparently the original of those figured, which is an inch long and well filled out.”

In my judgment, it would be much more reasonable to assume that Torrey's illustrator actually had at hand a specimen of *Q. havardii*. Although this species does not occur in the area of Ute Creek, James could have collected it later in the trip (around the 11th or 12th of August) as they followed the Canadian through the eastern part of the Texas Panhandle and into Oklahoma. *Quercus havardii* occurs on the Canadian watershed in Hemphill County, Texas, and in Roger Mills and Ellis counties, in western Oklahoma. Also, fruiting specimens could have been available, since mature acorns are found from late July onward (Rowell, 1967, p. 73). It is not strange that James confused this oak with those he had collected on Ute Creek, for they are quite similar in many characteristics. Indeed, the low, rhizomatous, large-fruited “shinnery oak” of the Staked Plains was long considered merely a form or variety of *Q. undulata* (Torrey, 1853; Torrey and Gray, 1854; Wilcox and Wood, 1877; Havard, 1885), and it was not until after the turn of the century that Rydberg (1901) described it as a distinct species.

The present whereabouts of any such specimen of *Q. havardii* is a complete mystery (except for the large acorn on the type sheet). This was evidently the case at the time of Watson's letter to Engelmann (Nov. 2, 1874), and was clearly the case when Greene (1890), in commenting on the type of *Quercus undulata*, stated that “Dr. Britton . . . adds the significant note that no specimens exist [in the Torrey Herbarium] which answer to the engraving published in the Annals of the New York Lyceum.”

DISCUSSION—Once the type locality had been decided upon, the site was visited on September 7, 1962. Here, on the Moise Romero ranch on Ute Creek, east and several miles north of Yates, Harding County, New Mexico, a side canyon (fitting James' description of the locale) enters the canyon of Ute Creek, in the northeast 40 of the northwest quarter of Sec. 13, T 22 N, R 29 E (Fig. 1). Shrubby oaks were abundant there, especially in the side canyon. A few were very *grisea*-like, with small, entire or sub-entire leaves, and light-colored, densely tomentose twigs. On the adjacent east-facing canyon side of Ute Creek, in more protected sites, were also a few shrubs of *Q. gambelii*. Most of the oaks, however, were inter-

