Rhodora

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NOTES FROM THE HERBARIUM OF THE UNIVERSITY OF OKLAHOMA—I[1]

MILTON HOPKINS

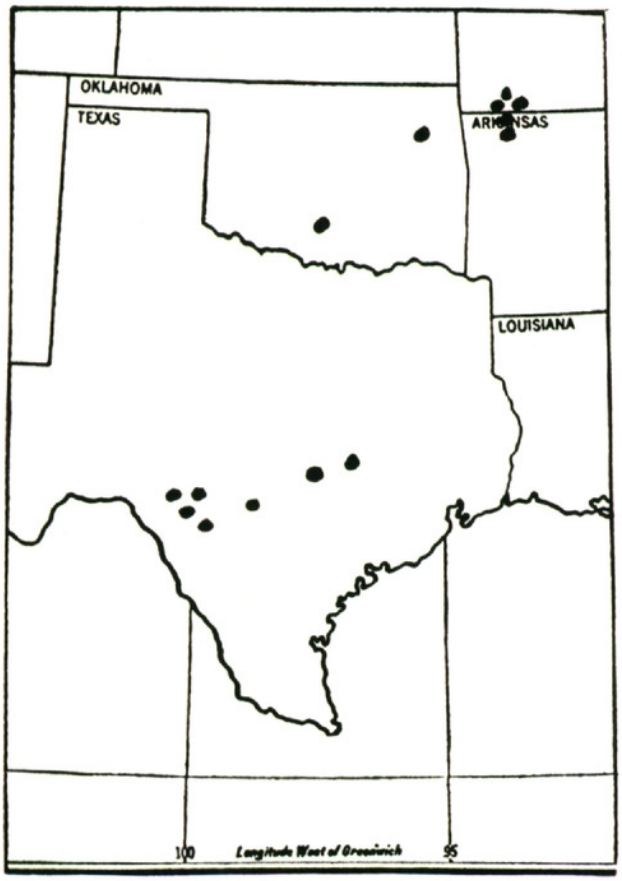
THE GEOGRAPHIC RANGE OF JUNIPERUS MEXICANA.—The Arbuckle Mountains of south-central Oklahoma have long been of interest to students of geology and botany because of their limestone formations and because of the unusual plants which occur there. In reality they form merely a xeric limestone plateau raised above the floor of the prairies around them.[2] As Palmer[3] has so lucidly pointed out, their

[1] Contribution from the Botanical Laboratory, University of Oklahoma, no. 50. The field-work of collecting the plants mentioned in this paper was made possible by a grant given to me by the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE through the OKLAHOMA ACADEMY OF SCIENCE.

[2] Palmer, E. J. "Notes on some Plants of Oklahoma" Journ. Arnold Arboretum xv. 132 (1934). Regarding the Arbuckle Mountains he says: "If the Wichita Mountains are such only by courtesy, it might be thought to put a strong tax upon the proprieties or at least upon scientific accuracy to designate the Arbuckle region as a mountainous one. The low rounded hills are underlaid largely by a hard Paleozoic limestone, through which has been thrust a mass of porphyritic intrusive rocks that now come to the surface over a small area. The limestone is exposed on many of the hill tops and slopes and as bluffs at some places along the Washita River which traverses the region. The soil is therefore decidedly alkaline over much of the area, although it is sandy and more acid in parts of the river valley as well as where the igneous rocks are exposed. The general aspect of the country with the outcrops of hard pure limestone eroded by occasional torrential rains that interrupt the usually dry climate, give it a strong resemblance to parts of the Edwards Plateau in central Texas, an impression which a study of the flora strongly confirms."

[3] l. c. Mr. Palmer also wrote me, in November 1937, as follows: "I found that most of the plants peculiar to the limestone hills of the Arbuckles were extensions of ranges from the Edwards Plateau of Texas, and that their incursion across the Red River and so far north is doubtless to be accounted for by the facts of the remarkable similarity in soil and physical conditions of the two regions. The only Juniper found in the Edwards Plateau—or at least in the typical parts of it—is *J. mexicana*, and it occurred to me that that was the species that should be found in the Arbuckles along with its consociates from further south. The case is really much stronger as to the similarity of the floras than I stated in my published paper, as a number of other Edwards Plateau plants have since turned up that I did not mention."

