# NOTES ON THE GENUS DIAMORPHA (CRASSULACEAE)

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One of the most striking plants of the southeastern United States is the crassulacean taxon long known as *Diamorpha cymosa*. This small plant occurs on mineral soil in shallow depressions on the principally granitic outcrops from North Carolina and southeastern Tennessee south into Georgia and Alabama (Map 1). The distinctive red color of the leaves and stems of the plants, together with the large numbers of individuals closely aggregated in depressions upon these barren outcrops, attracts the attention of even the most casual observer. It is therefore surprising to learn that this species was apparently overlooked by the Bartrams and Michauxs as well as all the other early botanists known to have visited some of the very outcrops upon which the genus is known to occur.

Thomas Nuttall apparently was the first both to encounter the plant and to comment upon its distinctive botanical features. He collected it in fruiting condition while visiting the outcrop north of Camden, South Carolina in late 1816 or very early 1817. Nuttall, however, mistakenly identified the withered and dead fruiting specimens with Michaux's brief description of *Sedum pusillum* which Michaux had collected at the apparent same locality in 1795 and later described (Fl. Bor.-Am. 1: 276. 1803.) Nuttall first concluded (Gen. 1: 110. 1818.) that his plant (and what he presumed Michaux also to have had) was perhaps better placed in the genus *Tillaea* and he called it *"T ? *cymosa"* with *Sedum pusillum* appended parenthetically. Additional study having convinced Nuttall that this plant was generical-

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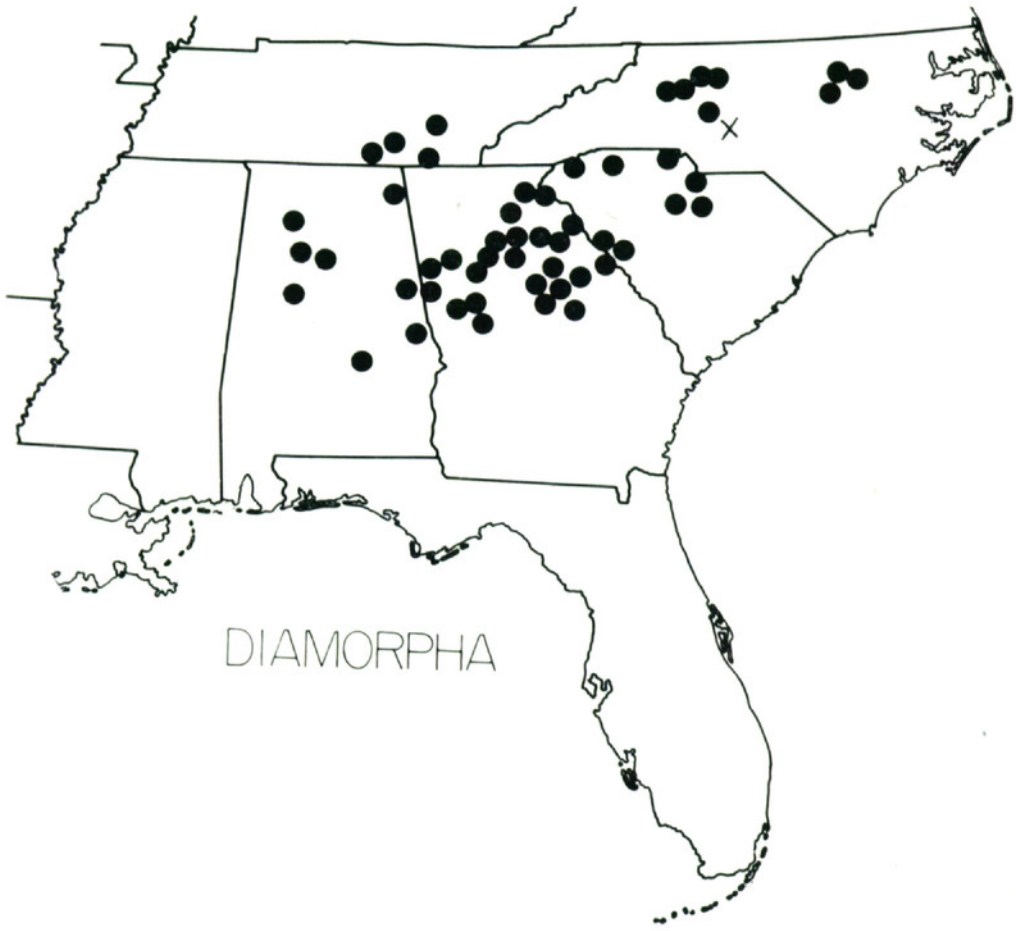


Map 1. Distribution of *Diamorpha*.
(The X in central North Carolina marks the type-locality of *D. Smallii*.)

ly distinct from both *Sedum* and *Tillaea*, he proposed later in the same volume the name *Diamorpha* and then reverted inexplicably to Michaux's epithet in calling it *D. pusilla*. The two species remained undifferentiated until Asa Gray pointed out their numerous distinctions (Proc. Am. Acad. 11: 71-72. 1876.) after studying them both on Georgia's Stone Mountain in April 1875.