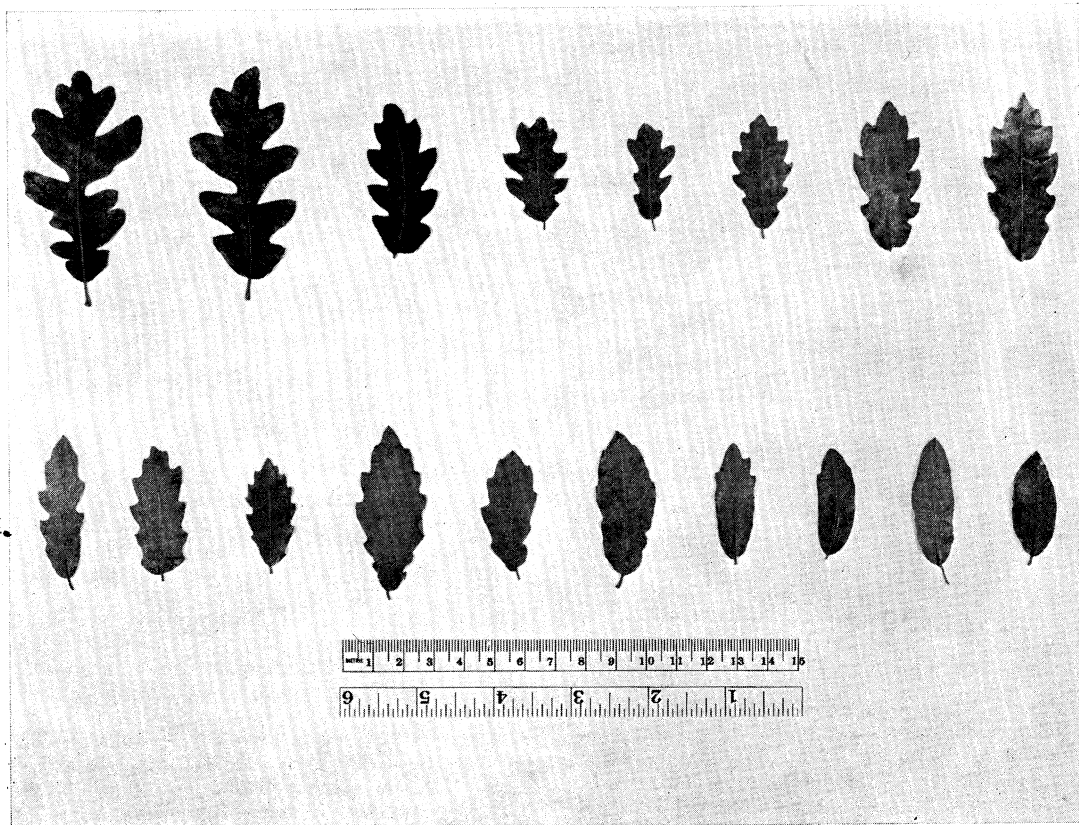


Fig. 13. Collections from the type locality of *Q. undulata* (Tucker 3640: 1-13, 3641: 1-4, 3642)—a single representative leaf taken from each specimen.

mediate in varying degrees between these two species, with relatively small, coarsely toothed or shallowly lobed leaves. Thus, it seemed obvious that this population had resulted from hybridization. Collections (*Tucker 3640: 1-13; 3641: 1-4; 3642*) reflecting this range of variation (Fig. 13) included forms quite similar to the twigs on the type sheet itself—both the type of *Q. undulata* and the twig annotated as *Q. grisea*. Although the type is much more similar to *Q. grisea*, and the influence of *Q. gambelii* is quite subtle in most characters, the stellate hairs of the lower leaf surface are quite revealing: the number of rays per hair falls largely in the intermediate range between those typical of *Q. gambelii* and *Q. grisea* (Fig. 14).

By way of a summary, the following points may be reiterated: (1) The stream Edwin James referred to as a source of the Canadian was Ute Creek, and not the upper Canadian proper. (2) The type locality of *Quercus undulata* has been determined from a synthesis of Edwin James' observations on the topography, geology, and botany of the canyon of Ute Creek. (3) When the location thus determined was actually visited, the site was found to harbor a variable oak population, certain forms of which proved to be a fairly close match for the twigs on the type sheet. Finally, (4) the presence at the type locality of *Q. gambelii*, *Q. grisea*, and numerous intermediate forms provides dramatic confirmation of the writer's central thesis in this whole study, namely,

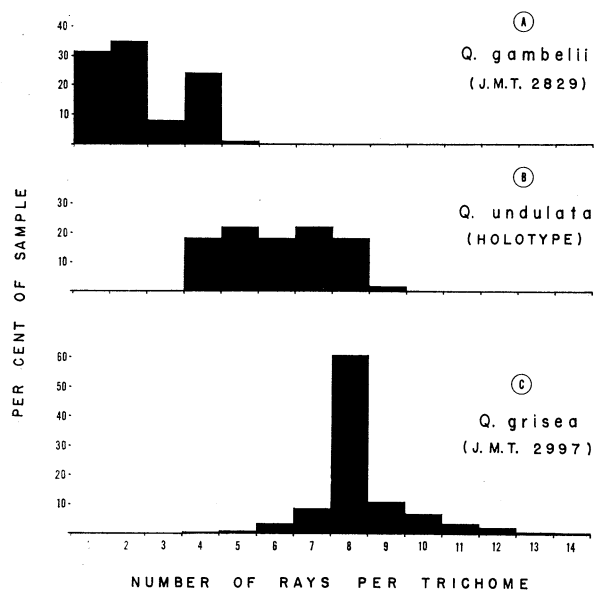


Fig. 14 A-C. Frequency distributions of ray numbers of stellate trichomes on lower leaf surface.—A. *Quercus gambelii* (*Tucker 2829*, Mesa Co., Colorado)—a population sample of 25 individuals (243 trichomes examined).—B. *Q. undulata* (*James*, 1820)—the holotype (50 trichomes examined).—C. *Q. grisea* (*Tucker 2997*, Jeff Davis Co., Texas)—a population sample of 25 individuals (750 trichomes examined).

that what has been regarded as a "species"—*Quercus undulata*—is in fact a variable complex derived from hybridization.

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