flora is as closely related to that of the Edwards Plateau of southwestern Texas as it is to any region within the political boundaries of Oklahoma, and consequently the occurrence there of the Mexican cedar is hardly to be considered unique, although its real identity in this state has long been confused. With Palmer's notes in my mind and with the discovery of "*J. Ashei*" on limestone bluffs in northeastern Oklahoma,[1] I endeavored to ascertain the exact range of *J. mexicana* within the United States, and to attempt to explain the reason for its distribution as far north as the Ozark area. "Juniper trips" were made to the Arbuckle Mountains and to the Wichita Mountains,[2] which are a range of hills in southwestern Oklahoma composed entirely of granitic formations, and herbarium specimens of cedars were borrowed from all of the larger botanical institutions. Insofar as I have been able to learn, the plant has a range as indicated in MAP 1. Common on the Edwards Plateau of Texas, it is found locally through central and northern Texas, occurs on the Ar-



MAP 1. Range of JUNIPERUS MEXICANA (north of Mexico).

[1] By Dr. Dwight M. Moore, of the University of Arkansas, who found the plant in Mayes County. It was described by Buchholz (Bot. Gaz. xc. 331. 1930) from northwestern Arkansas and southwestern Missouri, but Palmer and Steyermark (Ann. Mo. Bot. Gard. xxii. 454. 1935) have shown it to be synonymous with *J. mexicana*.

[2] The students at the University of Oklahoma became so "juniper conscious" that whenever field trips were scheduled in any department of the Biological Sciences the botanical collecting equipment was taxed by ardent young zoologists and ecologists eager to obtain cedars. Dr. A. O. Weese and his students in bio-ecology contributed materially to the one hundred or more specimens of *Juniperus* which found their way into the herbarium from various parts of the state.

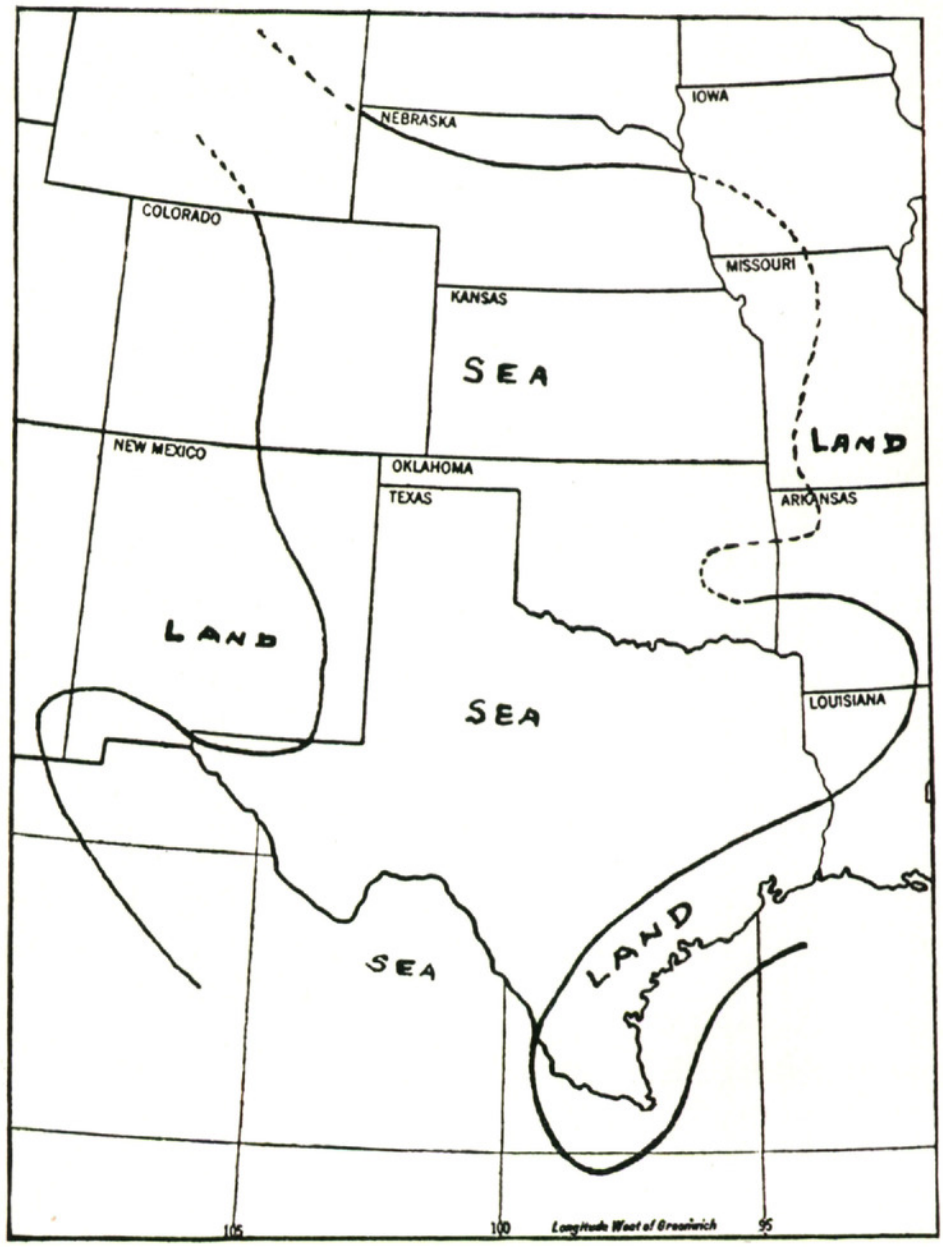
buckle limestones of Oklahoma where it is dominant, and then appears on limestone outcrops in northeastern Oklahoma and adjacent Arkansas and Missouri. In Oklahoma it covers the Arbuckles completely and is easily recognized in the field as distinct from *J. virginiana*[1] which is the only other cedar in the central part of the state. As one approaches the plateau from the prairies, the common red cedar is everywhere, but as soon as the slight ascent to Turner's Falls (in the "heart" of the Arbuckles) is made, *J. mexicana* is the only conifer to be found, and shares the region with such woody plants as *Rhus trilobata*, *Quercus marilandica* and *Q. stellata*. Its complete absence in the Wichitas, where *J. virginiana* abounds, is easily explained by the fact that there is no limestone in that area, except for a slight outcrop of the Arbuckle limestone several miles north, although no record of *J. mexicana* from that outcrop has come to my notice.