Michaux's and Nuttall's species were thereafter respectively known in botanical literature as *Sedum pusillum* Michx. and *Diamorpha pusilla* until sixty years ago when Small (Fl. Se. U.S. 498. 1903.) published the name *Diamorpha cymosa* attributing it to Britton. This nomenclature was employed by Britton in his treatment of the genus (N.

Am. Fl. 22: 56. 1905.) at which time he proposed *D. Smallii* as a second species in the genus. It supposedly differed from the earlier species in possessing "ovate-oblong" petals 2-2.5 mm. long and only "about twice as long as wide" in contrast to the "oblong" petals of *D. cymosa* which reputedly are 3 mm. long and "about three times as long as wide". *D. Smallii* was at that time known only from Small's collection made in late April at the "Falls of the Yadkin River, Stanley Co., North Carolina." Since then, no other specimens have been reported as belonging to that taxon. Small accepted this second species (Man. Se. Fl. 558. 1933.) and the differences claimed by him to differentiate the two species are summarized in the key presented below.

Petals elliptic, about twice as long as wide, 3-3.5 mm. long; carpels lanceolate, long-tipped; sepals about 1 mm. long ..... *D. cymosa.*
Petals ovate; slightly longer than wide, 2-2.5 mm. long; carpels ovoid, short-tipped; sepals about 0.5 mm. long ..... *D. Smallii.*

McVaugh (Ecol. Monogr. 13: 155. 1943.) concluded that *D. Smallii* "appears to be no more than a form of *D. cymosa.*"

An examination of the type of *D. Smallii* (and the only collection seen by me that either Britton or Small indicated as belonging to that species) shows it to possess only relatively immature flowers whose petal dimensions can be matched in shape and size with those of specimens of a comparable age from elsewhere within the range of the genus. The petals, as is to be expected, elongate with increasing age. The other supposed characters all seem to be such that could be expected to change with age or to fall within the range of variation within the species. There appears to be no basis whatsoever for recognizing a second taxon of *Diamorpha.* An attempt to relocate *Diamorpha Smallii* at or near its type locality in May 1963 was unsuccessful and it would appear that the power dams erected there have in all probability destroyed the site.

Unfortunately the nomenclature of this species still remains beclouded by the original confusion with *Sedum pusillum* which marred its botanical debut. As recounted above, Nuttall first (Gen. 1: 110. 1818.) published it as "*T* [*illaea*] ? **cymosa* (*Sedum pusillum* Mich.)" Even though we now

know that Nuttall was mistaken in equating his plant with the succulent found by Michaux at the same locality, Article 63 of our current Code clearly specifies a name so published to be illegitimate since it was "nomenclaturally superfluous when published." Nuttall's second name (Gen. 1: 293. 1818.), *Diamorpha pusilla*, was merely a transfer of Michaux's epithet which was cited in synonymy and hence can not be employed since its type is another species. And similarly Small's publication of *D. cymosa* was also a transfer since Nuttall's name is employed parenthetically and "*D. pusilla* Nutt." added in synonymy. If Small had not indicated this by the parenthetical inclusion of Nuttall's name, one could then have treated *Diamorpha cymosa* as a new name in accordance with Article 72 of our present Code. Since Small clearly indicated, however, that a transfer was made, we can scarcely reach any other conclusion.

The valid name for this southeastern species must therefore be *Diamorpha Smallii* Britton. Its synonymy is summarized below.

**Diamorpha Smallii** Britton, N. Am. Fl. 22: 56. 1905.

*Tillaea* ? *cymosa* Nutt., Gen. N. Am. Pl. 1: 110. 1818. *nom. illegit.* Art. 63. (*Sedum pusillum* Michx., included as a synonym.)

*Diamorpha pusilla* (Michx.) Nutt., Gen. N. Am. Pl. 1: 293. 1818 as to plant intended but excluding its basionym, *S. pusillum* Michx.