The Mexican cedar is definitely a calciphile, as every collector has observed. It appeared to me, therefore, that there might have been a former connection, now buried, between the Ozark, the Arbuckle and Texas stations, but geological evidence quickly convinced me that such a situation could hardly have been the case. A connection such as this could only have existed in the Cambrian, and no one can argue that coniferous plants occupied the earth at that time! Nor could I give credence to a theory that birds brought the seeds (as one of my students naïvely, but quite sincerely, pointed out) from the Edwards Plateau to the Arbuckles and the northeastern part of the state. Clearly, it seemed, there must have been an ancient seabed over the area, and with this hypothesis in mind, I conferred with my geological colleagues. They added information as follows. There was a Lower Cretaceous sea which extended from Mexico and Texas northward through Oklahoma, Kansas and Nebraska, and probably into northeastern Oklahoma and adjoining parts of Arkansas and Missouri (Map 2).[2] This sea invaded the region under discussion in the latter part of Lower Cretaceous time but the area was definitely not available to plants until the recession of the waters, and some erosion, took place in the Eocene. If we assume that *J. mexicana* came into existence at that time, and inhabited the limestone soils of that seabed we

[1] *J. mexicana* differs from *J. virginiana* in the field in its larger fruits, greyish twigs, and almost invariably forked stem. It is usually a more dwarfed plant with a broader crown. Frequently it is decidedly bushy in aspect rather than tree-like.

[2] This map has been constructed by Dr. F. A. Melton, of the Department of Geology in the University of Oklahoma, to whom I am deeply indebted for his kind cooperation.

would have a continuous range for the plant through Mexico, Texas, Oklahoma and the southern Ozark region. In later Tertiary this seabed was eroded back so that at present it is found as the calcareous



MAP 2. Extent of LOWER CRETACEOUS SEA. Solid lines after *Schuchert;* dotted lines after *Melton.*

outcrops with which we are familiar—the Mexican Plateau, the Edwards Plateau and the limestone outcrops of north and central Texas and southern Oklahoma. These outcrops in an earlier stage of erosion, while more widespread than at present, made the connection

with the older limestones of the Arbuckle Mountains and with the Ozark region. Naturally, when this ancient sea-bottom was eroded the juniper could not exist on the sandy, clay or acid soils and hence was eradicated, excepting at those localities where the calcareous outcrops, of Cretaceous origin, remained. Such stations are today the localities for the plant. This theory is in perfect accordance with geological evidence and appears to explain, quite simply, the present range of the cedar. Much additional research needs to be done, especially to discover whether angiospermous plants follow the same distribution. Palmer informs us that many of the Arbuckle plants are found on the Edwards Plateau but he fails to cite a reason for this northern extension of the Texas flora. It is highly probable that when complete information is available we shall be able to postulate that many identical species of flowering plants occur in southwestern Texas, in the Arbuckles of Oklahoma and probably also in the Ozark area of Oklahoma, Arkansas and Missouri.

SORGHASTRUM ELLIOTTII Nash. MCCURTAIN COUNTY: pine barrens and dry sterile woods, 6 miles southeast of Broken Bow, *Hopkins & Cross*, no. 2421.

In the course of a botanical survey of southeastern Oklahoma, a region of pine barrens and cypress swamps, this plant, among many others new to the members of our party, was found. Puzzled as to its identity, I sent a specimen to Mrs. Chase who most kindly named it for me and added that it represented a new addition to our flora. Having been found along the border states (Arkansas, Texas and Louisiana) its extension into Oklahoma merely emphasizes the fact that, although collections from this area have been made in the past, there is nothing like a complete knowledge of the flora. Additional new plants will, from time to time, be recorded in these papers.

PASPALUM CILIATIFOLIUM Michx. CADDO COUNTY: dry sandy bed of South Canadian River near Hinton, *Hopkins*, no. 2053.

Although primarily a Coastal Plain species, its occurrence in central Oklahoma can best be explained by the fact that it migrated up the river from Arkansas. The South Canadian flows into the Arkansas River not far from the state line and although this plant was found approximately 150 miles west of that point, such migrations are not unusual in our flora. The large rivers seldom possess much water except during the spring and fall and their broad sandy beds, often a mile wide, harbor numerous interesting plants, both

from the east and from the west. Mrs. Chase, again, has vouched for the determination, the collection being the first from within the state.

CHLORIS CUCULLATA Bisch. KIOWA COUNTY: dry sterile sandy hillside near Snyder, *Hopkins & Van Valkenburgh*, no. 858.

Although new to Oklahoma, it is not out of the limits of its natural range in Texas and New Mexico. I have specimens from Wilbarger County, Texas, on the border of the Red River, and as Kiowa County is not far from the state line, the occurrence of the plant on Oklahoma soil should evoke no interest save to emphasize again the paucity of our floristic knowledge. Collections from the southwestern counties have been so few that they can be numbered on the fingers of one hand.

ARABIS DENTATA (Torr.) T. & G. MUSKOGEE COUNTY: Hyde Park, *Mrs. E. L. Little*, no. 861.

Although collected in 1927, this specimen was labelled *Iodanthus pinnatifidus* (Michx.) Steud., and being filed in the folder containing plants of that genus, I did not chance upon it until very recently. It extends the known range of *A. dentata* approximately 100 miles southwestward and represents its first collection from Oklahoma. Inasmuch as E. L. Little, Jr., deposited most of his duplicates in this herbarium and seldom sent them elsewhere, I was unable to see this specimen when working on my monograph of *Arabis*.

ARABIS GLABRA (L.) Bernh.—A CORRECTION. In my recent paper, "*Arabis in Eastern and Central North America*," I incorrectly included this species in the floras of Missouri and Arkansas. Dr. Julian A. Steyermark, of the Field Museum, recently wrote me regarding this fact and requested that I again examine the specimens cited from these states to ascertain whether they were *A. glabra* or whether they belonged to another species. Accordingly, I requested a short loan of these plants and was soon convinced of my previous error. The specimen collected by *A. S. Hitchcock* from Jefferson Barracks, Missouri, on May 6th, 1890, and cited by me[1] as *A. glabra* is *A. pycnocarpa* Hopkins var. *adpressipilis* Hopkins, and the plant collected by *H. E. Hasse* at Little Rock, Arkansas in April, 1885, likewise cited as *A. glabra*, is *A. pycnocarpa* Hopkins var. *typica* Hopkins. Both specimens are in the late flowering stage and each superficially resembles *A. glabra*, but a thorough examination reveals that they do not belong to this species. *A. glabra*, therefore, does not occur either in Missouri or Arkansas, at least insofar as I am able to discern at the

[1] RHODORA XXXIX. 108 (1937).

present time. I am deeply grateful to Dr. Steyermark for pointing out this error.