*Diamorpha cymosa* (Nutt.) Britt. ex Small, Fl. Se. U. S. 498. 1903.

*Sedum cymosum* (Nutt.) Fröderström, Acta Horti Gotob. 10: App. 137. 1936.

*Sedum cymosum* var. *Smallii* (Britt.) Fröd., Acta Horti Gotob. 10: App. 138. 1936.

One perhaps should be more willing to accept the views of Fröderström, a monographer of *Sedum*, who considered that *Diamorpha* together with *Sedum Nuttallianum* Raf. and *S. pusillum* Michx. (= *Tetrorum pusillum* (Michx.) Rose) comprised a group of closely related American species. Even Berger (Nat. Pflanzenfam. 2 Aufl. 18a: 463. 1930.), whose general account of the entire family certainly entitles him to a respectful hearing, admitted, although accepting *Diamorpha* as a ditypic genus, that it might better be included within *Sedum*. ("Die Gattung ist vielleicht besser zu *Sedum* zu stellen.") Generic limits within the Crassulaceae

are notoriously difficult to delimit but at the present state of our knowledge little would be gained and perhaps something lost if one were to stretch even further the limits of the exceedingly diverse genus *Sedum*. In spite of its great diversity, the carpels of all true Sedums apparently dehisce along the ventral (= upper) suture which contrasts greatly with the large elliptic to tear-shaped flap that splits off of the dorsal surface of each carpel of *Diamorpha*. This unique extrorse dehiscence of the united carpels seems to be a feature of such profound importance that generic status ought to be accorded to *Diamorpha* at least until a more satisfactory demarcation of genera within the family is presented. Cytological evidence has also been presented in support of the generic status of *Diamorpha*. Baldwin (Madrono 5: 184-192. 1940.) reported the chromosome numbers of the three species of Crassulaceae mentioned here to be: *S. pusillum*, n = 4; *S. Nuttallianum*, n = 10 and *Diamorpha*, n = 9. He thought it reasonable that *Diamorpha* was an amphidiploid result of "fusions between the 4- and 5- chromosome tendencies" within *Sedum*. Baldwin concluded that *Diamorpha* was a "good" genus and that its "chromosome number appears to be unusual for the family, and that number is inferred to be the doubled product of the fusion between representatives of two different evolutionary streams."

Wiggs and Platt (Ecology 43: 654-670. 1962.) in an extensive study of the ecology of this succulent have concluded that an important adaptation of this species for survival is the retention of its seeds within the capsule several inches above the high surface temperatures of the shallow depressions. The seeds, according to their report, are not released "in the late summer and fall until the continued action of moisture brings about a breakdown of lateral sutures on the dorsal lip of the follicles, a process requiring 2-5 months." [Actually, as pointed out long ago by Torrey & Gray (Fl. N. Am. 1. 561. 1840.), the fruits are "not dehiscent by either suture, but by the vertical separation of the dorsal portion (nearly half) of each carpel in a valvular manner."] It

was hence observed with some surprise that all plants on the outcrops in eastern Wake County, N. C. early in June had shed their seeds. Observation upon numerous herbarium specimens from throughout the range of the species indicate that in most cases the seeds have been shed by very early summer if not in the late spring. It hence would appear that seed-retention for 2-5 months after the death of the plants is of no particular survival advantage to the species and is indeed not characteristic of at least most populations of the species.

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## FLORA OF MISSOURI[1] [2]

It would seem at first glance that hardly anything that might be looked for in a state flora has been left out of this vast work. On the basis of size one is reminded of Deam's *Flora of Indiana* but in many respects Dr. Steyermark's is a much more detailed study. Deam's was the result of long experience. This too represents nearly thirty years of progress on the Missouri flora since the publication in 1935 of E. J. Palmer's and Steyermark's *An Annotated Catalogue of the Flowering Plants of Missouri.* Twenty years ago many of us thought that Deam had achieved the ultimate in state floras, at least as compiled by one person. One is led to wonder if any individual botanist of the future will have the time, energy, ability, and inclination to surpass for any other state the work under review. Indeed, one might raise a question concerning the advisability of preparing similarly compendious treatments of adjacent states now that Missouri is so well done. Inevitably there would be much

[1]Flora of Missouri by Julian A. Steyermark, Iowa State Univ. Press, Ames, Iowa. LXXXIII + 1725 pp. Nov. 1, 1963, $18.50.

[2]We have been asked by the publishers to advise our readers that the date of publication was omitted from approximately the first 150 copies of the *Flora of Missouri.*