ARABIS VIRIDIS IN OKLAHOMA AND WISCONSIN.—I originally reported only one station for this plant in Oklahoma,[1] but later collections have materially added to my previous knowledge. It abounds in the Wichita Mountains in Comanche County, and has also been found in Cherokee County in the eastern part of this state. Regarding it as a typical Alleghenian plant I was greatly puzzled at its appearance in a region so remote from its normal climatic environment. Also isolated in the Wichitas are several other eastern species, notably *Phryma leptostachya* and *Arisaema dracontium*. These latter two, as well as *Acer saccharum* and *Epilobium coloratum* (to be discussed in a following paragraph) occur in Caddo Canyon, a deep canyon in the open prairies near the township of Hinton, in the geographic center of the state and far out of their normal range. The sugar maple is famous at that spot, but the *Arabis* appears absent. The situation is, briefly, this. The presence of Alleghenian plants in the Wichitas and in Caddo Canyon, approximately 150 and 200 miles west of the normal limits of their ranges, indicates that they must, at some time in the past, have had an uninterrupted distribution from eastern Oklahoma (with its flora essentially Alleghenian) westward and that this distribution was altered due to geological or climatic factors. Anthropologists, climatologists and ecologists agree that about 4,000 B. C. there was a period of moist humid climate throughout Oklahoma and that many plants had such a continuous range from east to west. With the advent of a xeric climate, like that possessed today by the Wichitas and Caddo Canyons, those plants preferring a moist and cooler environment could not exist, except at those sheltered stations which they occupy at the present time, and hence were eradicated. Sears[2] and Clements[3] postulate this hypothesis, and because of the absence of any geological evidence which would otherwise explain the ranges of the plants under consideration, I can heartily concur. Theoretically one would anticipate *Arabis viridis* in the Arbuckles, 60 miles east and slightly more to the south, for this region of lime-

[1] l. c.

[2] Sears, P. B., "Climatic change as a factor in forest succession." Journ. For. xxxi. 934–942 (1933).

[3] Clements, F. E., "Origin of the desert climax and climate." Essay in Geological Botany, in honor of William Albert Setchell, ed. T. H. Goodspeed, 87–140 (1936). University of California Press.

stone hills most certainly should offer a veritable paradise for the plant. But the Arbuckles are considerably lower than the Wichitas, and have few sheltered localities where the plant could obtain sufficient moisture for its needs. Plant collection in that region has been exceedingly active, due to its close proximity to several institutions of collegiate rank, and students on field trips (in taxonomy, in ecology, in zoology and in geology, as well as in several other "ologies") have perused the area with considerable zeal. Surely the *Arabis* would have been found by this time, if it occurred there! The Wichitas, on the other hand, offer numerous shady cliffs in deep woods where the plant can grow successfully, though seldom on limestone, as the Wichitas are chiefly granitic, and in its present environment it must be considered as a climatic relic.

Dr. J. F. Hermann of the University of Michigan recently sent me some specimens of *Arabis* which he collected in the summer of 1937 from south-central Wisconsin. Among them was a plant which is clearly *A. viridis*, the first station for this species from that state. Its presence in the famous Driftless Area adds another plant to the lengthy list of relics occurring there. Before attempting to postulate reasons for its presence in that region I should like to see more material, as Hermann's plant is only in anthesis, and the inflorescence is extremely lax, whereas in typical *A. viridis* the inflorescence is of close, compact racemes. In other characters, however, the specimen is typically *A. viridis*. Under the citation of specimens in my paper it will, therefore, be necessary to insert the following:

WISCONSIN: northwest of Merrimack, Baraboo Range, Sauk County, *Hermann*, no. 8760.

LEPIDIUM CAMPESTRE (L.) R. Br. TULSA COUNTY: in an open fallow field near Tulsa, *Luckhardt*, no. 184.

Although undoubtedly occurring elsewhere in the state, this common introduced European weed has never been incorporated into any published flora or checklist of Oklahoma, nor does Stevens mention it in his lengthy manuscript flora. If common weeds are not to be found in our local herbaria what good are such collections to the farmer and garden enthusiast who wishes to know what particular plant is taking over his field or perennial border?

LESPEDEZA INTERMEDIA f. HAHNII (Blake) Hopkins. CLEVELAND COUNTY: in open prairies, 3 miles southeast of Norman, *Pauline Hoisington*, no. 60.

The first collection of the form with spreading pubescence. I have seen no other specimens of this plant although Miss Hoisington tells me that she found numerous individuals together with the typical form of the species. This bears out my original contention[1] that f. *Hahnii* should be treated as a form rather than as a variety as there is no geographic segregation between the two.

EPILOBIUM COLORATUM Muhl. CANADIAN COUNTY: rich moist soil at bottom of Devil's Canyon, near Hinton, *E. L. Little Jr.*, no. 3996.

When Dr. Little sent this specimen to me for examination I was greatly surprised at its occurrence in central Oklahoma for it was supposed to reach its southwestern limit in Missouri and Kansas. This station extends its range approximately 150 miles southward. Little, who has adequately discussed the botany of Devil's Canyon,[2] considers the "relic flora [climate] hypothesis," mentioned above, the only plausible explanation for the presence of any eastern plants in the center of a prairie environment. Sugar maple (*Acer saccharum*) is found in four of the canyons peculiar to the region, its discovery in 1913 by G. W. Stevens being a noteworthy extension of range. Little, giving his explanation of the flora of these canyons says in part: "The most reasonable explanation is the relic flora hypothesis which has been used to account for disjunct patches of plants of various species driven south by ice sheets to be left there as glacial relics and those of prairie species left farther eastward during periods of dry climate.—It is reasonable that during humid periods of various fluctuations in past climates the eastern deciduous forest may have migrated further west. If so, sugar maples may have had a continuous range westward to these canyons and beyond; with the advent of a drier climate, plants of the more mesophytic species would die out at their limits and the limits of the ranges would shift eastward." Such a postulation for the presence of *Acer saccharum* in these canyons seems quite plausible and I think the same argument must hold for the *Epilobium*. If wind carried the seeds, surely intermediate stations between those of Kansas and Missouri would be found. Stevens, whose familiarity with the flora of northern and north-central Oklahoma was greater than that of any other local botanist of his time, fails to record it at

[1] RHODORA xxxvii, 264–266 (1935).

[2] Little, E. L., Jr. "The vegetation of Caddo Canyons, Oklahoma," unpublished manuscript in the Library of the University of Oklahoma (1937). [There are four large canyons, Devil's being the largest and most unique.]

any locality within the state. I also have collected in that interesting spot on several occasions but it has eluded me, although I made one trip with the specific intent of finding it! Except for the one specimen collected by Little, and deposited in this herbarium, no other record for it seems extant.

ASTER SPINOSUS Benth. CLEVELAND COUNTY: in sandy meadow on margin of bank of South Canadian River near Norman, *Charles Smith*, no. 701.

This interesting plant of New Mexico and Texas was found in September, 1937. I went with Mr. Smith to his station and found several large clumps which appeared to be several years old and which were apparently brought in by one of the annual floods which are characteristic of the South Canadian. No other record of its appearance in Oklahoma, or at any other locality so far east, is familiar to me.

NOTEWORTHY PLANTS OF SOUTHEASTERN VIRGINIA

M. L. FERNALD

(*Continued from p. 424*)

RUBUS OCCIDENTALIS L. SUSSEX COUNTY: rich deciduous woods south of Stony Creek, no. 8303. Noted locally eastward to SURRY COUNTY.

*R. PHOENICOLASIUS Maxim. SOUTHAMPTON COUNTY: alluvial woods, bottomland of Three Creek, Drewryville, no. 7880.

*RUBUS (CUNEIFOLII) **Longii,** sp. nov. (TAB. 521 et 522), arcuato-adscendens vel deinde depressus; turionibus 6 dm. altis pilosis glabratisque aculeis 4–6 mm. longis basi dilatatis rectis numerosis armatis; foliis primariis 3-foliolatis longe petiolatis, petiolis cinereo-villosis remote armatis, foliolis imis 5–7 cm. longis 3.5–5 cm. latis oblique rhomboideo-ovalibus lobatis vel divisis subtus densissime cinereo-tomentosis supra dense pilosis abrupte acuminatis grosse duplicato-serratis basi subcuneatis integrisque; foliolis terminalibus ellipticoovatis vel obovatis basi rotundatis; caulibus fructiferis valde arcuatis; foliis trifoliolatis, foliolis ellipticis 2.5–3.5 cm. longis subtus cinereo-pilosis anguste serratis; inflorescentia corymbiformi basi foliosa; rhachibus villoso-tomentosis; pedicellis valde adscendentibus villoso-tomentosis plus minusve armatis; sepalis oblongis tomentosis apice breviter caudatis; fructibus subglobosis 1.7–2 cm. diametro.—Sussex County, VIRGINIA: bushy margin of a peaty and argillaceous swale north of Littleton, June 10, 1938, *Fernald & Long*, no. 8298 (TYPE in Herb. Gray; ISOTYPE in Herb. Phil. Acad.).